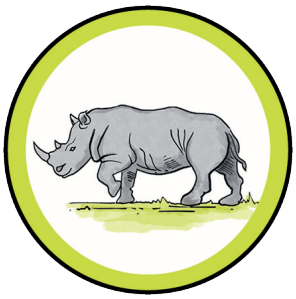


ANIMAL BEHAVIOURIST

South Africa's rich biodiversity has some of the most iconic species in the world, also including some of the most threatened, like the black rhino and elephant found in national conservation areas. These conservation areas are often surrounded by local communities sometimes impacted by human and wildlife conflicts. Animal behaviourism aims to understand animal behaviour and advise on their management and interactions in biophysical and social environments.

Animal behaviourists study animal behaviour and interactions. They research a wide range of species including birds, wildlife and livestock, examining their instinctual behaviour and the psychology that shapes their interactions within biophysical environments and in relation to other animals and people. Animal behaviourists can also be involved in the planning, management and monitoring of species within specific environments, such as black rhino habitats.

Animal behaviourists primarily work outdoors in natural environments where animals can be observed. They often collaborate with other natural science researchers. They would also work from an office base and could work in a laboratory setting as well.

Skills

Animal behaviourists must have a strong background in zoology and animal behavioural theory. They will also benefit from:

- Understanding interactions in ecosystems and the natural environment
- Excellent research competence
- Astute skills of observation and extensive patience
- Ability to work flexibly within some form of organisational structure

Tasks

- Observe, collect and analyse data on the behaviour of animals
- Develop plans and processes for the management of animals and their interactions within conservation and social environments
- Advise conservation managers in decision-making processes

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Zoology at all universities

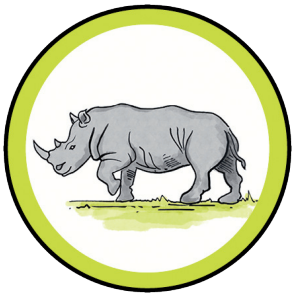
B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Animal Science at NWU, SU, UFH, UFS, UNISA, Univen, Unizulu and UP

Employers

Research institutions, zoos and aquariums.

Conservation organisations, both public, private and NGOs.

Private veterinary practices.



ARCHAEOLOGIST

South Africa has nine iconic World Heritage Sites and numerous important archaeological sites that need to be preserved to ensure that our national heritage is conserved. Archaeology involves studying ancient and the recent human past through material remains to understand culture, traditions and past civilizations.

Archaeologists collect and study artefacts such as ruins, tools, pottery and cave wall art of the past to develop a picture of how people lived in earlier cultures and societies. They examine, describe and classify artifacts according to archaeological guidelines. Some archaeologists work in protecting and managing archaeological or cultural heritage sites while others can focus on the protection of historical buildings ensuring compliance with the National Heritage Resources Act.

Archaeologists often work in teams with specialised professionals like anthropologists, curators and historians. They often travel in teams to remote areas for relatively long periods of time working through excavation sites. They can work in laboratories preserving artefacts or perform desk-based research in offices, as well.

Skills

Archaeologists require a solid background in history and sociology and must have a sound knowledge of heritage legislation and policy. They will additionally benefit from:

- Excellent research capability
- Highly methodical in fieldwork and laboratory competence
- Project management
- Good verbal, written communication and presentation skills

Tasks

- Plan research projects to answer questions and test hypotheses about human activity through environmental data of the past
- Develop data collection methods
- Document and analyse data, laboratory samples and other sources of information
- Advise organisations on the cultural impact of proposed plans, policies and programs

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Archaeology at UCT and Wits

B.A., B.A. (Hons), M.A. in Archaeology at UNISA, Univen, UP and Wits

Employers

Research institutions.

Heritage sites and museums.

BIOLOGIST

South Africa has natural wealth beyond comparison with exceptional species richness, diversity and endemism. To ensure the integrity of our ecological systems and services for natural and human wellbeing, we need accurate biological information. Biology in conservation examines interactions between living things (natural and human) with and within ecological systems.

Biologists study the origin, anatomy, physiology, reproduction and behaviour of living organisms and the ways in which they interact with the environment in which they live. They can advise, consult, conduct, oversee and manage biological and environmental research projects. Some biologists might also design conservation management plans for managing species and critical biodiversity areas as some examples.

Biologists undertake extensive fieldwork and work in laboratories processing and curating samples. They might also spend some time in an office. They work with and advise other natural science professionals as well as teach and supervise students in the related research fields.

Skills

Biologists require a comprehensive knowledge and understanding of biological principles, processes and interactions. They will additionally benefit from:

- Strong methodological ability in the field and laboratory
- Extensive research competence
- Critical and analytical thinking ability and problem-solving skills
- Excellent written and verbal communication and presentation skills

Tasks

- Study the origin, structure, function and development of animal and plant life within ecological environments
- Collect and analyse biological data
- Review and provide feedback on reports related to biological projects
- Supervise projects and report and publish scientific findings

Studies

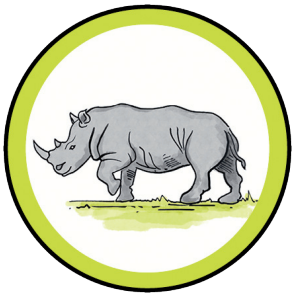
B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences at all universities

Employers

National, provincial and local government.

Conservation organisations, both public and private.

NGOs, research institutions, zoos and aquariums.



CHIEF INFORMATION OFFICER

South Africa has an incredible richness in natural assets that provide critical ecosystem services for economic and social development and wellbeing. Conserving biodiversity and supporting the sustainable use of natural resources requires up to date, reliable and accessible information, supported through the effective management of biodiversity information and supporting systems and processes.

Chief information officers plan, organise, direct, control and coordinate information and communication technology strategies. They evaluate and manage an organisation's use and needs for information and the technology to support collecting, processing, organising and making information available to varied users. They also oversee issues of security related to these systems, formulating strategies, policies and plans for best operational use.

Chief information officers predominately work in an office environment within a fast-changing technology landscape. They often manage a team of system analysts, programmers and other computer-related professionals as well as consult with vendors around technology and information requirements.

Skills

Chief information officers require excellent knowledge of information systems and infrastructure and related technology and innovation, along with:

- Creative problem-solving ability
- Excellent communication and information presentation skills
- Strong understanding of business processes
- Extensive team management experience

Tasks

- Evaluate and make recommendations for the organisations information technology use and needs
- Direct and prepare information management policy, strategies and standards
- Manage and control budgets for information technology needs
- Supervise the security of all information technology systems

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Information Technology at NWU, UFS, UJ and UNISA

B.Sc., B.Sc. (Hons), M.Sc. in Computer Science at NMU, NWU, RU, SPU, SU, UCT, UFH, UKZN, Unizulu, UP, UWC and Wits

Diploma, Advanced Diploma, M.Tech in Information Technology at CPUT, NMU, MUT, TUT, UJ, UNISA and VUT

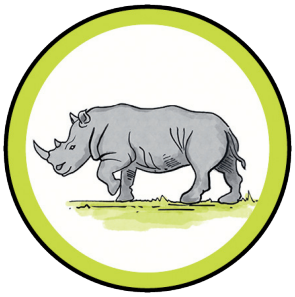
Employers

National, provincial and local government.

NGOs, community-based and development organisations.

Information technology companies.

Various organisations requiring information technology services.



CONSERVATION SCIENTIST

Nature and ecosystem services supports all life on earth, intrinsically and through providing for subsistence, livelihoods and natural resources for production and consumption. Biodiversity loss, the result of unprecedented development compromises ecosystems and the services through which life is sustained. Ongoing biodiversity assessments highlight potential threats and opportunities to minimise impact on biodiversity and loss of these critical ecosystem services.

Conservation scientists undertake research and develop and implement programs for the conservation and sustainable use of natural resources. They research the interactions between humans and ecosystems and decide on the systems, tools and infrastructure to be used for the management and restoration of priority conservation sites. A conservation scientist can also conduct environmental impact studies to examine the ecological effects of pollutants, diseases, human activities, nature and climate change on specific areas.

Conservation scientists collaborate with specialist professionals and site managers to supervise conservation projects. They often undertake fieldwork and could also work in a laboratory and office environment processing reports and preparing recommendations for policy and legislation.

Skills

Conservation scientists need a thorough and extensive knowledge of biodiversity and ecology. They could also benefit from a background in related policies and:

- Strong analytical and problem-solving ability
- Ability to carry out fieldwork and laboratory processes
- Extensive research competence
- Good verbal and written communication and presentation skills

Tasks

- Conduct research and perform field and laboratory analysis of samples
- Develop conservation plans and coordinate the implementation of environmental management systems
- Assess the compliance and impact of proposed projects
- Provide technical advice and conservation support services

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geography in Environmental Studies at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences at all universities

Diploma, Advanced Diploma, M.Tech in Nature Conservation at CPUT, MUT, NMU, TUT, UMP and UNISA

Employers

National, provincial and local government.

NGOs, and private consultancies.

Research institutions.

CURATOR

South Africa has natural wealth almost beyond comparison with exceptional species richness, diversity and endemism. Conservation management and development planning requires sound and in-depth knowledge of the nature and scope of biodiversity to minimise impacts and secure the integrity of biodiversity and the ecosystem services it supports. Curation involves the preservation, cataloguing and study of ecological information about plants, animals and fossil species.

Curators plan and oversee the management of collections of plants, animal specimens and archaeological artefacts. They design and manage the exhibition and events around preserved species, sometimes also promoting information to the public. They can also gather samples for collections and preserve and maintain rare specimens using specialised methods. Some curators can assist in administrative processes, encouraging funders to protect and display important environmental data.

Curators can work in an office environment but also spend time organising displays or collecting specimens for exhibitions. Some can preserve artefacts in laboratory settings and can sometimes be exposed to dangerous chemicals.

Skills

Curators require an in-depth understanding of plant and animal species and preservation and curation processes and will additionally benefit from:

- Excellent attention to detail
- Extensive analytical and research skills
- Strong organisational and administrative ability
- Excellent scientific communication capabilities

Tasks

- Research the origin, distributions and use of cultural and historical artefacts
- Direct classification and cataloguing of materials and objects
- Evaluate and preserve records of museum objects
- Organise and publicise exhibitions and special displays

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Zoology or Botany at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Archaeology at UCT and Wits

B.A., B.A. (Hons), M.Sc. in Anthropology at RU, SU, UFS, UJ, UL, UNISA, Unizulu, UP, UWC and Wits

Employers

National parks and gardens.

Museums and zoos.

Research institutions.

EARTH AND SOIL SCIENTIST

Soil plays a critical role in supporting biodiversity and effective ecological functioning. It similarly plays a key role in water purification and acts as a sink for atmospheric carbon dioxide. It is further vital in sustaining agriculture for food and economic security. To ensure the sustained health of soil, earth and soil science provides information about its composition and quality to manage changes to soil quality due to overuse, climate change and pollution, amongst others.

Earth and soil scientists analyse the composition, structure and other physical and chemical attributes of soil. They plan and implement soil management programmes and conduct environmental impact assessments for urban parks, agricultural enterprises and industrial sites. They can also develop plans and strategies for the reclamation and preservation of soil in areas such as wetlands, for example.

Earth and soil scientists collaborate with geologists as well as agriculture and environmental engineers to discuss strategies for soil rehabilitation and conservation. They can work between the field, laboratory and office environment, deliberating soil properties and sustainable soil practices.

Skills

A vast knowledge of soil properties and the physical and human interrelationships that impact its quality is needed by earth and soil scientists. They will further benefit from:

- Extensive research and laboratory analysis competence
- Meticulous attention to detail
- Logical analytical thinking skills
- Significant problem-solving skills

Tasks

- Conduct research and perform analysis on collected soil samples
- Develop and coordinate the implementation of soil management systems
- Conduct environmental impact audits and make recommendations
- Advise and provide support services to varied stakeholders

Studies

B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Soil Science at SU, UFH, UFS, UKZN, UL, Univen and UP

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Geomorphology at NMU, SU, UCT, UFH, UFS, UJ, UKZN, Univen, Unizulu, UP and Wits

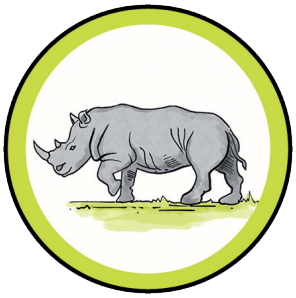
Employers

National, provincial and local government.

Research institutions.

Private consultancies.

Agricultural production and fertilizer manufacturing companies.



ECOLOGIST

South Africa is highly biodiverse, boasting nine biomes within its national borders. 10% of the world's plant species and 7% of its reptile, bird and mammal species make up intricate ecosystems. Understanding the interactions and interrelationships between living organisms and the physical environment, helps to identify changes in ecosystems that affects its health and ultimately the services it provides. It also informs strategies to conserve and ensure resilient ecosystems to secure all life on earth that it supports.

Ecologists study whole ecosystems, investigating the nature and distribution of living organisms, their interactions within and connection to the surrounding environment. They collect and test samples in marine, freshwater and terrestrial ecosystems. They use the data to plan and advise on environmental policies, species and habitat management, environmental restoration and conservation strategies. Some can also develop environmental education programmes to build ecological knowledge amongst key stakeholders.

Ecologists can engage with conservation and environmental scientists, policymakers and social scientists to make recommendations on the effective conservation of ecosystems. They typically work between the field, laboratory and an office environment to collect and analyse ecological data.

Skills

Ecologists require a comprehensive knowledge and understanding of biological and ecological principles, processes and interactions. They will further benefit from:

- Strong methodical ability in the field and laboratory
- Extensive statistical modelling ability
- Critical and analytical thinking ability and problem-solving skills
- Excellent written and verbal communication and presentation skills

Tasks

- Conduct field, laboratory and theoretical research
- Provide models and analysis to establish influencing factors
- Develop conservation strategies and projects
- Advise stakeholders and publish findings for sustainable ecosystem management

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany, Ecology and / or Zoology at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Conservation Ecology at SU and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Biodiversity and Conservation Biology at UWC

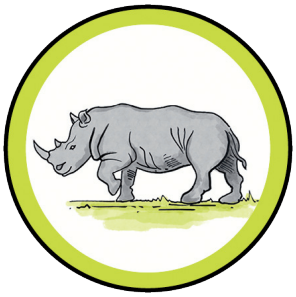
Employers

National, provincial and local government.

Conservation organisations, both public and private.

NGOs and research institutions.

Museums.



ENVIRONMENTAL EDUCATION MANAGER

South Africa's natural landscape is rich in biological and ecological diversity with over 95 000 species in nine distinct biomes to learn about. Healthy ecosystems are also critical to sustaining wellbeing and livelihoods of people, through economic and domestic activities. Education, training and learning activities play a key role in supporting understanding of and interactions in the environment and the development of actions for sustainable use and management of our natural assets.

Environmental education managers develop, implement and evaluate environmental learning programmes and resource materials to raise awareness, share and promote knowledge and an understanding of the environment and interrelationships within it. They coordinate and facilitate presentations, workshops and can conduct guided interactive field activities. Some also train volunteers and community groups around specific environmental themes.

Environmental education managers engage with different audiences in schools, colleges, businesses, community groups and the general public. They could work in a specific setting such as a cultural heritage site or museum or travel to sites on beaches, national parks or conservation sites to conduct educational activities.

Skills

A thorough understanding of the interrelated nature of the environment and experience in education, training and learning processes is required by environmental education managers, along with:

- Easily communicate complex environmental concepts and processes
- Excellent interpersonal skills
- Good planning and organisational competence
- Excellent written and communication skills

Tasks

- Research and develop environmental education materials
- Develop environmental education frameworks and programmes
- Coordinate the implementation of environmental programmes
- Identify, build and maintain networking structures and partnerships

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Environmental Studies at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany, Ecology and/ or Zoology at all universities

Diploma, Advanced Diploma, M.Tech in Nature Conservation at CPUT, MUT, NMU, TUT, UMP and UNISA

Specialist post-doctoral studies in Environmental Education at NWU, RU, SU and UNISA

Employers

National, provincial and local government.

NGOs and community-based and development organisations.

Research institutions.

National parks and gardens.

Zoos, museums and aquariums.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

ENVIRONMENTAL SCIENTIST

Boasting rich biological and ecological diversity, South Africa's natural landscape provides essential ecosystem services that supports socio-economic growth, development and livelihoods. Environmental risks, brought on by for example climate change, extreme weather events, increasing production and consumption, amongst others could significantly compromise these ecosystems and dependent human wellbeing and livelihoods. Environmental science explores environmental phenomena and people's interactions within the environment to identify opportunities for synergy and sustainable management.

Environmental scientists study the environment and interrelationships of plants, animals and other organisms within it. They also consider external interactions and influences to understand changes within the environment. They conduct environmental impact assessments to identify potential environmental risks and develop management systems to address these challenges. Some develop environmental standards, guidelines and policies for industry to prevent further harm and to maximise protection of the environment.

Through an interdisciplinary approach, environmental scientists collaborate with ecologists, environmental engineers and other professionals to address particular environmental challenges. They can work between an office and laboratory and travel to field sites to collect air, soil, water and other data for analysis.

Skills

Environmental scientists need to have an extensive understanding of environmental phenomena and interrelationships within the environment and will also benefit from:

- Strong analytical and problem-solving ability
- Ability to carry out fieldwork and laboratory processes
- Understanding of environmental legislation and policies
- Good verbal and written communication and presentation skills

Tasks

- Conduct environmental audits to evaluate potential impacts
- Develop and coordinate the implementation of environmental management systems
- Assess organisational compliance of environmental regulations
- Provide technical advice and support to organisations

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Environmental Studies at all universities

Employers

National, provincial and local government.

NGOs, community-based and development organisations.

Research institutions.

Construction and manufacturing companies.

Private environmental consultancies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

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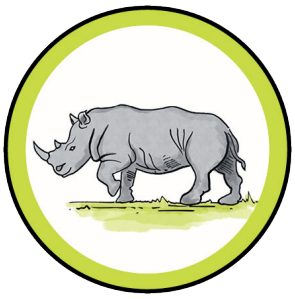


GENETICIST

South Africa is home to over 95 000 plant and animal species. Due to habitat transformation, climate and general environmental change, species evolve and adapt to opportunities, threats and risks. These special adaptations in turn shape ecosystems and their functioning which support the natural, social and economic world. Understanding the genetics of plant and animal species can assist in understanding ecosystem functioning, ecosystem change and guide the planning and management of these changes for ecological and social health and wellbeing.

Geneticists study the genes and genetic variations of living organisms. They research genetic diversity and population dynamics and conduct experiments to determine the origins, mechanisms and principles and laws of inherited traits of a species. They then develop and implement methods to improve heritability, growth, reproduction, immunity and disease resistance or tolerance or even create new variations of species. Some work with populations to understand the species evolution and change within natural populations.

Geneticists mainly work in laboratories to examine genetic material and occasionally go into the field to make observations or collect samples for testing. They sometimes work with hazardous chemicals and substances and are required to wear safety equipment during lab analyses.

Skills

Geneticists need a comprehensive knowledge of plant and animal biology, chemical properties and principles and will also benefit from:

- Extensive competence in laboratory techniques
- Creative and logical analytical ability
- Complex problem-solving ability
- Strong organisational skills and attention to detail

Tasks

- Design, implement and monitor research experiments
- Collect, study and test cell, tissue, bacteria and living organism samples
- Analyse findings and identify practical applications and potential risks
- Record and disseminate results in reports and presentations

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Genetics at SU, UCT, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Genetics at UFS, UKZN and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Biotechnology at SU, UJ, UKZN, UP and UWC

Diploma, Advanced Diploma, M.Tech in Biotechnology at CPUT, DUT, TUT, UJ and VUT

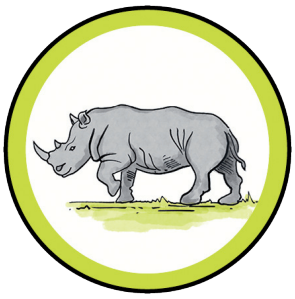
Employers

Agricultural and crop production companies.

Biotechnology and genetic engineering companies.

Pharmaceutical and chemical companies.

Research institutions.



OUTDOOR ADVENTURE GUIDE

With natural assets and biodiversity almost beyond compare, South Africa is world renowned for its diverse and extensive natural beauty and opportunities to explore and experience nature based and outdoor adventure activities. The tourism industry, attracting both local and international tourists contributes 3.7% to South Africa's GDP. With much to offer the outdoor adventurer, outdoor activity guiding is an increasingly expanding industry, and offers opportunities to share South Africa's natural beauty, sustainably.

Outdoor adventure guides direct, instruct and guide individuals or groups in outdoor recreational activities. They assemble the necessary equipment and demonstrate the essential skills and techniques to participants, providing individual support and instruction if needed. They enforce safety procedures, rules and regulations to ensure that activities are conducted in a manner that minimises risk to participants. They also provide information and answer questions about local interest points.

Outdoor adventure guides work with tourists, outdoor enthusiasts and other people interested in outdoor recreational activities. They spend the majority of their time in outdoor environments and can work irregular hours depending on the activity and the weather.

Skills

Outdoor adventure guides require extensive experience with an outdoor activity and knowledge of environment, health and safety procedures, with extensive experience in emergency procedures and first aid, coupled with:

- Excellent customer service and interpersonal skills
- Leadership competence in high-risk environments
- Strong and clear instructional ability
- Good physical stamina

Tasks

- Demonstrate the concept and skills used in outdoor adventure activities
- Explain and enforce safety procedures, rules and regulations
- Instruct clients in the use of relevant outdoor adventure equipment
- Evaluate and monitor clients as they participate in activities

Studies

Diploma and Advanced Diploma in Tourism Management at CPUT, CUT, DUT, TUT, UJ, UNISA and WSU

They can additionally benefit from a National Certificate in Tourism (Guiding) at National Qualifications Framework level 2 and 4 offered at the Wildlife and Environment Society of South Africa and the Field Guides Association of Southern Africa, accredited by the Culture, Arts, Tourism, Hospitality and Sport Sector Education and Training Authority. Training could also take place on the job with mentoring by an experienced guide.

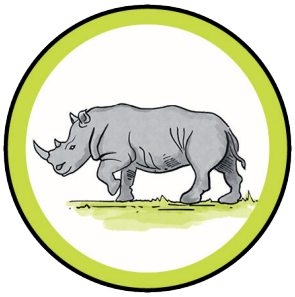
Employers

Adventure tourism companies.

Holiday resorts, hotels and lodges.

Private game reserves.

Private guiding services.



PALAEONTOLOGIST

South Africa's uniquely rich and diverse fossil record documents the earliest evidence of life in ancient humans, animal and plant species. Investigations of these past life forms help to explain the beginning of earths existence and identify and explain how life, landscapes and climate have changed over time and how living things have adapted to those changes. Palaeontology is the scientific study of the evolution of life on earth through fossil and other records.

Palaeontologists study the fossilised remains of humans, plant, animal, fungi, bacteria and other single-cell organisms. They conduct preliminary research to determine the location and historical context of fossils and survey and excavate fossils within layers of sedimentary rock. They then analyse fossils to determine age and examine relationships between extinct species and present-day living counterparts to understand extinction events and their relation to current phenomena such as lifestyle, environmental and climate change.

Palaeontologists often work in teams with specialised professionals like anthropologists, curators and historians. They often travel to remote areas for relatively long periods of time working through excavation sites. They can also work in laboratories preserving artefacts or perform desk-based research in offices.

Skills

Palaeontologists require extensive knowledge of geology and biology and an understanding of heritage legislation and policy. They will additionally benefit from:

- Excellent research capability
- Highly methodical fieldwork and laboratory competence
- Critical and analytical thinking ability
- Strong attention to specific detail

Tasks

- Conduct field work, excavate and identify the time period and geography of fossils
- Analyse field data, laboratory samples and other data
- Prepare reports and present research findings
- Advise organisations about the potential impacts of fossil discoveries

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Palaeontology at Wits

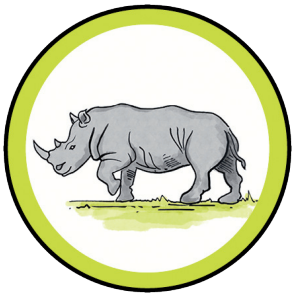
B.Sc., B.Sc. (Hons), M.Sc. in Archaeology at UCT and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geology at NMU, NWU, RU, SU, UCT, UFH, UFS, UJ, UKZN, UL, UP, UWC and Wits

Employers

Research institutions.

Heritage sites and museums.



PARK MANAGER

South Africa's 19 national parks, covering over 9 million hectares, aim to conserve rich biodiversity, landscapes and heritages sites. Various provincial and local government nature reserves complement this aim. These conservation areas generate revenue and contribute to the economy through nature-based tourism and support neighbouring communities whose livelihoods rely on the natural resources within and around these conservation areas. The efficient, effective and sustainable management of parks conserve biodiversity and associated ecosystems and ensure the sustainable use of natural resources.

Park managers oversee the management and conservation of natural and cultural resources according to the Protected Areas Act. They establish the goals and objectives of a park to ensure recreational experiences align with conservation targets as well as supervise resource conservation programmes and research within park premises. They also oversee the procurement of required personnel, resources, equipment and materials and control budgetary expenses. Some park managers also supervise educational outreach initiatives.

Park managers engage with park rangers, researchers, citizen groups, local communities and other stakeholders in the promotion, conservation and engagement with parks and reserves. They work between an office and the field conducting inspections of park areas.

Skills

Park managers require experience in natural resource management, conservation area planning and biodiversity stewardship and an understanding of relevant legislation, coupled with:

- Strong leadership, management and business acumen
- Understand ecological, cultural and socio-economic interactions
- Strong planning and organisational competence
- Excellent communication and interpersonal skills

Tasks

- Direct park operations according to government regulations
- Plan and oversee resource conservation services
- Manage the planning, construction and maintenance of facilities
- Manage administrative functions and cooperative relations with stakeholders

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Management at UFS, UJ, UNISA and UP

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences at all universities

Diploma and Advanced Diploma in Environmental Management at CPUT

Diploma, Advanced Diploma, M.Tech in Nature Conservation at CPUT, MUT, NMU, TUT, UMP and UNISA

Employers

National, provincial and local government parks and reserves.

Public and private game reserves.

SOCIOLOGIST

South Africa is rich in biodiversity and natural assets. South Africa's diverse and different people, as well as foreign communities depend on these natural systems for ecosystem services, goods and services for health, wellbeing and leisure. Understanding social and natural interactions and dependencies provide insights for sustainably managing the natural environment without compromising the health, wellbeing and rights of people to these resources. Sociology studies the interconnections and dependencies between people and the natural or biophysical environment.

Sociologists study society, social institutions and social relationships and the systematic development, structure, interaction and collective behaviour of organised human groups in relation to their environment. They design research projects that test theories around social phenomena and make recommendations for policy development based on analyses and findings. Some become lecturers, educating and supervising students around social theories.

Sociologists can collaborate with policymakers and other specialists in investigating diverse social aspects of society. They work mainly in an office environment, and occasionally travel to interact with, interview and observe people within their communities.

Skills

Sociologists need a sound theoretical knowledge of society and the ability to apply social theories in varied contexts. They will further benefit from:

- Extensive research competence
- Good interpersonal skills
- Strong objective analytical skills
- Excellent verbal and written communication and presentation skills

Tasks

- Conduct research and prepare scholarly papers and reports
- Develop theories, models and methods to interpret and describe social phenomena
- Advise on practical applications of research findings in the formulations of economic and social policies
- Evaluate the outcome of political decisions concerning social policy

Studies

B.A., B.A. (Hons), M.A. in Sociology at NWU, RU, SU, UCT, UFS, UJ, UKZN, UL, UMP, UNISA, Unizulu, UWC and Wits

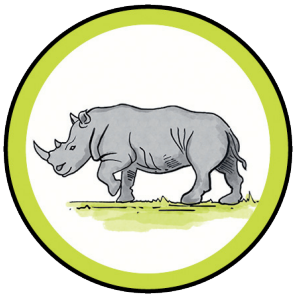
B.Soc.Sc., B.Soc.Sc. (Hons), M.Soc.Sc. in Sociology at UFH, UFS, UKZN and UP

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.



TAXONOMIST

South Africa is home to rich and diverse flora and fauna with over 95 000 plant and animal species. Classifying species can help build information about species groups, determine endangered and invasive species as well as plays a crucial role in understanding how species respond to environmental change such as climate variation. These insights and knowledge inform decision-making and conservation strategies. Taxonomy is the science of discovering, describing and classifying species based on their biological structure, origin and behaviour.

Taxonomists collect and examine living organisms such as plants, animals, fossils, fungi and micro-organism species. They identify, name and organise specimens into classifications according to morphological, behavioural, genetic and biochemical characteristics. They also explore how species relate to other species and how they fit into their ecosystems. If a specimen does not conform to a preidentified group, they are considered new and are formally described and reported on. Taxonomists also sketch and write detailed species descriptions and report their findings in publications.

Taxonomists spend time collecting specimens in the field or studying preserved species in herbariums or museums, returning to a laboratory or office to assess collections. They can work with curators, biologists and other specialists when classifying species.

Skills

Taxonomists require a comprehensive knowledge of biology and the ability to use varied classification techniques such as DNA sequencing. They will also benefit from:

- Strong observation and keen attention to detail
- Competence in research and field and laboratory processes
- Ability to organise and work with large data sets
- Good verbal and written communication and presentation skills

Tasks

- Study the development aspects and life processes of specimens
- Examine the internal components and external factors impacting species
- Identify, classify and record species into accessible catalogues
- Compose scientific reports and maintain informational databases

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Marine Biology at UCT and UKZN

B.Sc., B.Sc. (Hons), M.Sc. in Microbiology at all universities

Employers

National, provincial and local government.

Aquariums, museums and herbariums.

Research institutions.

Environmental consultancies.

Private agricultural companies.

VETERINARIAN

South Africa's biodiversity includes a wide range of key animal species that attracts a wide spectrum of local and foreign visitors and supports local livelihoods. Similarly its animal production sector, domestic, small scale and commercial, also make key economic, social and environmental contributions. The practice of veterinary sciences, involving the treatment and care of all types of animals is key to conservation, the agricultural production industry as well as the domestic care of household pets.

Veterinarians diagnose, treat and prevent animal diseases, ailments and injuries. They vaccinate against diseases, medicate animals suffering from infections or illness, treat and dress wounds, set fractures, perform surgical or dental procedures and advise owners about animal feeding, behaviour and breeding. Some conduct clinical research on the spread of animal diseases or inspect livestock to advise on breeding programmes or disease treatment. They can also manage veterinary practice operations, finances and recruit appropriate staff for assistance.

Veterinarians work closely with veterinary nurses and may consult animal behaviourists. They may need to travel to treat food producing animals or advise on a wild animal or animal population. They often work long hours and may be called at any time in emergencies.

Skills

Veterinarians need to have a comprehensive knowledge and practical understanding of the physiology, nutrition and behaviour of a variety animals, coupled with:

- Ability to diagnose and address animal health problems
- Experience in performing clinical and surgical procedures
- Methodical and analytical problem-solving skills
- Ability to simply communicate diagnoses with empathy

Tasks

- Treat animals medically and surgically and perform autopsies
- Determine the presence and nature of abnormal conditions in animals
- Test and inoculate animals against infectious diseases
- Advise clients on health, nutrition, feeding, hygiene, breeding and care of animals

Studies

B.VSc. at UP

Medical registration of veterinarians is a requirement for practice.

Employers

Private veterinary practices and hospitals.

Government veterinary providers.

NGOs, animal shelters and zoos.

Research institutions.

Medical and pharmaceutical laboratories.

Wildlife rehabilitation centres.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

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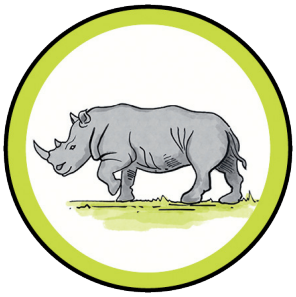

VETERINARY NURSE

South Africa is home to a wide spectrum of animals found in the wild, conservation and animal production contexts. Domestically, animals play a significant role culturally across South Africa and extensively support local livelihoods and some are kept and cared for as pets. Veterinarian science, supported by veterinary nursing, plays a key role in the responsible care, health promotion and management of all animals, across these multiple contexts.

Veterinary nurses care for animals under treatment and assist in the performance of procedures and operations of ill or injured domestic, farm and wild animals. They prepare animals for surgery, administering injections as well as maintaining and sterilizing surgical equipment. They also provide support to both animals and caretakers pre- and postoperatively by monitoring for signs of infection or distress. Veterinary nurses can also provide advice about animal companion care, behaviour and breeding.

Veterinary nurses directly assist veterinarians in caring for animals and regularly interact with the carers of animals. They work long hours in examination or surgical rooms or even outdoors assisting wildlife veterinarians, for example. They can also be exposed to animals with different temperaments.

Skills

Veterinary nurses require technical knowledge and experience in the care and maintenance of a variety of animals. They will also benefit from:

- Strong empathy and interpersonal skills
- Excellent organisation and attention to detail
- Ability to work effectively in a team
- Good verbal and written communication skills

Tasks

- Conduct examinations of animals
- Prepare animals for examination or treatment
- Assist veterinarians with administering medicine, anaesthetics and oxygen
- Monitor animal care recovery following surgery or other procedures

Studies

B.Vet.Nurs. at UP

Medical registration of veterinary nurses is a requirement for practice.

Employers

Private veterinary practices and hospitals.

Government veterinary providers.

NGOs, animal shelters and zoos.

Research institutions.

Wildlife rehabilitation centres.

WWF

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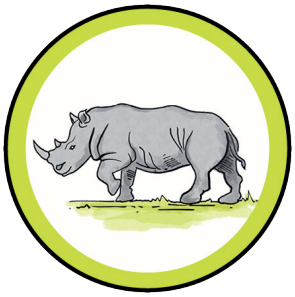


ZOOKEEPER

South Africa is home to extensive biodiversity including a number of iconic wildlife species, most of which are found in the wild. In some instances though, animal sanctuaries such as zoos, nature reserves and aquariums, play a key role in the care and rehabilitation of injured animals that can no longer survive in the wild. They also play a key role growing and increasing population sizes of declining, threatened or endangered species. Zookeeping involves caring for animals that live in captivity.

Zookeepers feed, provide water for and monitor the health of animals kept in sanctuaries. They prepare food and medicine and develop feeding schedules to ensure animals are properly cared for. They train animals to facilitate grooming or medical processes and provide rehabilitation support and appropriate exercise and mental stimulation. Zookeepers also clean, fix and maintain animal enclosures and provide important information to the public about animals through educational programmes and exhibits.

Zookeepers work alongside animal curators and veterinarians when training or treating animals and occasionally interact with the public around animal education programmes. They work long hours and at varied times of the day, depending on the nature of the animal they are caring for.

Skills

Zookeepers require a thorough understanding of the physical needs and behaviour of a variety of animal species as well as patience while working with animals. They will additionally benefit from:

- Strong observation and a keen attention to detail
- Good organisational and record keeping ability
- Good relational competence
- Physical stamina and strength

Tasks

- Observe animals to detect signs of illness
- Inspect cages, grottos and pens for cleanliness and structural defects
- Supervise and coordinate activities of workers
- Conduct education programmes and provide information about animals

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Zoology at all universities

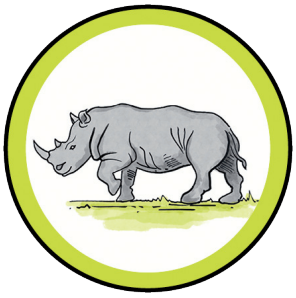
B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Animal Science at NWU, SU, UFH, UFS, UNISA, Univen, Unizulu and UP

B.Sc. (Hons) in Wildlife Management at UP

Employers

Zoos and aquariums.

Nature reserves, parks and conservation sanctuaries.



ZOOLOGIST

South Africa has unique species richness, diversity and endemism with over 20 000 plant species and 75 000 animal species that include mammals, birds, reptiles and other species. This diversity of animals is found in conservation and tourist contexts and also play a key role in supporting local livelihoods. As ecological habitats change over time, for example as a result of climate change, zoology is the science of understanding the interaction and adaptation of animals within and to their physical environment to inform the development of strategies to manage and conserve species populations.

Zoologists study the anatomy, physiology, behaviour, characteristics and environments of animals. They investigate the origin of animal species, interactions, interrelationships, classifications, life histories, habits, life processes, diseases and genetics in relation to the environment. They further examine the growth, development and distribution of animal populations. Some assist in the development of breeding programmes, as well as conservation and eco-tourism initiatives.

Zoologists typically work between an office environment, laboratory and the field, observing species and collecting samples for testing. They can be consulted by behaviourists, zookeepers, marine and wildlife biologists and veterinarians to understand and manage animal populations.

Skills

Zoologists must have a comprehensive knowledge of biological and environmental characteristics of animal species, coupled with:

- Extensive research ability
- Excellent observation and attention to detail
- Strong logical and problem-solving competence
- Good relational competence

Tasks

- Design and conduct research projects, analysing data and writing scientific papers
- Study animals in their natural habitat, collecting specimens for testing
- Dissect and examine specimens to carry out experimental studies
- Assist captive breeding programmes and promote conservation efforts

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Zoology at all universities

B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Animal Science at NWU, SU, UFH, UFS, UNISA, Univen, Unizulu and UP

Employers

National, provincial and local wildlife parks.

NGOs, conservation sanctuaries and private consultancies.

Museums, zoos and aquariums.

Research institutions.

ARBORICULTURAL FARM MANAGER

Forestry operations support over 650 000 of South Africa's rural population through employment and provision of ecosystem services and livelihoods. Sustainably managed indigenous forests and plantations secure and support healthy functioning ecosystems, sustainable economies and growth and consequently livelihoods, both directly and indirectly. Arboricultural farming is the cultivation and management of trees, shrubs and woody plants within the forestry sector.

Arboricultural farm managers plan, direct and coordinate production in large scale forestry operations. They inspect forest plantations, ensuring compliance with government regulations and standards. They determine maturity dates of trees, define harvesting schedules and estimate potential crop damage from extreme weather events. They also have oversight over plantation sales and purchases and the selection, training and performance of forestry workers and contractors.

Arboricultural farm managers work on site in forestry plantations and spend some time in an office environment. They can work long hours, particularly during harvesting seasons. They may collaborate with forest scientists or engineers to increase production yields or to determine unknown tree diseases.

Skills

Arboricultural farm managers require a comprehensive understanding of the forestry life cycle and plantation practices. They also must be knowledgeable about forestry management regulations and compliance, coupled with:

- Knowledge of market trends of forestry and related products
- Meticulous planning and organisation ability
- Strong financial planning and business management competence
- Extensive managerial experience

Tasks

- Direct and coordinate forestry activities
- Monitor forestry market activity and plan production to meet contract requirements and market demand
- Analyse soil to determine type and quantities of fertilizer required
- Establish and manage budgets, monitoring output and farming costs

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Forestry at NMU, SU and Univen

M.Sc. in Forest Management and the Environment at UP

Diploma and Advanced Diploma in Forestry at NMU

Diploma in Forestry at Fort Cox Agriculture and Forestry Training Institute

Employers

Timber plantations and sawmill organisations.

Private forestry and preservation companies.

BIOENGINEER

Forests play a vital role in ecosystem functioning for human and natural wellbeing. They support regulating surface and groundwater flows, reducing water-related risks like landslides, floods and droughts and prevent desertification and salinisation. They also extract and process carbon dioxide into biomass. Forestry could also impact the natural environment, especially water quality and quantity. Engineering design and technology supports practices that maximise benefits and minimise impacts of forestry.

Bioengineers design, develop and improve processes to convert raw materials such as wood pulp into products such as paper, tissue and even plastic alternatives. They coordinate forestry processes and trial experimental designs to increase production, quality and reduce impact and costs. They also assist in the development and implementation of remediation projects to address factors such as soil erosion or slope instability, for example.

Bioengineers work closely with technical and operation personnel to monitor and optimise processes. They can work between research and development laboratories, an office environment and will occasionally visit forestry sites to gather samples and information.

Skills

Bioengineers require a strong understanding of chemistry and engineering principles and processes. They will further benefit from:

- Creative problem-solving and analytical skills
- Ability to draft designs based on abstract ideas
- A strong attention to detail
- Excellent spatial competence

Tasks

- Conduct research and develop new synthetic materials
- Perform tests and propose processes for the manufacture of new products
- Design equipment and processes for the manufacture of new products
- Report findings, establish control standards and procedures for future production

Studies

B.Sc.Eng. in Chemical Engineering at UCT, UKZN and Wits

B.Eng. in Chemical Engineering at NWU, SU, UKZN and UP

Diploma, Advanced Diploma, M.Tech in Chemical Engineering at CPUT, DUT, MUT, TUT, UJ, UNISA and VUT

Employers

Pulp and paper mill organisations.

Private forestry companies and consultancies.

Research institutions.

FOREST SCIENTIST

South Africa's forestry resources cover over 40 million hectares of land and need to be managed effectively to maintain and contribute to healthy functioning ecosystems, economies and livelihoods. Forestry science explores the complex dynamics in forest ecosystems and bio-physical and social interactions with dependent production processes and communities who depend on ecosystem services and natural resources for livelihoods.

Forest scientists research, develop and support the management of forest areas for commercial production, recreational uses and conservation purposes. They undertake assessments of changes to the forest environment due to fires, alien infestations, pests and diseases and make recommendations on managing impacts. They also make inputs into developing management plans and policy for sustainable forestry.

Forest scientists work between laboratories when processing data, forestry sites undertaking investigations or fieldwork and an office environment when writing and publishing reports on findings. They may consult with forestry operation managers, firefighters and land use planners and other professionals, finding the most sustainable use of forest resources.

Skills

Forest scientists must have a thorough knowledge of all tree species and the ecosystems within which they thrive and key threats to forestry. They will benefit from the ability to map large, forested areas, using geographic data and software, as well as:

- Ability to conduct extensive and complex research and fieldwork
- Analytical and critical-thinking ability
- Project management
- Written and verbal communication and presentation skills

Tasks

- Analyse trees and forest conditions, identifying factors that impact growth and production yields
- Develop short and long-term plans for the management of forests
- Supervise and implement forest and conservation projects
- Monitor and evaluate forestry activities according to government regulations

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Forestry at NMU, SU and Univen

Diploma and Advanced Diploma in Forestry at NMU

Diploma and Advanced Diploma in Wood Technology at NMU

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Timber plantations and sawmill organisations.

Research institutions.

WWF

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FORESTRY OPERATIONS MANAGER

The forestry sector plays a key role in the South African economy contributing just over 10% from plantations and 5% from related value chain industries. It employs approximately 165 000 people, from growing timber to processing primary and by-products and all related services. Managing forestry operations involves the design and control of wood production processes and by-products.

Forestry operations managers plan, organise, direct and control the production activities of a forestry operation to maximise yield and profit. They oversee planning, planting and harvesting schedules of plantations and reforestation procedures once crops are cleared from the land. They also have oversight of key requirements to ensure the efficient and sustainable use of land and associated resources.

Forestry operations managers are most often stationed in rural forestry settings where they work with diverse groups of forestry personnel. They mainly work in an office environment and will often undertake site inspections across plantations.

Skills

Forestry operations managers must have a comprehensive and sound understanding of the operations of a plantation and associated production processes and a working knowledge of legislation and policy regarding land and resource use, coupled with:

- Extensive business management and leadership experience
- Excellent planning and organisation competence
- Strong project management skills
- Good interpersonal skills

Tasks

- Direct and coordinate activities such as planting, irrigation, chemical application, harvesting and grading
- Inspect plantations and fields to determine maturity dates of crops or estimate crop damage due to pests or weather
- Monitor agricultural and forestry market activity and plan production
- Establish and manage budgets, monitor production output and costs

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Forestry at NMU, SU and Univen

M.Sc. in Forest Management and the Environment at UP

Diploma and Advanced Diploma in Forestry at NMU

Diploma in Forestry at Fort Cox Agriculture and Forestry Training Institute

Employers

Timber plantations and sawmill organisations.

Private forestry and preservation companies.

WWF

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LOGGING PLANT OPERATOR

The forestry industry is a significant contributor to the national economy, accounting for around 1% of its GDP. Forestry operations could however have significant impact on the natural environment, which could compromise both ecosystems functioning as well as the sustainability of the industry. Improved and responsible logging practices is key to promoting sustainable timber extraction and long-term ecosystem health.

Logging plant operators operate machinery to shear tree limbs, fell, drag and organise cut pieces into preassigned areas. They confirm the tree species and log and load cut logs on transporter trucks and prepare relevant documentation as needed. Some purchase supplies and replacement parts to assist with or maintain and repair vehicles and machinery. They also work with specialists for the upgrade and repair of machinery and vehicles.

Logging plant operators work as part of a logging team. Due to the dangerous nature of their work, they are required to wear protective gear. Weather conditions also determine the work of logging plant operators.

Skills

Logging plant operators need a basic understanding of tree species and the capability to operate varied types of tree felling equipment and machinery. They will further benefit from:

- Excellent hand-eye coordination and multitasking ability
- Astute attention to detail
- Good communication skills
- Ability to work well as part of a team

Tasks

- Prepare and position logging equipment for operations
- Drive logging machinery to transport logs from felling sites
- Inspect equipment for safe and effective operation
- Perform basic maintenance tasks on logging machinery

Studies

Logging plant operators can benefit from a General Education and Training or Further Education and Training Certificate in General Forestry or a National Certificate in Forestry (Silviculture) at National Qualifications Framework Level 1 to 4 offered at Opelong Business Institute, Uphiwe Skills Training College and the South African Forestry Company Limited. Training could also take place on the job with mentoring by an experienced mentor.

Employers

Timber plantations and sawmill organisations.

Private forestry and preservation companies.

WWF

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TREE FELLER OPERATOR

Forestry plays a key role in the functioning of ecosystems and South Africa is richly endowed with more than 1 700 tree and shrub species. To ensure sustainable access to forestry spaces and products, responsible practices that yield the greatest economic and social benefit, with minimal environmental impact are needed. Tree felling is part of the logging process in forestry operations, where trees are sustainably harvested for production.

Tree feller operators use hand-held chain saws to trim top branches and cut down trees. Prior to cutting, they make observations to determine the safest and natural way for the branches and trees to fall. Once the tree has been cut down, they cut the tree into more manageable pieces so that it can be easily transported. Some can also assist other crew members by attaching cut trees to tractors to transport to preassigned areas.

Tree feller operators work as part of a logging team coordinating areas of forests to fell. Due to the dangerous nature of work, they are required to wear protective gear. Weather conditions and seasons determine work frequency and hours.

Skills

A good knowledge of tree species and their characteristics as well as cutting techniques is required by tree feller operators. They will further benefit from:

- Physical stamina and strength
- Astute attention to detail
- Good communication skills
- Ability to work well as part of a team

Tasks

- Plan and decide on best felling methods for a forested area
- Clear area around intended fall of each tree
- Remove or trim branches and tree tops
- Operate manual and machine saws to fell trees

Studies

Tree feller operators can benefit from a General Education and Training or Further Education and Training Certificate in General Forestry or a National Certificate in Forestry (Silviculture) at National Qualifications Framework Level 1 to 4 offered at Opelong Business Institute, Uphiwe Skills Training College and the South African Forestry Company Limited. Training could also take place on the job with mentoring by an experienced mentor.

Employers

Timber plantations and sawmill organisations.

Private forestry preservation companies.

National, provincial and local government.

WWF

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AIR POLLUTION ANALYST

The increasing impacts of climate change, fuelled by excessive greenhouse gases, pose significant risks to the health and wellbeing of people, often the most vulnerable and marginalised. Understanding the origins and extent of air pollution, through air pollution analysis, informs the development of responses to greenhouse gases and its impacts on environmental and human health and wellbeing.

Air pollution analysts collect, analyse and interpret air quality data and work to provide responses to address air pollution. They develop and coordinate the implementation of environmental management systems, to enable organisations to identify the impact of emissions on the environmental health of people. Air pollution analysts also support the formulation of reports and evaluation of draft and existing policies for managing air quality and remediation strategies.

Air pollution analysts can work as part of a team and liaise with environmental engineers, scientists and lab technicians. They sometimes visit testing sites, collecting emission data but mostly work in office and laboratory environments.

Skills

A solid understanding of national and international air pollution guidelines, regulations and policy is vital for air pollution analysts. They will further benefit from:

- Strong research competence
- Ability to work with large data sets
- Analytical and logical problem-solving ability
- Good verbal and written communication and presentation skills

Tasks

- Conduct research and perform field and laboratory analysis
- Conduct risk assessments and audits of existing and proposed projects
- Develop and coordinate the implementation of environmental management systems
- Assess organisational compliance and provide technical advice

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Atmospheric Science at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Chemistry at all universities

Diploma and Advanced Diploma in Environmental Health at CPUT, CUT, MUT and TUT

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Mining and manufacturing companies.

AIR POLLUTION CONTROL ENGINEER

South Africa is primarily powered by coal fired electricity which significantly impacts air quality, not only close to power generation plants, but also in geographies close to mining and agriculture. Effective air quality management requires sound policies and regulations, monitoring and legal enforcement. Air pollution control includes the use of engineering techniques to reduce atmospheric emissions that harm human and environmental health.

Air pollution control engineers research atmospheric emissions and develop responses to air pollution. They evaluate the impact of hazards and design regulations and procedures to prevent or reduce harmful emissions. They further provide technical support for civil, environmental and litigation projects and provide input into and develop air quality policies and strategies.

Air pollution control engineers often collaborate with environmental scientists, urban planners, hazardous waste technicians, engineers from other disciplines and even law and business professionals. They often visit sites of interest returning to office environments to develop plans and reports.

Skills

Air pollution control engineers must have the skills to analyse and understand pollution levels and have a solid understanding of pollution control techniques. They also need extensive knowledge of air quality policies and regulations, coupled with:

- Ability to apply engineering principles related to air pollution
- Logical analytical and problem-solving ability
- Strong project management skills
- Excellent verbal and written communication and presentation skills

Tasks

- Evaluate and model air pollution sources
- Monitor emissions and compliance with applicable regulations
- Design and implement air quality procedures and processes
- Advise on procedures for the mitigation or remediation of air pollution sites

Studies

B.Sc.Eng. in Civil Engineering at UCT, UKZN and Wits

B.Eng. in Civil Engineering at SU, UJ and UP

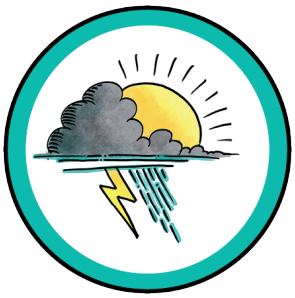
Diploma, Advanced Diploma, M.Tech in Civil Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

National, provincial and local government.

NGOs and private consultancies.

Research institutions.



ASTRONOMER

South Africa has a long tradition in astronomy due to its favourable climate and geographical location. It is becoming increasingly advanced in this field with the establishment of observational telescopes, in Carnarvan and Sutherland in the Northern Cape, the latter being the largest in the southern hemisphere. Astronomy investigates celestial objects, space and the physical universe to understand origins and evolution.

Astronomers study matter, space, time, energy, forces and fields and the interrelationship between physical phenomena to further understand the laws governing the universe. They apply these laws to solve practical problems and discover new information about the Earth and its connection to outer space. They also investigate how interstellar dust, gas clouds, planets, stars, galaxies and clusters of galaxies came to exist and how they behave.

Astronomers collaborate with other scientists and carry out research using large telescopes and advanced technologies. The majority of their time is spent in observatories and offices where it is common to work irregular overnight hours for night sky observation.

Skills

Astronomers need to have an excellent understanding of physics, chemistry and mathematical principles and the ability to work with and interpret astronomy specific software, additionally benefiting from:

- Excellent research capability
- Strong analytical competence
- Creative problem-solving ability and innovation
- Good verbal, written communication and presentation skills

Tasks

- Develop and test theories, software and astrological observation techniques
- Analyse large quantities of celestial data
- Design computer simulations to model physical data
- Write scholarly articles based on discoveries and draft funding proposals

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Physics specialising in Astronomy or Astrophysics at NWU, RU, UCT, UFH, UFS, UJ, UKZN, UNISA, Univen, Unizulu, UP and Wits

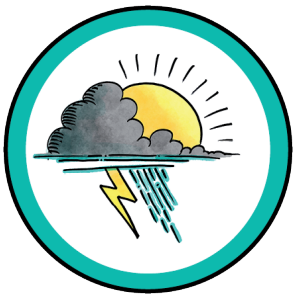
B.Sc., B.Sc. (Hons), M.Sc. in Applied Mathematics at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Computer Science at NMU, NWU, RU, SPU, SU, UCT, UFH, UKZN, UL, Unizulu, UP, UWC, and Wits

Employers

Astronomical research observatories.

Research institutions.



ATMOSPHERIC SCIENTIST

Climate change is a global concern resulting in extreme weather patterns that impact human wellbeing, livelihoods and environmental integrity. Water and food security, health, built and natural infrastructure and ecosystem services are all at risk from changing climate. Understanding atmospheric changes supports developing strategies for mitigating, adapting and building resilience to the effects of climate change. Atmospheric science involves the study of the earth's atmosphere and its physical processes.

Atmospheric scientists study atmospheric conditions and phenomena to better understand climate patterns and their effects and develop forecasts of where and when these events are expected to occur. They collect and compile data from the field and assist in the development of new data collection instruments. Some can advise stakeholders on risks or opportunities caused by weather events and climate change such as flash floods and droughts.

Atmospheric scientists spend most of their time in an office environment, sometimes travelling to gather field information or liaising with varied professionals addressing climate impacts in areas of energy and agriculture, for example.

Skills

Atmospheric scientists must have a comprehensive knowledge of atmospheric and climate patterns, trends and processes. Additional required skills include:

- Mathematical and statistical ability to develop forecast models
- Exceptional analytical ability
- Critical thinking and problem-solving skills
- Ability to communicate complex atmospheric concepts

Tasks

- Research seasonal and ocean forecasting and climate predictions
- Monitor climate variability and change
- Develop and improve numerical and computer models to predict atmospheric processes
- Report and advise on significant atmospheric research findings

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Meteorology at UP

B.Sc., B.Sc. (Hons), M.Sc. in Ocean and Atmosphere Science at UCT

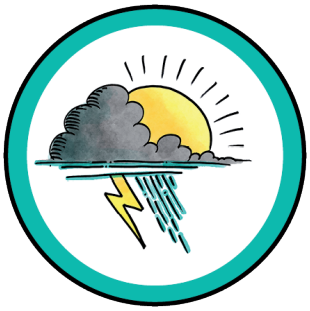
B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Atmospheric Science at all universities

Employers

National, provincial and local government.

NGOs and private consultancies.

Research institutions.



CLIMATE CHANGE SCIENTIST

In 2015, 196 countries committed, through the Paris Agreement, to ensure temperature increases from greenhouse gas emissions are capped at 1.5°C, and the impacts of resulting climate change are minimised. Understanding climate change and its causes is critical to developing mitigation and adaptation measures that builds resilience for people and nature. Climate science investigates significant changes in temperature, precipitation and other measures of climate over several decades.

Climate change scientists research, collect and evaluate climate data and develop models that predict changes to the environment, economy and society. They advise government on policy and legislation that can help to mitigate the impacts of climate change and advise businesses and industry and civil society on mitigation and adaptation measures.

Climate change scientists can work in global teams with other climate specialists and policy makers to address matters of climate change. They mostly work in office environments, analysing data and writing reports and making recommendations from findings.

Skills

Climate change scientists require extensive knowledge of factors causing climate change and strong competence in mathematical modelling. They will also benefit from:

- Extensive problem-solving ability
- Excellent logical reasoning and analytical skills
- Ability to work with and manage large datasets
- Strong research competence

Tasks

- Research policies, practices or procedures for climate management
- Create models to simulate effects of changes to climate
- Provide analytical support and advise on climate change policy
- Make legislative recommendations related to climate change

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Climate Science at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Meteorology at UP

B.Sc., B.Sc. (Hons), M.Sc. in Ocean and Atmospheric Science at UCT

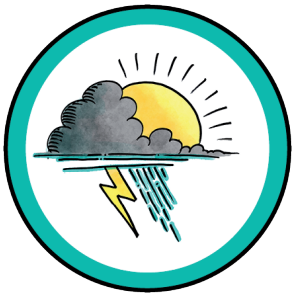
B.Sc. (Hons), M.Sc. in Climate Change and Development at UCT

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private companies and consultancies.

Research institutions.



GEOGRAPHER

The social and economic wellbeing of nations and individuals depend on complex and interrelated interactions between people and natural and built environments. Nature provides goods and services that respond directly or indirectly to our needs and wants. Understanding complex interactions between people and their physical environments ensures that human health and wellbeing is ensured, and economies flourish sustainably while securing the ecological integrity of our natural systems. Geography involves the study of these interactions in varied geographical spaces.

Geographers study and analyse the interrelationships and interactions between human activities and the natural and built environment. They study varied environmental phenomena and human spatial relations. They collect and create datasets to map and interpret these relations and advise on the best opportunities for a sustainable environment and thriving society. Some may analyse the regional distribution of resources and economic activities or provide support for geopolitical affairs.

Due to its interdisciplinary nature, geographers engage with a range of professionals in different fields. They can spend a lot of time in an office environment, occasionally travelling for fieldwork to gather data for research.

Skills

An in-depth understanding of spatial relations and scale is required by geographers, and the ability to map geographic information using GIS and other spatial software. They will also benefit from:

- Critical thinking ability to analyse complex interrelationships
- Excellent analytical skills
- Good understanding of geographical theories
- Strong spatial competence

Tasks

- Study physical landform features, climate and socio-economic factors
- Construct, modify and interpret representations of geographic data
- Advise government and other stakeholders on the assessment of geographic conditions and anomalies
- Write reports and publish research findings

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geography at all universities

B.A., B.A. (Hons), M.A. in Geography at NWU, RU, SU, UMP, UWC and Wits

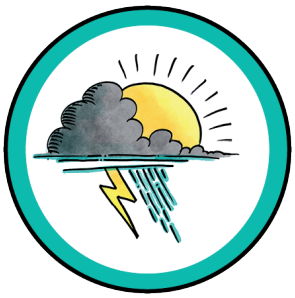
Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Urban and town planning firms.



METEOROLOGIST

Changes in weather and climate patterns are associated with increasing global temperatures caused by excessive greenhouse gas emissions. Extreme weather events, such as extended droughts and flooding, associated with climate change has significant impacts on natural resources and ecosystem functioning. With further adverse implications for social and economic wellbeing. Studying weather patterns and climate change is critical to inform mitigation, adaptation and resilience strategies to minimise associated risks.

Meteorologists study the physics and dynamics of the atmosphere and weather patterns to identify climatic trends and changes. They investigate the direction and speed of air movement, pressure, temperature, humidity and the physical and chemical transformation of pollutants and other phenomena in the atmosphere. They can also develop and test mathematical models for experimental or operational use. Some can directly disseminate meteorological information to the public through radio and television broadcasts.

Meteorologists mostly work in weather stations and office environments analysing meteorological data. They can engage with climate change scientists, policy makers and stakeholders in forestry, agriculture, conservation and environmental management sectors, for example.

Skills

Meteorologists must have a solid understanding of atmospheric and physical science principles and processes, and will also benefit from:

- Extensive mathematical and statistical modelling ability
- Manage and organise large, complicated and complex data sets
- Excellent research and analytical thinking ability
- Strong verbal and written communication and presentation skills

Tasks

- Measure meteorological factors such as air pressure and temperature
- Collect global, national and local satellite and remote sensing data
- Create computer models for short and long-range weather forecasts
- Liaise with stakeholders around weather forecasts

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Meteorology at UP

B.Sc., B.Sc. (Hons), M.Sc. in Ocean and Atmosphere Science at UCT

B.Sc., B.Sc. (Hons), M.Sc. in Agriculture specialising in Agrometeorology at UFS and UKZN

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Atmospheric Science at all universities

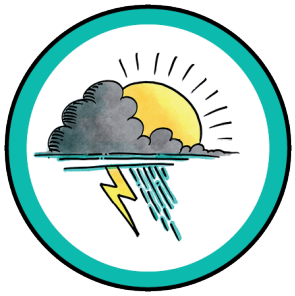
Employers

South African Weather Services.

National, provincial and local government.

Research institutions.

Television and radio organisations.



PHYSICIST

Globally the intensity of climate change is of increasing concern as greenhouse gases are emitted into the atmosphere through production and industrial activities. These changes in global climate patterns result in the frequent occurrence of extreme weather events like droughts and floods that impact human livelihoods and wellbeing and ecological integrity. The principles of physics can explain the complex and interrelated forces that shape weather patterns and accurately predict the impacts of climate change.

Physicists study matter, space, time, energy, forces and fields and examine the interrelationships between physical phenomena to understand the laws governing the universe. They apply these laws to identify practical opportunities to address challenges and discover new information about the earth and the universe. Some can focus on the design of specialised equipment such as aerospace technology, for example.

Physicists can spend time between research and development laboratories testing experiments and formulating theories in an office environment. They can engage with astronomers, engineers and other professionals around development and experimental theories.

Skills

Physicists need to have a comprehensive knowledge of mathematical and physical science principles and laws, coupled with:

- Ability to conduct experiments and develop theories
- Extensive attention to detail
- Strong analytical and problem-solving skills
- Excellent research competence

Tasks

- Conduct research on forces and other physical phenomena
- Evaluate the results of experiments, methodologies and quality control tests
- Provide technical support and advice on calculations and experiments
- Report findings through reports, presentations or published articles

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Physics at all universities

Diploma and Advanced Diploma in Physics at TUT

Employers

National, provincial and local government.

Research institutions.

Mining and manufacturing companies.

Astronomical observatories.

AQUATIC BIOLOGIST

Well-functioning catchments, made up of rivers, wetlands, estuaries, springs and aquifers are critical in supplying enough, good quality freshwater to support ecological functioning, the needs of the economy for example, in production and manufacturing and human wellbeing. Understanding aquatic biology, freshwater quantity and quality and ecosystem functioning and impacts can inform strategies to ensure future water security.

Aquatic biologists study the ecology and living organisms in freshwater. They monitor the health of water by examining biological indicators such as micro and macroinvertebrates as well as the physical conditions of water such as salinity, temperature and oxygen content. Aquatic biologists also monitor and report on pollution levels and its impact on water quality.

Aquatic biologists work mostly in the field collecting samples and monitoring water quality as well as run tests and develop computer models in laboratories. They are likely to collaborate with all stakeholders in catchments, for example local communities and policymakers, addressing water quality challenges and opportunities.

Skills

Aquatic biologists must have an extensive knowledge of freshwater ecology, and biological species in freshwater systems. They will further benefit from:

- Ability to conduct extensive and complex fieldwork
- Strong research and analytical competence
- Excellent laboratory processing skills
- Good verbal and written communication and presentation skills

Tasks

- Research aspects of plant and animal life in water and the interrelated environmental conditions
- Conduct field research, collect samples and make observations of the health and behaviour of plant and animal organisms
- Analyse data and write reports on research findings
- Liaise with stakeholders, conferring reported findings

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Biodiversity and Conservation Biology or Environmental Water Sciences at UWC

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

PLUMBER

Access to good quality potable water and adequate sanitation, is a global human right. Efficient water access is critical for human wellbeing and supporting the economy and the jobs and livelihoods it supports. In a water scarce country like South Africa, water use efficiency is paramount. Appropriate plumbing systems are important for the safe provision of water and the efficient processing of wastewater.

Plumbers install and repair water provisioning, drainage and sewerage pipes and systems. They are involved with the construction of new houses and plumbing systems, but also with assessing and fixing problems in existing and older systems. Plumbers can specialise in the installation and maintenance of sustainable plumbing systems such as rainwater tanks, solar hot water and greywater plumbing systems that will assist users in efficient water use and reducing environmental impact.

Plumbers work in a variety of domestic, commercial and municipal locations. They interact with a variety of people from homeowners to building and construction managers. Work hours can vary, especially with emergencies.

Skills

Plumbers must have a sound knowledge of plumbing practices, legal compliance and safety regulations. They will benefit from physical stamina and:

- Good manual dexterity and coordination
- Ability to read and interpret blueprints
- Problem-solving competence
- Foundational measuring and mathematical ability

Tasks

- Measure, cut, thread, bend, join, assemble, install, maintain and repair plumbing features
- Install dishwashers and water heaters, sinks and toilets
- Lay clay, concrete or cast-iron pipes to form sewers, drains or water mains
- Inspect, examine and test installed systems and pipes

Studies

Plumbers are trained through a National Certificate in Engineering Studies in Plumbing at National Qualifications Framework Level 1 to 3 offered at all Technical and Vocational Education and Training Colleges across the country.

They can also qualify with a General Certificate in Plumbing offered at Eastcape Training Centre, SA Plumbing Trade School and uMfolozi Technical and Vocational Education and Training College.

Vocational registration of plumbers is a requirement for practice.

Employers

National, provincial and local government.

Plumbing and pipe-fitting companies.

Construction companies.

Independent consultancies.

WASTEWATER PLANT OPERATOR

Effective wastewater management is critical for human health and well-being. It is also critical to maintaining the integrity of both ecological and built infrastructure. In urban centres, particularly in sites of dense living, the need for effective wastewater management is even more important. A key service in wastewater management is the operation of wastewater plants, that involves the removal of pollutants from wastewater.

Wastewater plant operators manage activities in a plant that stores, distributes and treats water for safe disposal and domestic and commercial reuse, through the removal of pollutants and the treatment of wastewater. They collect, test and analyse water samples as well as operate chemical-feeding devices for the treatment of wastewater. Some operators repair pumps and valves, reporting more serious defects if necessary.

Wastewater plant operators work in the plant site and may be exposed to hazardous chemicals and unpleasant odours. They can engage with scientists and technicians in laboratories to process and analyse test samples.

Skills

Wastewater plant operators must have a thorough knowledge of plant mechanics and machinery and chemical principles. They also need an in-depth understanding of water quality standards and regulations, coupled with:

- Critical thinking and problem-solving competence
- Strong organisational ability around plant activities
- Keen attention to detail and accuracy
- Skills to effectively manage plant operations

Tasks

- Collect and test water and sewage samples
- Control equipment operation and treat wastewater with chemicals
- Analyse test results and adjust plant equipment, chemical input and systems
- Inspect equipment and monitor conditions to detect malfunction

Studies

Wastewater plant operators can benefit from a General Certificate in Water and Wastewater Reticulation Services at National Qualifications Framework Level 2 to 4 offered at CPUT and the Water Academy.

They can also benefit from a National Certificate in Water and Wastewater Treatment Practice at National Qualifications Framework Level 1 to 4 offered at Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced operator.

Employers

Wastewater treatment plants.

WATER ALLOCATION OFFICER

South Africa is a water scarce country with highly variable rainfall and drought patterns, making water a high premium reserve. Using water efficiently is critical for both effective ecosystem functioning as well as sustainably providing water for basic human needs. Water allocation involves assessing present and future water demand and enabling adequate and equitable access to water, for commercial and domestic use.

Water allocation officers monitor the allocation and use of water from rivers, dams and reservoirs. They advise on and develop distribution and allocation policies, strategies and guidelines for water use. They also oversee water use registration and licensing and maintain oversight of water availability and demand. Some officers can also provide inputs for water user billing and water pricing.

Water allocation officers work in an office environment but often travel to sites to monitor and perform inspections. As part of their evaluations, they can engage with community members, local departments and engineering and water professionals.

Skills

Water allocation officers require a thorough understanding of the water cycle, urban and rural water systems and knowledge of water use guidelines, laws, policies and regulations. They will further benefit from:

- Ability to use geographical software to monitor and map data
- Strong problem-solving ability
- Analytical skills with excellent critical thinking capacity
- Good communication and negotiation skills

Tasks

- Develop and implement water use regulatory frameworks for institutions and organisations
- Assess water use license applications and permits
- Coordinate varied stakeholder inputs into water use licensing
- Provide support and advise water use authorisation processes

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Hydrology at NWU, UKZN, Univen and Unizulu

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science at NWU, RU, UJ, UMP, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science at UWC

B.Sc. in Hydrology and Water Resources Management at CUT

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Employers

National, provincial and local government.

Water utility companies.

WATER AND WASTEWATER ENGINEER

South Africa is a water scarce country, intensified by climate variation and extreme events such as drought and floods. Increasing demand, encroachment on ecological infrastructure and functioning and maintenance of built infrastructure can compromise access to sufficient, clean water. Water and wastewater engineering ensures the design of water and wastewater systems to support ecological, economic and social needs and the sustainable management of water resources.

Water and wastewater engineers design and oversee projects involving the management, distribution, disposal and treatment of water. They conduct water quality and feasibility studies for the location and development of facilities such as water supply systems or water treatment plants. They also design and perform analyses on the most effective equipment and processes needed for functioning water systems. Some can provide interventions and risk management for the provision of flood-related damage or drought contingency systems.

Water and wastewater engineers liaise with water quality and use specialists, urban and town planners and other engineers and specialists around water and wastewater management systems. They work in an office environment and often travel to project sites to monitor and direct operations or address on-site challenges.

Skills

Water and wastewater engineers need a sound knowledge of engineering principles and an understanding of water and environmental regulations, processes and challenges, coupled with:

- Critical problem-solving and analytical thinking ability
- Ability to design water and wastewater equipment and processes
- Independent project management competence
- Good verbal and written communication and presentation skills

Tasks

- Oversee the construction, operation and maintenance of water systems
- Design and develop equipment and projects around water management systems
- Conduct impact studies related to water and wastewater collection, treatment or distribution
- Provide technical direction and support around water engineering projects

Studies

B.Sc.Eng. in Civil Engineering specialising in Water Engineering at UCT, UKZN and Wits

B.Eng. in Civil Engineering specialising in Water Engineering at SU, UJ and UP

Diploma, Advanced Diploma, M.Tech in Civil Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

National, provincial and local government.

Water utility companies.

Water treatment plants.

Research institutions.

NGOs, community-based and development organisations and private consultancies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

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WATER CONTROL OFFICER

South Africa is generally an arid country with variable rainfall and is prone to droughts. Its freshwater is supplied by 22 water source areas situated in the highest lying plains of our water catchments, where the most rainfall is received. The availability of good quality freshwater is a basic right and critical for sustaining livelihoods, wellbeing and the economy. Water resource management is crucial to ensure enough quality freshwater.

Water control officers monitor and control water abstraction in catchment areas. They undertake the inspection of dams in accordance with legislation and assist with water registration, validation and issuing of water licenses. They can also record water meter readings and alert designated authorities on the misuse of water resources.

Water control officers work in teams, occasionally engaging with water quality analysts and engineers to ensure the sustainable use of water resources. They often travel to water supply areas such as dams and reservoirs, returning to an office environment to strategize water control procedures.

Skills

Water control officers require knowledge of water management and distribution systems and the legislation and regulations that govern water provision in South Africa. They will also benefit from:

- Understanding the principles of monitoring and evaluation
- Good analytical and problem-solving skills
- Strong organisational ability
- Good verbal and written communication skills

Tasks

- Control and release the distribution of water
- Record and monitor water balances and metre readings
- Collect and keep records of hydrological data
- Inspect and report on dam and reservoir infrastructure maintenance

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science at NWU, RU, UJ, UMP, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science at UWC

M.Sc. in Water Management at UFS and UP

B.Sc. in Hydrology and Water Resources Management at CUT

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Water control officers can also benefit from a General Certificate in Water Demand Management offered at Rand Water, accredited by the Energy and Water Sector Education and Training Authority.

Employers

National, provincial and local government.

Water utility companies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

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WATER INSPECTOR

South Africa experiences high variability in rainfall, both geographically and periodically. An arid country, large parts experience severe droughts and it is typically described as a water scarce country. Water is essential in maintaining effective ecosystem functioning, providing domestic water and sanitation and sustaining the economy. Monitoring water use through regular inspections supports the sustainable use and highlights opportunities to improve water supply and access.

Water inspectors evaluate and inspect the extraction, use and quality of water in domestic use, irrigation in agriculture and manufacturing purposes. They regulate and monitor water permits and licensing and facilitate investigations around water use complaints and infrastructure compliance. They also inspect water storage facilities such as instream and off-channel dams to ensure they comply with water regulations.

Water inspectors engage with landowners and communities as well as land use planners and engineers. They frequently undertake site inspections at wastewater treatment facilities, reservoirs, dams and even beverage manufacturing plants, returning to an office to evaluate and report on usage.

Skills

Water inspectors need a comprehensive understanding of water systems in urban and rural areas and knowledge of water use guidelines, laws, and regulations, coupled with:

- Methodical approach to investigation
- Analytical and critical thinking ability
- Excellent problem-solving ability
- Safety awareness and consideration

Tasks

- Inspect water infrastructure, plumbing, piping, fixtures and water metres
- Conduct water flow and pressure tests
- Investigate complaints, emergency calls and causes of unusual consumption
- Examine and monitor permits and water licenses

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science at NWU, RU, UJ, UMP, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science at UWC

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Water inspectors can benefit from a Further Education and Training Certificate or National Certificate in Water Treatment Practice at National Qualifications Framework Level 1 to 3 offered at Technical and Vocational Education and Training Colleges.

Employers

National, provincial and local government.

Water utility companies.

WWF

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Higher Education and Training

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WATER LIAISON PRACTITIONER

Water is a critical resource for human wellbeing, ecosystem functioning and supporting all forms of economic activity. From catchments, water travels a long journey through multi-purpose landscapes providing water along the way for various ecological, domestic and economic purposes. Sustainable use of water resources requires collaboration amongst all key stakeholders in catchments and downstream users in urban areas. Water liaison practitioners provide clear and concise water related information for good governance, and management that promotes equitable and sustainable water use.

Water liaison practitioners develop and implement communication strategies to relay appropriate water-related information to promote sustainable water resource management and use. They analyse water related legislation and policies and its application. They also establish, maintain and promote collaborative relationships and partnerships amongst water users. Some also organise events and workshops around specific water projects and coordinate the participation of stakeholders.

Water liaison practitioners regularly consult with varied public and private stakeholders, scientists and businesses. They work in an office environment but regularly travel to sites to gather information and talk to strategic partners.

Skills

Water liaison practitioners require a thorough knowledge of water practices and associated legislation and policies governing water access and use, coupled with:

- Excellent interpersonal and networking skills
- Strong analytical and problem-solving ability
- Events coordination and management skills
- Good verbal and written communication and presentation skills

Tasks

- Design and develop water related communication strategies
- Establish, maintain and promote collaborative partnerships
- Initiate, coordinate and promote water stewardship events
- Identify and analyse appropriate systems and tools for information dissemination

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science at NWU, RU, UJ, UMP, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science at UWC

B.A., B.A. (Hons), M.A. in Communication Studies at NWU, UFH, UFS, UJ, UL, UNISA, Unizulu and UWC

Diploma, Advanced Diploma, M.Tech in Public Relations and Communication at CPUT, DUT, TUT, UJ, VUT and WSU

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Employers

National, provincial and local government.

Catchment management agencies.

Water utility companies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

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WATER QUALITY ANALYST

South Africa is an arid, water scarce country with variable rainfall patterns both geographically and periodically. Water therefore has a high currency in South Africa. That which we have, has to be used efficiently and sustainably. Along the journey of water from catchment to coast, various domestic and commercial activities could impact the quality of water and in turn threaten the health of individuals, ecosystems and economic activity. Water analysts assess water quality and develop strategies to address any challenges.

Water quality analysts analyse freshwater and develop policies and plans for the control of factors which may produce water pollution. They collect water samples, conduct chemical, bacteriological, physical and biological analyses and compare the results to predefined water quality standards. They then provide recommendations and procedures to address challenges or maintain or improve water quality.

Water quality analysts work between laboratories analysing water samples and the field collecting samples in dams and wastewater treatment plants, for example. They can be exposed to hazardous organic materials and inorganic chemicals and are required to wear protective clothing and equipment.

Skills

Water quality analysts require a comprehensive knowledge of water chemistry and biological properties and a thorough understanding of the standards that govern water quality. They will further benefit from:

- Competence in laboratory processes and equipment
- A sound analytical approach to problem-solving
- Good attention to detail and organisational ability
- Ability to easily communicate complex concepts

Tasks

- Conduct research and fieldwork and analyse water samples
- Develop and coordinate the implementation of environmental management systems
- Conduct audits to evaluate environmental impacts of existing activities
- Advise and recommend ways to prevent, control and remediate water pollution

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Chemistry at all universities

B.Sc. in Water and Sanitation at UL

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Employers

National, provincial and local government.

Research institutions.

Water treatment plants.

Private consultancies and testing laboratories.

WATER RESOURCE MANAGER

As a water scarce country that experiences high variability in rainfall, both geographically and seasonally, water is a premium resource in South Africa. Sufficient availability and access to quality water is exacerbated by climate change, and resultant droughts and floods, with many parts of South Africa experiencing severe ecological, economic and livelihood impacts. Effective water resource management can help plan, develop and manage strategies for the optimum use of water resources.

Water resource managers design and implement water resource programs and strategies, related for example, to ecological infrastructure and provision such as supply, quality and regulatory compliance. They conduct investigations around water storage, wastewater discharge, compliance and regulatory challenges and identify specific sources of water pollution. They also assess the implications of proposed water resource schemes and drought management measures. They develop strategies to address water supply, conservation and ecosystem management, and regulatory compliance according to water standards and laws.

Water resource managers consult with water quality analysts, engineers and other professionals to develop water resource protection plans. They work in an office environment and occasionally go into the field to collect specific data or make observations.

Skills

Water resource managers need a solid understanding of hydrological processes and water quality standards and experience in implementing water programmes, coupled with:

- Critical problem-solving and analytical thinking ability
- Understanding of water compliance and regulatory legislation
- Experience in modelling and mapping hydrological data
- Excellent verbal and written communication and presentation skills

Tasks

- Oversee investigations of water quality, storage and compliance
- Create and implement water monitoring and assessment methods
- Develop strategies and opportunities for water resource improvements
- Advise on the development or implementation of varied water programmes

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Hydrology at NWU, UKZN, Univen and Unizulu

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science at NWU, RU, UJ, UMP, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science at UWC

B.Sc. in Hydrology and Water Resources Management at CUT

M.Sc. in Water Resource Management at UP

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Employers

National, provincial and local government.

Catchment management and other local water management agencies.

Water utility companies.

Private consultancies.

WATER TREATMENT PLANT OPERATOR

Water security, for ecological security and domestic use, is a high priority in a water scarce South Africa, with high rainfall variability, geographically and seasonally, further exacerbated by changing climate. The treatment of wastewater ensures the safe reuse of water, domestically and in industry, and helps to ensure water security. The removal of harmful contaminants in wastewater and the maintenance of water treatment infrastructure can assist in securing a complementary source of clean water for domestic and economic use.

Water treatment plant operators operate plant equipment and processes to store, treat and distribute water including water purification for domestic use and removing waste and contaminants from sewage water. They collect and analyse samples throughout the treatment process to ensure adequate chemicals are added to purify the water. They also inspect equipment and monitor operating conditions to ensure they are functioning correctly.

Water treatment plant operators assist water quality analysts and water service technicians in analysing water quality and operating the treatment plant. They are exposed to harmful chemicals and substances, requiring them to wear protective clothing and equipment and may work extra hours during emergencies such as storm water surges.

Skills

Water treatment plant operators need knowledge of chemistry and understand the principles and procedures related to the operation and maintenance of a water treatment plant, along with:

- Critical problem-solving and analytical skills
- Meticulous attention to detail
- Ability to troubleshoot basic machinery issues
- Good physical stamina

Tasks

- Collect and test water samples for chemical and bacterial content
- Analyse test results to adjust plant equipment and systems
- Perform security and safety checks on equipment and the plant
- Complete and maintain plant logs and records

Studies

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

Water treatment plant operators can benefit from a Further Education and Training Certificate or National Certificate in Water and Wastewater Treatment Practice at National Qualifications Framework Level 1 to 4 offered at CPUT and Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced operator.

Employers

Wastewater treatment plants.

WATER USE SPECIALIST

South Africa is a water scarce country with variable rainfall seasonally and geographically and 50% of the country's water is produced in 8% of the land. 62% of water resources are used by agriculture, 3% by forestry and 27% by municipalities. South Africa's water supply needs to be carefully managed to ensure effective ecosystem functioning, economic sustainability, growth and development and human health and wellbeing. Water use monitoring provides evidence to guide effective water resource use and management.

Water use specialists monitor, evaluate and audit water use programs or initiatives. They conduct water use surveys and collect and analyse water samples to determine changes in water supply and quality. They also develop and operate data and information management systems to enable effective water resource monitoring. Some report and advise on strategies to address water use challenges and opportunities as well as water regulation processes.

Water use specialists can engage with communities, land use planners, engineers and water professionals in monitoring water use practices. They spend time between the field, laboratory and office analysing data and drafting feedback reports.

Skills

Water use specialists need a solid knowledge of hydrological processes and water use practices and a strong understanding of water compliance and regulatory legislation. They will also benefit from:

- Strong analytical and problem-solving ability
- Ability to carry out fieldwork and laboratory processes
- Good project management competence
- Good verbal and written communication and presentation skills

Tasks

- Carry out water resource monitoring and evaluation
- Operate and maintain supporting data, information and report management systems
- Compile and present investigation feedback reports
- Advise stakeholders on authorisation, compliance and enforcement processes

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Hydrology at NWU, UKZN, Univen and Unizulu

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science at NWU, RU, UJ, UMP, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science at UWC

B.Sc. in Hydrology and Water Resources Management at CUT

Diploma, Advanced Diploma, M.Tech in Water Science and Technology at TUT

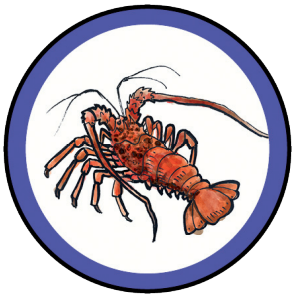
Employers

National, provincial and local government.

Catchment management and other local water management agencies.

Water utility companies.

Private consultancies.



COMPLIANCE OFFICER

Maritime trade and industry contributed over R130 billion to the national economy in 2019. Along its 3000-kilometre coastline, many communities derive livelihoods from fishing practices, either for subsistence or for market. These domestic and economic activities could however pose a significant threat to marine ecosystems and resources. Laws and regulations in the marine environment encourage sustainable maritime practices that mitigate against pollution, overfishing and the loss of marine ecosystems.

Compliance officers develop, implement and manage an organisations compliance program ensuring contractual obligations, government regulations and laws are adhered to when operating within oceans and coasts. They design compliance monitoring plans along with undertaking regular audits to ensure company regulations are followed. They also advise on and coordinate the training of staff on operational compliance.

Compliance officers frequently interact with the staff of an organisation as well as fisheries and marine safety officers to ensure compliance. They work mainly in an office environment but can travel to harbour sites to interact with maritime personnel and inspect fishing and other marine vessels.

Skills

Compliance officers need a comprehensive knowledge of standards, laws and regulations that govern the marine industry. They will also benefit from:

- Knowledge of industry processes and risk management
- Excellent analytical and critical thinking ability
- Strong problem-solving skills
- Good verbal and written communication

Tasks

- Facilitate the development and maintenance of compliance risk management processes
- Examine facilities to ensure accessibility and safety
- Lead internal audits of procedures and update policies when needed
- Advise and train staff and crew on how best to ensure compliance

Studies

B.Com., B.Com. (Hons), M.Com. in Law at all universities

LLB., LLM. specialising in Legal Compliance at all universities

Employers

National, provincial and local government.

NGOs and private consultancies.

Commercial and private shipping companies.

FISHERIES OFFICER

In South Africa, approximately 312 million kilograms of fish are consumed each year through formal markets supplied by commercial fisheries. Additionally, many coastal communities fish for subsistence and recreationally for domestic consumption. Increasing consumer demand, pollution and impacts of climate change threaten both fish stocks and the marine ecosystems that sustain them. Sustainable fishing practices can secure the integrity and quality of South Africa's marine and coastal ecosystems.

Fisheries officers inspect fishing vessels, gear, licenses, permits and catches to ensure compliance with fisheries laws and regulations. They check fish quantities and size sold in markets and processing plants and enforce regulations for juvenile and spawning fish. Some are also involved in fish stock recovery operations for species at risk of decline or that are endangered. Fisheries officers further provide advice on sustainable fishing practices.

Fisheries officers work closely with national environmental and law enforcement protection agencies in surveillance and enforcement. They sometimes work in harsh physical and sometimes even hostile environments. They can work aboard fishing vessels for long periods, returning to an office environment to report on fishing activities.

Skills

Fisheries officers need to have a sound knowledge of fish species and a comprehensive understanding of the laws and regulations that govern the fishing industry, coupled with:

- High level of attention to detail
- Physical stamina
- Good interpersonal skills
- Strong verbal and written communication competence

Tasks

- Identify and classify the biological and environmental characteristics of marine and estuarine fish species
- Report on activities for subsistence, recreational and commercial fishing
- Enforce compliance of fishing regulations and laws
- Communicate and advise external bodies, stakeholders and the public

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Ichthyology and Fisheries Science at RU

B.Sc., B.Sc. (Hons), M.Sc. in Marine Biology at UCT and UKZN

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

Diploma and Advanced Diploma in Marine Science at CPUT

Employers

National, provincial and local government in coastal areas.

NGOs, community-based and development organisations and private consultancies.

FISHERIES SCIENTIST

Fish stocks and marine ecosystems are increasingly threatened by growing consumer demand and the impacts of climate change and extensive pollution, particularly plastics. Information about these changes in the marine environment is needed to inform creative responses to ensure the integrity of marine ecosystems, including fish resources and responsible and sustainable fishing practices. Fisheries science studies the life history and state of fish stocks.

Fisheries scientists monitor, sample and evaluate fish species and implement projects to evaluate the habitats and behaviours of fish species. They develop plans for hatchery management and monitor and maintain relevant fish inventories. They can conduct educational programmes with local fishing communities and make inputs into policy to ensure that fishing laws and regulations are followed to maintain sustainable fish populations.

Fisheries scientists can work with fish in both freshwater and ocean environments undertaking research. They can work with various stakeholders, including local communities as well as water quality scientists and marine biologists, for example.

Skills

Fisheries scientists must have a passion for fish and marine life and a comprehensive knowledge of laws and regulations guiding the fishing industry. They will also benefit from:

- Astute observation and fieldwork ability
- Extensive research competence
- Creative problem-solving skills
- Strong verbal and written communication and presentation skills

Tasks

- Design and implement research and conservation projects
- Conduct field examinations, collecting and analysing biological data
- Develop and conduct educational programmes
- Advise on the development and implementation of policy and rehabilitation programmes

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Ichthyology and Fisheries Science at RU

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

Diploma, Advanced Diploma, M.Tech in Oceanography at CPUT

Diploma and Advanced Diploma in Nautical or Marine Studies at CPUT and DUT.

Employers

National, provincial and local government.

Fisheries industry.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

FISHING HAND

The South African fishing industry contributes 3.2% to the national economy and relies on a flourishing and sustainable marine environment. Fishing hands play a key role in fishing operations of commercial concerns and could make a key contribution to ensuring sustainable fishing practices.

Fishing hands catch fish and shellfish using nets, pots, lines and traps. They perform everyday tasks of baiting, setting lines or traps, hauling and sorting catch. They also maintain fishing vessels and gear and are responsible for securing and removing mooring lines when vessels dock or leave harbours.

Fishing hands work in deep waters on commercial ships or trawlers, often for weeks at a time with large crews. They could also work in shallow waters on smaller fishing boats making short day runs with only a few crew members. Regularity of work and income is highly dependent on weather conditions and the ability of vessels to go out to sea.

Skills

Fishing hands must have physical strength and stamina, given the nature of the job and will additionally benefit from:

- Machine and mechanical operating capability
- Endurance to withstand difficult work conditions
- Foundational measuring and mathematical ability
- Strong team player

Tasks

- Operate fishing gear to catch fish and shellfish
- Prepare and maintain nets, lines and fishing tackle and other deck equipment, surfaces and the fish hold
- Clean, sort and pack seafood in ice and salt and stow catch in the hold
- Handle the mooring lines of the fishing vessel when entering and exiting the harbour

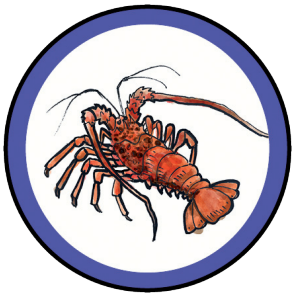
Studies

Fishing hands can benefit from a General Education and Training or Further Education and Training Certificate or a General Certificate in Transport (Fishing) at National Qualifications Framework Level 1 offered at the National Occupation Safety Association, SA Maritime School and Training Force. Training could also take place on the job with mentoring by experienced crew.

Employers

Commercial and small-scale fishing companies.

Private charter fishing companies.



MARINE BIOLOGIST

South African oceans and coasts contain rich and diverse marine ecosystems and resources that provide food and livelihoods for local communities and supply key value chains. Marine biology involves studying all aspects of marine environments to understand and secure effective ecosystem functioning and the sustainable use of marine resources.

Marine biologists study the anatomy, physiology, functions, characteristics, behaviour and environments of all forms of life living in the sea and connected water bodies. They work directly with marine species, focussing on care and rehabilitation and also might focus on studying and analysing changes, reasons and ways to minimise impact on the marine environment.

Marine biologists primarily perform fieldwork in estuaries, along the coastline and in the ocean, observing, collecting, and analysing marine data. They also work in an office environment at times and sometimes also conduct studies in aquariums or laboratories.

Skills

Marine biologists require an extensive knowledge of the marine environment, including marine species, and will additionally benefit from:

- Analytical and logical problem-solving ability
- Ability to conduct extensive and complex fieldwork and research
- Knowledge of related policy and legislation
- Understand socio-economic dynamics with the marine environment

Tasks

- Study the behaviour, genetics, origins and diseases of marine flora and fauna
- Assess ecological effects and changes in the marine environment,
- Investigate physical conditions such as salinity, temperature, acidity, light and oxygen content of ocean water
- Conserve and rehabilitate marine environments and species

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Marine Biology at UCT and UKZN

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

Diploma, Advanced Diploma, M.Tech in Oceanography at CPUT

Employers

National, provincial and local government in coastal provinces.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Aquariums, museums and zoos.

MARINE ECOLOGIST

South Africa's marine environment is rich in biodiversity, with over 10 000 recorded marine plant and animal species and over 150 distinct ecosystem types with habitats ranging from cool-water kelp forests to subtropical coral reefs. However, overfishing, unsustainable fishing practices and pollution exacerbated by the effects of climate change, threaten these ecological systems and their capacity to support livelihoods. Investigation of marine habitats, populations and interactions within marine ecosystems assists us in rehabilitation and sustainability actions within the marine environment.

Marine ecologists research marine ecosystems, focusing on the interactions of organisms within their surrounding environment. They study the biochemical, cellular, individual and community characteristics of marine organisms and their connection to the ecosystem and biosphere. They also observe, collect and test samples from marine ecosystems to identify conservation opportunities and challenges. Some can also develop environmental education programmes to build ecological knowledge in local communities.

Marine ecologists can work within open, deep-sea or coastal marine ecosystems and may work underwater using scuba diving gear. They can analyse collected data in laboratories, returning to an office environment to write up reports and findings.

Skills

Marine ecologists require an extensive knowledge of marine biodiversity and ecosystems and will further benefit from:

- Strong methodological ability in the field and laboratory
- Extensive research capability
- Critical analytical thinking and problem-solving ability
- Ability to develop and interpret mathematical modelling

Tasks

- Conduct field, laboratory and theoretical research
- Provide models and analysis to establish influencing factors on the marine ecosystem
- Develop conservation strategies and projects for ecosystems under threat
- Advise stakeholders and publish findings for sustainable ecosystem management

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Marine Biology at UCT and UKZN

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

Diploma, Advanced Diploma, M.Tech in Oceanography at CPUT

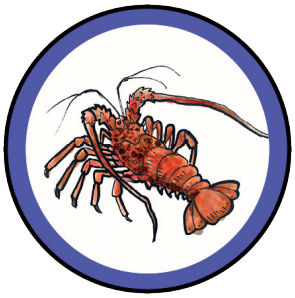
Employers

National, provincial and local government.

NGOs and private consultancies.

Research institutions.

Aquariums, museums and zoos.



MARINE ENGINEER

South Africa has a lucrative trade industry with 96% of imports and exports transported by sea through its eight major ports. The marine transport and manufacturing economic sectors contribute around R56 billion to the economy annually, indicating its significance in sustaining a broad spectrum of jobs. These maritime operations rely on the efficient and effective functioning of vessels which ideally have a minimal impact on the marine environment and associated biodiversity and ecosystems.

Marine engineers design, develop, construct and install new equipment for marine vessels. They create blueprints and design engines, propulsion systems and power supply systems, test prototypes and supervise the construction of ships to ensure equipment and machinery follows required standards. They conduct performance, operational and environmental tests and perform inspections of machinery and equipment. Some can build and operate offshore oil and gas platforms, rigs, pipelines and equipment.

Marine engineers can work as part of a ship crew or independently. They can work at a shipyard, in an office, on a ship, at a port or underwater. They may be at sea for months at a time and are exposed to dangerous conditions that require safety training and protective clothing.

Skills

Marine engineers require a comprehensive knowledge of engineering principles, an extensive knowledge of maritime engineering and associated regulations, processes and challenges, coupled with:

- Ability to apply engineering science and design
- Extensive logical and analytical thinking
- Excellent problem-solving capability
- Good verbal and written communication and presentation skills

Tasks

- Design, develop, construct and maintain marine vessels
- Oversee and inspect installations, engines, instruments and other systems
- Establish control standards and safety procedures
- Ensure equipment, operations and maintenance comply with design specifications

Studies

B.Sc.Eng. in Mechanical Engineering at UCT, UKZN and Wits

B.Eng. in Mechanical Engineering at NWU, SU, UJ and UP

Diploma and Advanced Diploma in Mechanical Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

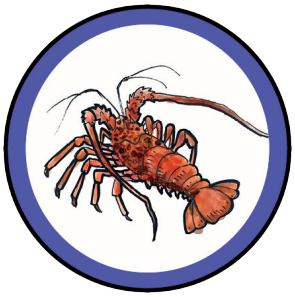
Employers

Military services.

Large and small marine vessel manufactures.

Public and private shipping companies.

Private consultancies.



MARINE SAFETY OFFICER

The South African coastline is advantageously positioned along some of the world's most important sea trading routes that are used to transport over 96% of the country's imports and exports. An important consideration and responsibility is ensuring the safe and responsible operation of seafaring vessels and the health and safety of all mariners during these operations.

Marine safety officers inspect all parts of a vessel to ensure compliance with health and safety standards and regulations. They check the functionality, availability and supply of firefighting and lifesaving devices and equipment. They often train operating crew on safety procedures and drills and conduct interviews to evaluate whether correct procedures are followed in the case of emergencies. They further inspect for potential environmental hazards.

Marine safety officers work on board boats and shipping vessels with crew members as part of a team. They can work in dangerous environments, demanding long working hours.

Skills

Marine safety officers need to have a very good understanding of the maritime standards, rules and regulations that govern occupational health and safety on board shipping vessels. They will further benefit from:

- Creative problem-solving ability
- Safety conscious and be able to stay calm in emergencies
- Strong organisational competence
- Excellent interpersonal and communication skills

Tasks

- Inspect processing, transport, handling and storage areas on vessels
- Advise all crew members on the rules and regulations of the occupational health and safety on the ship
- Inspect all safety components, addressing default or missing equipment
- Investigate and report on emergency cases, accidents or incidents

Studies

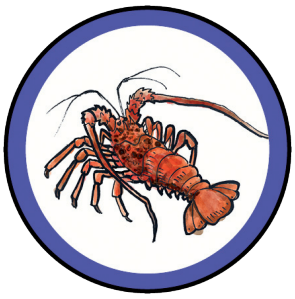
Diploma and Advanced Diploma in Nautical or Marine Studies at CPUT and DUT

Marine safety officers can also benefit from a Certificate in Ship Safety offered at Grindrod Shipping and Training Academy, Project Maritime Training and Sea Safety Training Group.

Employers

Commercial and small-scale fishing companies.

Private charter fishing companies.



MARINE SCIENTIST

South Africa has extensive marine biodiversity with over 10 000 marine species within 150 diverse ecosystems. The oceans economy also contributes 4.2% to the country's economy and the marine environment is key in supporting coastal livelihoods. Threats of overfishing, pollution and the effects of intensifying climate change impact marine resources and the overall functioning of the marine environment. Understanding marine systems, interactions with and within it and threats and opportunities is key to safeguarding the health of the marine environment and associated biodiversity.

Marine scientists research the oceans and coasts and interactions between organisms, sea floors, coastal areas and the atmosphere. Some research interactions between the marine environment and communities who rely on this resource for livelihoods. They study varied aspects of marine systems, collect samples and make observations to analyse and predict changes to oceans and coastal infrastructure. They can use this information to advise on maritime policies and legislation and develop environmental protection and conservation projects.

Marine scientists engage with climate change scientists, marine engineers, other natural science professionals and coastal communities. They work between an office, laboratory and ocean and coastal sites where research can be done over weeks or months at a time.

Skills

A comprehensive and extensive knowledge of the marine environment, and an understanding of the social and economic interactions within and surrounding it, is needed by marine scientists, along with:

- Ability to conduct extensive and complex fieldwork and research
- Analytical and logical problem-solving ability
- Mathematical modelling and mapping ability
- Understanding of maritime policy and legislation

Tasks

- Plan and undertake laboratory and field-based research
- Record, analyse and interpret data from biological and physical processes
- Report on and present research findings
- Advise on and make input into maritime policies

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Marine Biology at UCT and UKZN

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

Diploma, Advanced Diploma, M.Tech in Oceanography at CPUT

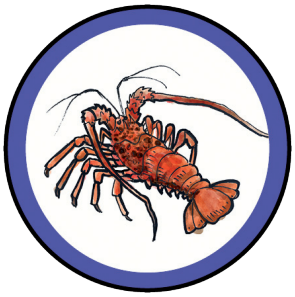
Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Engineering companies.



OCEANOGRAPHER

South Africa's oceans and coasts are dynamic environments shaped by wind, water density and tides that regulate climate, absorb carbon and cycle nutrients for marine ecosystems. These systems are constantly in a state of flux due to variations in climate, which in turn shapes marine biodiversity and ecosystems. Understanding the properties and interrelated nature of oceans and coastal systems support decision-makers in managing oceans and coastal environments that support global and local economies and livelihoods.

Oceanographers study the physical, chemical and biological properties of the ocean. They investigate the interactions between the sea and air to establish its influences on weather and climate patterns. They also examine the processes involved in the formation of the seafloor and coastline, forecasting potential changes and its causes. Some also investigate the chemical composition of seawater, determining the quality of water and its impacts on marine environments.

Oceanographers periodically work aboard research ships or boats observing and collecting data, returning to a laboratory and office environment to perform tests and report their findings. Due to the nature of their work, they can be out at sea for days, weeks or even months at a time.

Skills

Oceanographers need a thorough knowledge of marine systems and practical experience with digital mapping, remote sensing and computer modelling. They will also benefit from:

- Strong research and laboratory competence
- Ability to logically analyse large data sets
- Excellent physical fitness, for diving and long periods at sea
- Good verbal and written communication and presentation skills

Tasks

- Perform research and plan marine expeditions
- Analyse and interpret data from samples, measurements and remote sensing aids
- Perform simulations of oceanographic phenomena
- Report on and publish findings in academic journals and books

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Oceanography at UCT

B.Sc., B.Sc. (Hons), M.Sc. in Marine Biology at UCT and UKZN.

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology at all universities

Diploma, Advanced Diploma, M.Tech in Oceanography at CPUT

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Museums.

Offshore mining companies.

SHIP'S MASTER

More than 96% of South Africa's imports and exports is transported by sea. Well positioned along some of the world's most important sea trading routes and with access to eight commercial ports, South Africa's shipping industry is a key contributor to the economy, economic growth and trade development. The efficient and safe operation of shipping vessels is vital to maintaining health and safety of seafaring staff as well as managing impacts on the marine environment.

Ship's masters control and manage the operation of ships and other marine vessels. They navigate marine vessels through challenging ports and narrow waterways, as well as make voyage plans and consult weather forecasts to ensure the safest journey to a destination. They recruit and supervise ship crew, making sure they abide by all maritime law regulations and safety procedures. They also do regular checks of equipment and inventory and oversee all required maintenance and repairs.

Ship's masters can work at sea for many days and months at a time, exposed to harsh weather conditions. They mainly work in the control station cabin of large shipping vessels but do regular patrols of the vessel and participate in deck and bridge watch activities.

Skills

Ship's masters require practical experience in the operation and control of marine vessels under varied conditions and a comprehensive understanding of maritime law and safety regulations, along with:

- Excellent navigation skills
- Geographical understanding of domestic and international waters
- Strong planning and organisational competence
- Excellent communication and interpersonal skills

Tasks

- Control and direct marine vessels during berthing and mooring
- Navigate the vessels course, recording route alteration and daily occurrences
- Manage and maintain operational expenditure and budgets
- Coordinate cargo loading and discharge operations

Studies

Diploma and Advanced Diploma in Nautical or Maritime Studies at CPUT and DUT

Ship's masters can also benefit from a Certificate in Vessel Commander or Ships Master accredited by the South African Maritime Safety Authority offered at Sea Safety Training Group, South African Maritime School and Transport College and South African Maritime Training Academy.

Employers

Shipping companies.

Ferry and charter companies.

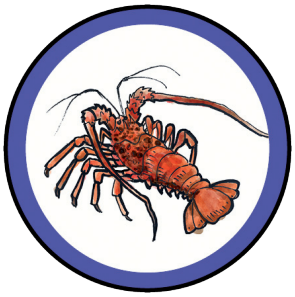
Cruise ship companies.

Military and defence force.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha
Make the right choice. Decide your future.



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Employers

Shipping companies.

Ferry and charter companies.

Cruise ship companies.

Military and defence force.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha
Make the right choice. Decide your future.

AGRICULTURAL ECONOMIST

Agriculture plays a crucial role in the South African economy, supplying food, fibre, fertilizers and fuel products for local and export markets. Agricultural economics involves studying these markets to optimise and advise the stakeholders in farming activities.

Agricultural economists study economic and financial trends and patterns in local and global markets, develop market forecasts and advise producers in the agricultural value chain to improve production yield and profitability. They make input into and develop national, regional and global policies for the sustainable growth of agriculture and the economy. Agricultural economists could also focus on the interactions between economic trends and environmental impact and propose more sustainable production processes.

Agricultural economists work mainly in an office environment and could also spend some time in client environments like farms, production or processing plants when consulting and advising farmers and other stakeholders in the agricultural sector.

Skills

Agricultural economists must have a comprehensive knowledge of economic trends, patterns, practices and policies related to agriculture, and will additionally benefit from:

- Strong mathematical and statistical skills
- Extensive research competence
- Excellent analytical skills in micro and macroeconomic trends
- Good verbal and written communication and presentation skills

Tasks

- Advise on the production, manufacturing and distribution of agricultural products, policy and costs
- Conduct research related to agricultural markets
- Analyse economic patterns and trends and identify opportunities for agricultural development
- Develop costing models for the efficient use of resources

Studies

B.Agric., B.Agric. (Hons), M.Agric. in Agricultural Economics at UFH and UFS

B.Com., B.Com. (Hons), M.Com. in Agricultural Economics at NWU and UP

B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Agricultural Economics at NWU, SU, UFH, UFS, UKZN, Univen and UP

Employers

National, provincial and local government.

Financial and banking institutions.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Various organisations along the agriculture value chain.

AGRICULTURAL ENGINEER

Agriculture and related industries are key contributors to the South African economy. Agricultural engineering involves exploring opportunities and challenges related to agricultural production, processing and distribution with the goal of ensuring profitable and sustainable agriculture and related practices.

Agricultural engineers research, design and develop agricultural equipment and machinery, as well as systems and procedures for the production, processing and distribution of agricultural products. Some might focus on adapting farming practices such as ploughing and harvesting techniques to enhance soil quality, developing run-off systems to better manage water use or implementing renewable energy technologies. They also research and develop plans and specifications for the construction and modification of agricultural infrastructure.

As part of multi-disciplinary teams, agricultural engineers engage with varied professionals, exploring innovative strategies and opportunities to deal with challenges. They typically work in offices and laboratories and sometimes on-site to assess the needs of farming and related operations.

Skills

Agricultural engineers must have a comprehensive knowledge and ability to apply scientific and mathematical principles and be able to use popular engineering and design software to design equipment, machinery and processes. They will also benefit from:

- Creative problem-solving skills
- Analytical and logical reasoning skills
- Project management
- Written and verbal communication and presentation skills

Tasks

- Design and manage agricultural equipment, machinery and processes
- Oversee and manage construction and production operations
- Modify environmental factors that affect agricultural production
- Research technical problems and develop new methods and techniques

Studies

B.Sc.Agric. in Agricultural and Rural Engineering at Univen

B.Sc.Eng. in Bio-resources Engineering at UKZN

B.Sc.Eng. in Mechanical Engineering at UCT, UKZN and Wits

B.Eng. in Mechanical Engineering at NWU, SU, UJ and UP

Employers

National, provincial and local government.

Financial and banking institutions.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Agricultural equipment manufacturers.

Various organisations along the agriculture value chain.

AGRICULTURAL EQUIPMENT OPERATOR

Agriculture plays a critical role in South Africa's economy. It is a key employer and provides food, fibre and fuel for domestic use and further production of goods and services. Agriculture is becoming increasingly mechanised to maximise production yield and keep pace with demand. Highly specialised equipment and machinery used in agricultural production requires competent and skilled operators.

Agricultural equipment operators drive and operate varied equipment and machinery used in agricultural production. They use equipment and machines to clear, cultivate and sow land. Some harvest and transport crops or assist in spraying crops with fertilizer and pesticides. They inspect tools and equipment to ensure safe and effective operation as well as run basic maintenance and repairs.

Agricultural equipment operators spend majority of their time in farming fields and work long hours in peak seasons. They can also be exposed to dangerous chemical and equipment and are required to work in all types of weather conditions.

Skills

Agricultural equipment operators must have a strong understanding of how to operate and monitor heavy machinery. They need to have good physical stamina and strength, also benefitting from:

- Hand-eye coordination and simple decision making
- Ability to troubleshoot machinery issues
- Run basic repairs on operating machinery
- Good driving ability

Tasks

- Operate tractors, combines, irrigation and other farm equipment
- Attach farm implements such as sprayers to harvesters or tractors
- Monitor, repair, and service farm machinery when machines malfunction
- Load hoppers, containers, or conveyors to feed machines with products, using forklifts, transfer augers, suction gates, shovels or pitchforks

Studies

Agricultural equipment operators will benefit from a National Certificate in Primary Agriculture in Plant Production at National Qualifications Framework Levels 1 to 4 offered at agricultural colleges and most Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced operator.

Employers

Commercial farming organisations.

Private farming operations.

AGRICULTURAL FARM MANAGER

South African agriculture contributes approximately 2.4% to the national economy and is especially essential for food security, employment and the supply of raw materials to other sectors. The everyday decisions and management of farming operations has the potential to not only maximise profits but also promote effective sustainable farming methods to meet future domestic and production needs.

Agricultural farm managers plan, direct and coordinate production and other activities on crop or livestock farms. They maintain finance, operation, production and employment records as well as prepare budgets and the sale, storage and transportation of products. They also inspect and analyse crops or livestock to determine prime harvesting time or breeding schedules and address all plant and livestock diseases and illness.

Agricultural farm managers can work closely with agricultural scientists, engineers and economists to ensure production targets are met. They tend to work between farm fields and offices, working longer hours during busy harvesting periods.

Skills

Agricultural farm managers must have the ability to practically apply agricultural theory and knowledge and have a robust understanding of agricultural markets and activities. They may also benefit from:

- Extensive managerial experience
- Strong financial management and knowledge of market trends
- Understand agricultural and labour legislation and regulations
- Excellent written and verbal communication skills

Tasks

- Direct and coordinate farm operations and worker activities
- Inspect and analyse crops and livestock for harvest, sale and activity adjustments
- Establish and manage budgets, monitoring economic activity for challenges and opportunities
- Confer with buyers to arrange for the sale of crops and livestock

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Agriculture at NWU, SU, UFS, UFH, UKZN, UL, UMP, UNISA, Univen, Unizulu and UP

B. Agric., B. Agric. (Hons), M. Agric. in Agricultural Management at UFS and UKZN

Diploma, Advanced Diploma, M.Tech in Agriculture at CPUT, MUT, TUT and UMP

Diploma and Advanced Diploma in Agricultural Management at CPUT, CUT, NMU and UNISA

Employers

Commercial farming organisations.

Agricultural cooperatives.

Private farming companies.

AGRICULTURAL SCIENTIST

South African agriculture produces a wide range of crops and livestock that meet our daily material needs and wants. It is essential that we manage this sector and its socio-economic benefits through responsible and sustainable resource use. Agricultural science explores the most sustainable and efficient agricultural practices to ensure maximum production and profitability.

Agricultural scientists research and explore large and small-scale commercial and subsistent crop and livestock agricultural practices and production. They study the genetics, reproduction and development of livestock and crops to improve production economic returns. With the evident impact of climate change, they are increasingly concerned with building crop and livestock resilience and to find the best use of land and other natural resources, especially water in water scarce South Africa.

Agricultural scientists work with a range of laboratory processes, equipment and chemicals and can work with various agricultural stakeholders. They often move between farm fields, greenhouses, laboratories and offices.

Skills

Agricultural scientists need to have an in-depth knowledge of plants, animals, land use and natural resource management, as well as trends and patterns in agricultural production. Additional key skills include:

- Excellent research ability
- Analytical and problem-solving skills
- Creativity and innovative thinking
- Writing good communicative reports, explaining complex ideas

Tasks

- Research the impacts of diverse factors on animal and crop production
- Develop procedures and techniques to address challenges and improve production
- Study environmental factors affecting crop production, pasture growth, animal breeding and the growth and health of plants
- Advise on techniques used to improve production of crops and livestock

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Agriculture at NWU, SU, UFS, UFH, UKZN, UL, UMP, UNISA, Univen, Unizulu and UP

Diploma, Advanced Diploma, M.Tech in Agriculture at CPUT, MUT, TUT and UMP

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

Various organisations along the agriculture value chain including specific agricultural sector associations.

AGRICULTURE EXTENSION OFFICER

The South African agricultural sector and related industries rely on current information to boost agricultural productivity, increase food security and improve rural economic growth. Agricultural extension is the application of scientific research to agricultural practices through providing the link between farmers and research.

Agriculture extension officers liaise with farmers, providing information that supports decision-making for effective and sustainable farming. They engage with scientists to understand new and better ways of ensuring improved and sustainable production and translate this information into advice and guidance for farmers. They are also increasingly supporting the development of smallholder farmers, often through training both in production practices and enterprise development to support access to both formal and informal markets.

Agriculture extension officers work on-site, mostly in rural areas, engaging with farmers in the field. They also spend some time in laboratories and will have their base in an office environment, developing plans for sustainable farming.

Skills

A solid understanding of trends and patterns in sustainable agricultural production is vital for agriculture extension officers. Their interaction with farmers and scientists will benefit from:

- Strong communication and interpersonal skills
- Knowledge of the farming environment and enterprise
- In-depth insight into sustainability in agriculture
- Project planning and management

Tasks

- Engage with research around sustainable farming practices
- Develop plans and strategies to promote sustainable farming practices
- Liaise with farmers to support increased production yields and implement sustainable practices
- Provide training to support improved and sustainable production processes

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Agriculture at NWU, SU, UFS, UFH, UKZN, UL, UMP, UNISA, Univen, Unizulu and UP

B.Agric., B.Agric. (Hons), M.Agric. in Agricultural Extension at UFS, UFH, UKZN, UMP and UP

Diploma and Advanced Diploma in Agricultural Management at CPUT, CUT, NMU and UNISA

Diploma and Advanced Diploma in Agricultural Extension at CUT, TUT and UMP

Employers

National, provincial and local government.

NGOs, community-based and development organisations and private consultancies.

Agricultural sector associations.

BIOTECHNOLOGIST

In South Africa agriculture is a key contributor to the national economy. It contributes around 2.4% to GDP, is a key exporting industry and is critical for local food security. Biotechnology works with living organisms and its derivatives to produce products and investigates processes for higher production yields. It also explores biological crop and plant management for example, in pest control. Biotechnology is also increasing as a career field in the management of invasive alien plants.

Biotechnologists study the anatomy, physiology and characteristics of living organisms and biological molecules and develop new materials for a range of purposes. They examine the chemical, genetic and physicality of cells, tissues and organisms. Some may find ways to improve animal feed or genetically modify crops to make them more pest resistant or to increase productivity. Biotechnologists could also use and research agricultural crops to produce biodegradable plastics or biodiesel.

Biotechnologists can work with farmers, agricultural scientists, engineers and pest management officers in finding the best products for crop growth or plant disease, for example. They mainly work in laboratories, wearing protective clothing as they work with dangerous chemicals and biological specimens.

Skills

Biotechnologists must have a solid knowledge of biology and its associated laboratory techniques and an understanding of chemical properties. They will further benefit from:

- Complex problem-solving ability
- Creative and logical analytical ability
- Strong organisation and attention to detail
- Excellent written and verbal communication skills

Tasks

- Design, implement and monitor research experiments
- Collect, study and test cell, tissue, bacteria and living organism samples
- Analyse findings and identify practical applications and potential risks
- Record and disseminate results in reports and presentations

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Biotechnology at SU, UJ, UKZN, UP and UWC

B.Sc., B.Sc. (Hons), M.Sc. in Microbiology at all universities

Diploma, Advanced Diploma, M.Tech in Biotechnology at CPUT, DUT, TUT, UJ and VUT

Employers

Agricultural and crop production companies.

Conservation organisations.

Biotechnology and genetic engineering organisations.

Pharmaceutical and chemical companies.

Research institutions.

GAME FARMER

South Africa is home to approximately 10 000 game farms, with the wildlife industry contributing significantly to the national economy through the biodiversity economy. As part of the biodiversity economy, the wildlife economy is steadily expanding to focus on wildlife and game farming for ecotourism, the supply of game meat and associated products and restocking and recovering wildlife populations. Game farming involves the breeding and management of wildlife species for services and products in the wildlife economy.

Game farmers plan, organise and perform farming operations to breed and raise game. They regularly inspect game, ensuring grazing areas can support the number of animals on the farm. They plan breeding schedules and organise veterinary assistance if needed. They also plan the sale and transportation of animals and can participate in game capture programmes ensuring the wellbeing of animals during the process.

Game farmers engage with wildlife veterinarians when animals require medical assistance and network with other farmers and reserve managers to ensure the profitability of the game farm. They work between the farm and an office, monitoring game populations.

Skills

Game farmers need to have an intricate knowledge of the biology and environmental ecosystems needed for game species to thrive and will additionally benefit from:

- Good leadership and management capability
- Extensive biodiversity and game farming industry experience
- Astute business acumen
- Organisational and administrative competence

Tasks

- Examine the physical conditions of animals to detect illness, for example
- Monitor market activity and organise production accordingly
- Coordinate breeding plans and assist with animal births
- Market and arrange the sale, purchase and transportation of animal stock

Studies

B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Animal Science at NWU, SU, UFH, UFS, UNISA, Univen, Unizulu and UP

B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Zoology at all universities

B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Agribusiness Management or Agricultural Economics at NWU, SU, UFH, UFS, UKZN, Univen, Unizulu and UP

Diploma and Advanced Diploma in Game Ranch Management at NMU and TUT

Employers

Game farms.

Private and public game reserves.

HARVESTER / PICKER

Agriculture contributes 2.4% to the national economy, employs around 810 000 people and is key to securing food security in South Africa. Following crop production or cultivation of crops, fruit, vegetables, fibre and grains, for example, is harvested manually or with machinery. As a key part of the agricultural value chain, crops need to be carefully picked at the right time to be processed, packaged and distributed for consumption.

Harvesters or pickers manually extract crops from orchards or fields ensuring that quality is not compromised during the handling process. They select crops to harvest according to size and ripeness and discard overripe produce. They load harvested produce onto containers or bundles and move them to collection sites where they are sorted and packed. Some harvesters or pickers operate special handheld equipment for specific crops such as nuts, for example.

Harvesters or pickers work in small teams on farms and are exposed to the natural elements. They work with ladders, mechanical hoists, spades and other equipment and are required to wear protective clothing such as gloves, boots and overalls. Work can be seasonal, depending on the crop.

Skills

Harvesters or pickers need to be able to identify crops and know when and how to pick crops without causing damage, and will also benefit from:

- Physical stamina and strength
- Foundational measuring and mathematical ability
- Basic machine and mechanical operating capability
- Ability to work as part of a team

Tasks

- Select and harvest crops according to size, shape and colour
- Load crops into containers or bind crops into manageable bundles and bales
- Prepare work sites and strategically manage crops into workable units
- Transport crops to collection sites, preparing and assisting the loading of goods onto conveyors, trucks, trailers or containers

Studies

Harvesters or pickers can benefit from a National Certificate in Primary Agriculture in Plant Production at National Qualifications Framework Levels 1 to 2 offered at agricultural colleges and most Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced farm worker.

Employers

Farms.

HORTICULTURIST

South African agriculture produces varied crops from fruit and vegetables to ornamental plants and nuts. Horticulture is the art of cultivating and producing fruit and vegetables, decorative indoor and outdoor plants, landscape plants and grasses, medicinal plants, and other perennial plant species. The sustainable propagation, cultivation and maintenance of seedlings and plants, the work of horticulture, is key in the production of healthy and resilient plants.

Horticulturists propagate and cultivate trees, shrubs and ornamental and flowering plants and grasses. They analyse plants to identify whether they are nutrient deficient, infected with disease or infested with pests, determining the best means to remedy the plant. They draw up maintenance plans for the propagation and care of rare plants as well as garden designs and landscaping. Some also develop and give educational presentations to the public around plant species.

Horticulturists can work with landscape architects, conservationists, town planners and engage with the general public and students around plant education. They mainly work outdoors in nurseries or botanical gardens, for example and return to an office environment to research and plan planting schedules.

Skills

Horticulturists require a vast knowledge of indigenous and non-indigenous plant species and the properties that govern their development. They will further benefit from:

- Excellent planning and organisational ability
- Strong project coordination competence
- Creative ability
- Good written and verbal communication ability

Tasks

- Oversee the production and care of plants
- Manage crop scheduling for timing of appropriate planting and harvesting
- Perform propagation, irrigation and pest management of plants
- Advise and educate varied stakeholders on plant species

Studies

B.Sc. in Agriculture specialising in Horticulture at NWU, SU, UFH, UKZN, UL and Univen

Diploma, Advanced Diploma, M.Tech in Horticulture at CPUT, DUT, TUT and UNISA

Horticulturists can also benefit from a Diploma or General Certificate in Horticulture at Cedara Agricultural College and Elsenburg Agricultural Training Institute.

Employers

National parks and botanical gardens.

Plant nurseries.

Landscaping firms.

Golf, country and housing estates.

HYDROLOGIST

Agriculture plays a significant role in the South African economy, contributing 2.4% towards GDP, employing around 810 000 people and is key in securing food security. It is also one of the most vulnerable sectors in the context of climate change, given its significant dependence on water resources. In South Africa, agriculture uses an estimated 63% of total water available. In this context, hydrology plays a critical role in understanding and managing the movement and distribution of water for sustainable use.

Hydrologists study the quality, quantity, distribution, circulation and physical properties of surface and underground water. They study the impact of precipitation and identify water supply sources to evaluate the effect of human activities on the quantity and quality of water as well as study interactions between components within the hydrological cycle. They also map and model future water levels by tracking usage and precipitation data and advise on effective water use programmes.

Hydrologists work with agricultural scientists, engineers and other professionals to ensure acceptable water levels are used. They spend a lot of time in the field in catchment and consumer areas for observation. And spend some time in a laboratory and office to analyse collected data.

Skills

Hydrologists need to have a comprehensive understanding of the hydrological cycle and an understanding of water policies and regulations. They will further benefit from:

- Extensive research and fieldwork capability
- Ability to geographically map and model hydrological data
- Excellent analytical and problem-solving ability
- Good verbal and written communication and presentation skills

Tasks

- Collect and analyse water and soil samples
- Create, test and interpret prediction models and maps
- Evaluate the feasibility of water-related projects
- Prepare written reports and presentations on research findings

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Hydrology at NWU, UKZN, Univen and Unizulu

B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Hydrogeology at UFS, UP and Wits

Employers

National, provincial and local government.

Research institutions.

Water utility companies.

Private consultancies.

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INDOOR PLANT WORKER

South African agriculture produces a variety of products from fibre, fruit, grains, vegetables, poultry and livestock and ornamental horticulture amongst others. Ornamental horticulture involves the production of flowers and plants for landscaping, gardening and indoor display. Indoor plants are often more resilient in enclosed spaces as compared to outdoor plant variations. They help to purify the air and add aesthetic appeal to spaces such as offices, restaurants and retail spaces, for example.

Indoor plant workers assist with the planting and care of indoor plants. They check whether plants require water and based on soil moisture measurements, water plants as needed. They also rotate and prune away dead and diseased plant matter as well as clean dust accumulated on plants. Indoor plant workers also inspect plants for evidence of pests or disease and select and apply the appropriate course of treatment or replace the plant if needed.

Indoor plant workers work as part of a team and travel to maintain indoor plants in varied business and domestic spaces. They return to a nursery environment to treat and grow indoor plants and attend to administrative tasks.

Skills

Indoor plant workers require a good knowledge of indoor plants, their characteristics and the principles for growing them and will further benefit from:

- Good customer service skills
- Time management competence
- Ability to work as part of a team
- Good interpersonal skills

Tasks

- Identify and replace unhealthy or unsightly plants
- Water indoor plants, adjusting the schedule if environmental factors change
- Feed and fertilize plants and conduct simple soil tests to determine if nutrients are needed
- Control the spread of pests, fungi and viruses on plants

Studies

Indoor plant workers may benefit from a National Certificate in Primary Agriculture in Plant Production at National Qualifications Framework Levels 1 to 4 offered at agricultural colleges and most Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced mentor.

Employers

Indoor plant rental companies.

Nurseries.

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IRRIGATIONIST

South Africa is a water scarce country that experiences variable rainfall, seasonally and geographically, agriculture uses 67% of available water in South Africa. Smart, water wise irrigation systems can help the efficient use of water resources in agriculture, that is key to the economy and ensuring food security. Irrigation involves the watering of crops through varied systems of tubes, pumps and sprays so that crops receive the optimal amount of water to grow.

Irrigationists install and maintain irrigation systems to ensure optimum soil moisture levels for the production of crops. They lay pipes down with a predetermined number of sprinkler heads at specified points or adjust lateral-moving irrigation systems to maximise the watering of crop areas. They also perform maintenance of these systems by repairing or replacing valves, pumps and other equipment. They can further install timers and clocks as well as prepare equipment for use during winter periods.

Irrigationists work in teams, coordinating with farm managers and supervisors in the irrigation of crops. They predominately work outdoors in farming areas and can be exposed to adverse weather conditions.

Skills

A good understanding of basic irrigation, hydraulic and electrical principles is needed by irrigationists. They will additionally benefit from:

- Physically fitness and stamina to walk large farm fields
- Ability to read blueprints and technical diagrams
- Capability to drive and operate farming machinery
- Good teamwork and communication competence

Tasks

- Assemble, disassemble or move portable irrigation systems
- Measure and estimate the quantity of water required
- Operate water pumps, regulating and controlling water flows
- Monitor and perform maintenance on all parts of an irrigation system

Studies

Irrigationists can benefit from a National Certificate in Landscape Irrigation at National Qualifications Framework Level 1 to 2, accredited by the Agriculture Sector Education Training Authority.

They can also benefit from a National Certificate in Primary Agriculture in Plant Production at National Qualifications Framework Levels 1 to 2 offered at agricultural colleges and most Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced irrigation technician.

Employers

National and provincial government.

Commercial and small-scale farms.

Agricultural co-operatives.

Research institutions.

LIVESTOCK FARM FOREMAN

Livestock farming is South Africa's largest agricultural sector and includes the production of cattle, pigs, sheep, goats, rabbits and ostrich. Meat, especially red meat is widely a South African favourite. Meat is also a key export product. Export markets for meat products are stringent and require adherence to specific health and quality standards. The sustainable production of livestock needs careful consideration to meet market standards and consumer health and safety needs.

Livestock farm foremen plan, organise and perform farming operations to breed and raise livestock. They cultivate pastures and provide and monitor fodder and water supplies to maintain the nutrition of livestock. They supervise the caretaking of animals and the control of illnesses and direct the breeding or raising of stock using recognised breeding practices to ensure stock improvement. Livestock farm foremen also maintain and clean farm facilities.

Livestock farm foremen can work closely with veterinarians and other professionals in the breeding and health maintenance of livestock. They mainly work outdoors or in farm buildings, working longer hours when animals are bred and born.

Skills

Livestock farm foremen need a solid understanding of animal production systems and principles and the health and safety standards of a farm. They will also benefit from:

- Good organisational and planning competence
- Ability to troubleshoot basic machinery issues
- Physical stamina and strength
- Effective communication skills

Tasks

- Distribute feed and water to livestock, monitoring level of supplies
- Monitor and examine animals to detect injury, illness or disease
- Maintain, clean farm buildings, machinery, equipment and structures
- Store and process animal and dairy produce

Studies

B.Sc.Agric. in Animal Science at NWU, SU, UFH, UFS, UNISA, Univen, Unizulu and UP

Diploma in Agriculture in Animal Production at CPUT, CUT, Fort Cox Agriculture and Forestry Training Institute, MUT and TUT

Livestock farm foremen can benefit from National Certificate or Further Education and Training Certificate in Primary Agriculture: Animal Production at National Qualifications Framework Level 1 to 4 offered at most Technical and Vocational Education and Training Colleges and Elsenburg Agricultural Training Institute. Training could also take place on the job with mentoring by an experienced farm foreman.

Employers

National and provincial government.

Commercial and small-scale farms.

Agricultural cooperatives.

Research institutions.

MIXED CROP FARM PRODUCTION FOREMAN

Agriculture is a key contributor to South Africa's economy, people and culture, with crop production accounting for some 52% of agricultural production. Crop production in South Africa is highly diverse, including grains, cereals, vegetables, fruit, nuts, flowers, fuel and fibre. Sustainable farming practices such as growing more than one crop variety simultaneously in the same field, also known as mixed crop production, enables more profitable and effective production, increasing yield stability, resource efficiency and minimising the risk of pest infestation.

Mixed crop farm production foremen oversee, coordinate and perform farming operations to grow a range of crops. They supervise the planting, fertilizing, watering, cultivating and harvesting procedures of two or more types of crops and monitor and adjust processes according to the different crop requirements. They also maintain farm facilities and equipment, ensuring production needs are met. Some also monitor market trends to determine the best type and quantity of crops to grow.

Mixed crop farm production foremen can work with agronomists, soil scientists and other professionals in the production of crops. They tend to work between farm fields and offices, working longer hours during busy harvesting periods.

Skills

Mixed crop farm production foremen require knowledge of varied crop types and their associated production requirements and health and safety standards of a farm, coupled with:

- Good organisational and planning ability
- Ability to troubleshoot basic machinery issues
- Effective communication skills
- Physical stamina and strength

Tasks

- Plan and coordinate production of mixed types and quantities of crops
- Sow seeds, plant seedlings and maintain and harvest crops
- Maintain farm building structures, equipment and water supply systems
- Assist in arranging the sale, purchase and transportation of produce and supplies

Studies

B.Sc. in Crop Science or Plant Production at NWU, Univen, Unizulu and UP

B.Sc.Agric. in Crop or Plant Science at SU, UFH, UFS and UKZN

Diploma and Advanced Diploma in Agriculture specialising in Crop Production at CPUT, MUT, TUT and UMP

They can also benefit from a Diploma or National Certificate in Primary Agriculture in Plant Production at National Qualifications Framework Levels 1 to 4 offered at agricultural colleges and most Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced farm foreman.

Employers

National and provincial government.

Commercial and small-scale farms.

Agricultural cooperatives.

Research institutions.

PEST MANAGEMENT OFFICER

Pest control is vital in ensuring public health and safety and also plays a critical role in ensuring food security, livelihoods and economic contribution of agriculture by reducing the risk of disease and pest infestations. In agriculture, pest management is especially important for effective and sustained production, the prevention of damage to crops and livestock and excessive waste of resources. Pest management is the eradication or control of pest species that ensure human, animal and plant health.

Pest management officers identify pests and monitor and control threats and infestations according to environmental protection, public health and food safety regulations and protocols. They identity the type and extent of pest invasion, often collecting samples for laboratory testing. They will then provide strategies for the eradication of pests, taking into consideration financial, social and environmental aspects. Some are consulted in agricultural farming, around the identification and eradication of pest and vector breeding occurrences.

Pest management officers work in offices but spend a considerable amount of time inspecting pest sites such as homes, factories, farms and warehouses, for example. They can be exposed to areas that may be contaminated and potentially dangerous and are required to wear protective clothing and equipment.

Skills

Pest management officers must have a comprehensive knowledge of pest varieties and associated elimination techniques and an understanding of public health and safety regulations and procedures, along with:

- Good customer service skills
- Strong organisation and keen attention to detail
- Physical stamina
- Good written and verbal communication ability

Tasks

- Inspect for the presence of pest and vulnerabilities to infestation
- Select, recommend and motivate appropriate pest control procedures
- Apply and implement pest control procedures
- Monitor, measure and record the success of control procedures

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Health at NMU, UJ and UP

Diploma, Advanced Diploma, M.Tech in Environmental Health at CPUT, CUT, MUT and TUT

Pest management officers can also benefit from a Further Education and Training Certificate in Pest Control Operations at National Qualifications Framework Level 4 offered at Pest Control Industries Training Academy and Pest Management Academy. Training could also take place on the job with an experienced mentor.

Employers

National, provincial and local government in agriculture and public health and safety.

Pest elimination companies.

PROCUREMENT MANAGER

Global economies are all highly dependent on efficient and effective procurement of goods and services, either as value add or consumer products. For efficiency in production and supply, and particularly within the perishable goods value chain such as agriculture and fishing, timeous, appropriate, efficient and effective procurement, upstream and downstream, is critical. Procurement of goods and services are therefore a critical component in all goods and services value chains to maximise efficiency, enable sustainability and minimise waste.

Procurement managers plan, administer and review the supply, storage and distribution of equipment, materials and goods. They research and forecast levels of demand for services and products and develop and monitor distribution requirement plans and budgets to see to these needs. They also source suppliers, undertake contract negotiations and establish service programs to match the company's requirements. Procurement managers can also run risk assessments to ensure sourcing processes are safe, reliable and sustainable.

Procurement managers work closely with farm operators and managers, engineers, varied suppliers and legal professionals to ensure essential supplies are procured. They mainly work in an office environment and occasionally travel to supplier sites.

Skills

Procurement managers require in-depth knowledge of supply chain structures and functioning and a comprehensive understanding of markets. They will also benefit from:

- Strong interpersonal and negotiation skills
- Excellent analytical and problem-solving ability
- Solid financial management and business experience
- Effective project management skills

Tasks

- Determine, implement and monitor purchasing, storage and distribution strategies, policies and plans
- Negotiate contracts with suppliers to meet quality, cost and delivery requirements
- Establish and direct operation and administration procedures
- Establish and manage budgets and control expenditure ensuring efficient resource use

Studies

B.Com., B.Com (Hons), M.Com. in Supply Chain Management at SU, UKZN, UNISA and UP

Diploma, Advanced Diploma, M.Tech in Supply Chain Management at TUT

Employers

National, provincial and local government.

All forms of commercial scale business.

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SUSTAINABILITY MANAGER

Modern consumer lifestyles demand much from our natural resources and ecosystem services, in addition to value add goods and services used in the processing and production of goods and services, packaging and distribution. As the demand for goods and services increases, so does the demand for more equitable and sustainable production processes, both globally and locally. Sustainability practices ensure a steady and constant flow of goods and services, the production and supply of which uses resources efficiently and optimally and minimises the generation of waste.

Sustainability managers plan, organise, direct, control and coordinate sustainability or environment-related risk assessments of an organisations business practices. They develop methodologies to assess the viability or success of sustainability initiatives as well as monitor and evaluate their effectiveness. They then advise on ways to improve operations and set goals to achieve sustainability targets. Sustainability managers can also create and implement staff training programs to increase participation and practice of environmental initiatives.

Sustainability managers engage with organisations personnel as well as external stakeholders that contribute to sustainable business operations. They mainly work in an office environment and occasionally travel to investigate specific company operations or meet stakeholders.

Skills

Sustainability managers require a thorough understanding of global and local sustainability concepts, goals and objectives and have a working knowledge of environmental trends, legislation, policies and guidelines, coupled with:

- Strong interpersonal and leadership skills
- Critical problem-solving and analytical thinking ability
- Excellent organisational and project management competence
- Good verbal and written communication and presentation skills

Tasks

- Evaluate and develop methodologies for sustainability initiatives
- Enact and socialise polices on an organisations energy use, resource conservation and waste management
- Supervise employees in sustainability endeavours
- Advise on meeting regulations laid out in environmental law

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Management at UFS, UJ, UNISA and UP

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geography and Environmental Studies at all universities

Diploma and Advanced Diploma in Environmental Management at CPUT

Diploma and Advanced Diploma in Environmental Science at TUT

Employers

National, provincial and local government.

NGOs, community-based and development organisations.

Engineering and environmental consultancies.

Industrial processing and mining companies.

Property development and construction companies.

Waste management companies.

WWF

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AIR-CONDITIONING AND REFRIGERATION MECHANIC

More than 65% of South Africans inhabit cities, the centres of economic activity and employment. The dense populations in cities require creative and innovative solutions in housing and work spaces and manufacturing processes. Air-conditioning and refrigeration are key contributors to greenhouse gases, warming urban centres and climate change impacts. To reduce and minimise human and environmental impact, these processes need to function effectively and efficiently.

Air-conditioning and refrigeration mechanics install and maintain piping, ducting and equipment for heating, cooling and ventilation of buildings and vessels. They also check and overhaul systems, diagnose faults and repair and replace defective components.

Air-conditioning and refrigeration mechanics may work in varied environments with climate control equipment, from homes to office buildings, retail centres and factories. They can work irregular hours, responding to emergencies and site conditions can be dangerous and cramped. They may also work alone, as part of a team or with associated tradespeople.

Skills

Air-conditioning and refrigeration mechanics must have a thorough knowledge of electrical and airflow principles and processes and an understanding of compliance and safety regulations. They will also benefit from:

- Excellent problem-solving ability
- Ability to read and interpret varied specification drawings
- Physical stamina and strength
- Good communication skills

Tasks

- Interpret blueprints, drawings and other specifications
- Test systems, diagnose faults and perform routine maintenance or servicing
- Assemble, install, and repair components for air-conditioning and refrigeration systems
- Connect piping and equipment by bolting, riveting, welding or brazing

Studies

Air-conditioning and refrigeration mechanics will benefit from a National Certificate in Engineering Studies in Electrical Systems offered at Technical and Vocational Education and Training Colleges. Additionally, courses can be taken at the Air-conditioning and Refrigeration Academy and Paddy's Refrigeration and Air-conditioning Training Centre.

Employers

Air-conditioning and refrigeration contracting companies.

Installation and service maintenance companies.

Manufacturing companies.

ARCHITECT

67% of the South African population live in cities. Increasing urbanisation puts significant pressure on the demand for adequate and appropriate housing as well as the natural environment. Affordable housing and buildings that minimise environmental impact can change cities into inclusive, safe, resilient and sustainable living and work spaces. Architecture involves the design of buildings and associated structures.

Architects design and advise on buildings as well as provide concepts, plans, specifications, and detailed drawings for construction. They negotiate with builders, estimate building costs, materials needed, and project time frames to build. Architects interested in sustainability can design buildings that conserve water and energy and include systems for improved waste management. They also undertake research and advise on the sourcing and procurement of more sustainable building materials.

Architects engage with builders, engineers, urban planners, interior designers, and other professionals involved in building projects. They mainly work in an office environment and could spend some time visiting building and construction sites.

Skills

Architects must have excellent spatial competence and understanding of architectural principles and design and knowledge of building regulations. They will additionally benefit from:

- Excellent creative and problem-solving skills
- Excellent planning and organisation competence
- Extensive communication and interpersonal skills
- Ability to use popular architecture and design software

Tasks

- Prepare project designs integrated with structural, mechanical and aesthetic elements
- Write building specifications and contract documents for builders
- Liaise and consult with clients and relevant stakeholders and specialists
- Monitor construction or restoration projects to ensure compliance with quality standards and regulations

Studies

B.Arch.Stud., B.Arch.Stud. (Hons), M.Arch. at NMU, UCT, UFS, UJ, UKZN, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Applied Science Architecture at UP

Diploma, Advanced Diploma, M.Tech in Architectural Technology at DUT, NMU, TUT and UJ

Employers

National, provincial and local government.

Architectural firms.

Building contractor and construction companies.

Research institutions.

ENVIRONMENTAL ECONOMIST

Cities are centres of economic growth and play an important role in providing social and economic opportunities for urban communities. As urbanisation and associated demand increases, global societies are challenged by equitable and sustainable development. This is a particular challenge in a developing nation like South Africa. Environmental economics involves the study of the economic and financial value of the environment and conservation.

Environmental economists study the economic and financial valuation of natural resources from extraction, through value adding processes, use and waste returned to the environment. They investigate the implications of economic incentives for the environment and the use of natural resources in sustainable practices and environmental opportunities. They can conduct cost-benefit analyses of industrial activities and cost environmental impacts as well as develop cost-effective and sustainable recommendations based on research findings.

Environmental economists work mainly in an office environment and could also spend some time in client environments such as landfill sites, for example when consulting and advising stakeholders.

Skills

Environmental economists require a comprehensive knowledge of economic trends, patterns, practices and policies related to environmental concerns, and will also benefit from:

- Strong mathematical and statistical skills
- Extensive research competence
- Excellent analytical skills in micro, meso and macroeconomic trends
- Good verbal and written communication and presentation skills

Tasks

- Research impacts of environmental conservation initiatives and projects
- Monitor and analyse market and environmental trends
- Develop costing models and make recommendations for environmental policy and plans
- Advise and provide reports to policymakers, industry and other stakeholders

Studies

B.Com., B.Com. (Hons), M.Com. in Economics at all universities

B.Econ., B.Econ. (Hons), M.Econ. at RU and UWC

B.A., B.A. (Hons), M.A. in Politics, Philosophy and Economics at NWU, SU, UCT, UJ, UKZN, UNISA, UP and Wits

Employers

National, provincial and local government.

Financial and banking institutions.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

WWF
Forestry, Fisheries and the Environment
Higher Education and Training
khetha

ENVIRONMENTAL ENGINEER

Cities as hubs of intensive economic activity use vast amounts of electricity and water, produce large volumes of waste and require efficient infrastructure for the movement of goods, services and people. With increasing urbanisation, creative housing solutions are also required to maximise land use while minimising environmental impact. Environmental engineering involves designing construction methods, processes and outputs that minimise impacts on the natural environment.

Environmental engineers manage the implementation, coordination, monitoring, evaluation and reporting of projects related to construction, environmental impact assessments, natural resource management and pollution control. They research proposed or existing construction projects to determine potential environmental risk and impact, report findings and advise on mitigation measures. These engineers are also involved in the design of improvements, additions or new sustainable facilities or processes and are responsible for obtaining the necessary permits and updating standard operating procedures.

Environmental engineers collaborate with environmental scientists, urban and town planners, hazardous waste technicians and other engineers and specialists. They work between offices and specific project sites overseeing development and ensuring compliance.

Skills

Environmental engineers require a comprehensive knowledge of engineering principles and environmental regulations, processes and challenges. They will further benefit from:

- Ability to apply engineering science and design
- Logical analytical and problem-solving ability
- Independent project management competence
- Good written and verbal communication and presentation skills

Tasks

- Conduct research, assess and report on environmental impacts
- Design and oversee the development of systems, processes and equipment for control, management or remediation of environmental quality
- Provide engineering and technical support for environmental remediation
- Report and advise on projects and procedures related to environmental impact

Studies

B.Sc.Eng. in Civil Engineering at UCT, UKZN and Wits

B.Eng. in Civil Engineering at SU, UJ and UP

Diploma, Advanced Diploma, M.Tech in Civil Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

National, provincial and local government.

Construction and mining organisations.

Waste management companies.

NGOs, community-based and development organisations and private consultancies.

Research institutions.

WWF
Forestry, Fisheries and the Environment
Higher Education and Training
khetha

ENVIRONMENTAL HEALTH OFFICER

Cities, centres of dense social and economic activity face many environmental health challenges, that impact people and the environment. This could include pollution of air and water, impacts of flooding, contaminated food sources, risks associated with the disposal of wastewater or the management of excessive waste. Environmental health concerns the identification, analysis and remediation of activities and risk that impact human, animal and environmental health.

Environmental health officers develop, enforce and evaluate environmental health policy, legislation and regulations. They investigate incidences and activities that pose health risks and develop and implement strategies and programmes to mitigate these. They can also develop educational programmes to inform individuals on health and safety matters. Some can also identify, evaluate and control air pollution sources, highlighting challenges and opportunities for its reduced impact.

Environmental health officers liaise between organisation managers and regulatory bodies sharing current and new regulations. They can work in an office environment and often travel to visit, sometimes harmful sites for inspection.

Skills

Environmental health officers require an in-depth knowledge and understanding of environmental health legislation, policy and compliance with regulations. They will additionally benefit from:

- Competence to easily explain complex legislation and procedures
- Keen attention to detail
- Strong interpersonal and negotiation skills
- Good verbal and written communication and presentation skills

Tasks

- Identify, test and report risk in the environment and workplace
- Advise on methods to eliminate, prevent, control or reduce exposure to hazards
- Develop, implement and review environmental pollution programmes
- Implement educational programmes to minimise potential environmental risks

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Management at UFS, UJ, UNISA and UP

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Health at UP

B. in Environmental Health at NMU and UJ

Diploma and Advanced Diploma in Environmental Health at CPUT, CUT, MUT and TUT

Employers

National, provincial and local government.

Mining and construction companies.

All manufacturing and production companies, particularly food and beverage manufacturers.

Medical service providers.

Tourism accommodation providers.

Private consultancies.

ENVIRONMENTAL LAWYER

The South African constitution enshrines the right of all people to an environment that is not harmful to health or well-being and one that is protected for current and future generations. This right devolves into various other laws intended to prevent environmental degradation and pollution, promote conservation and sustainable development, and enable sustainable access and use of natural resources that support livelihoods. Environmental law involves the application of the law to ensure human and environmental rights.

Environmental lawyers provide legal advice, prepare and draft legal documents and conduct negotiations on behalf of clients on matters associated with the law and the environment. They develop policies and engage in litigation that prevents further environmental damage, enforce environmental compliance and ensure that people have access to natural resources or are adequately compensated for any loss resulting from transgressions.

Environmental lawyers spend time between an office, travelling to sites of complaints and transgressions to gather further evidence and information and court for litigation. They can sometimes engage various stakeholders to obtain additional insight into environmental cases.

Skills

Environmental lawyers must have a detailed knowledge of human rights, environmental and administrative laws and understand legal and procedural requirements for environmental decision-making, coupled with:

- Excellent legal research competence
- Objective analytical ability and attention to detail
- Strong networking and interpersonal skills
- Excellent writing competence

Tasks

- Provide legal research and opinions on environmental matters
- Compile evidence and interview clients, witnesses and persons of interest
- Counsel and advise clients that seek environmental law input
- Negotiate legal agreements and liaise between stakeholders

Studies

LLB., LLM. in Environmental Law at NWU, RU, UCT, UKZN, UL, UP, Wits and UWC

Employers

National, provincial and local government.

Private practice law firms.

NGOs, civil society and advocacy agencies.

ENVIRONMENTAL MANAGER

Urbanisation continues to intensify across cities of the world. This increases the demand for housing, infrastructure, transport, urban green spaces, consumer goods and adds a significant burden on waste and air quality management as some examples. Effective environmental planning and management is needed to create sustainable, inclusive and resilient cities. Environmental management has a key role to play in assessing, advising and guiding sustainable urban development, as well as supporting both urban and rural conservation and environmental planning.

Environmental managers plan, organise, direct, control and coordinate the development and implementation of environmental management systems for private, public and civic organisations. They identify and develop opportunities to alleviate environmental challenges in compliance with environmental legislation and ensure corporate sustainability. They also undertake environmental impact assessments and audits and develop and monitor environmental and sustainability initiatives.

Environmental managers oversee teams of technical, scientific and engineering staff. They can work between office environments analysing organisational processes and perform site visits to audit and observe organisational processes and performance.

Skills

Environmental managers require experience in implementing organisational environmental systems and a solid understanding of environmental impact, management, laws and regulations, coupled with:

- Extensive research capability
- Advanced data analysis and analytical thinking ability
- Excellent interpersonal skills
- Strong verbal and written communication and presentation skills

Tasks

- Monitor, evaluate and report on an organisation's environmental performance
- Plan, direct and coordinate environmental services and related work activities
- Manage budgets, control expenditure to ensure efficient use of resources
- Oversee the selection, training and performance of staff

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Management at UFS, UJ, UNISA and UP

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

Diploma and Advanced Diploma in Environmental Management at CPUT

Diploma and Advanced Diploma in Environmental Science at TUT

Employers

National, provincial and local government.

Production and manufacturing companies.

Conservation and environmental organisations

Power generation utilities.

Private consultancies.

ENVIRONMENTAL PRACTICES INSPECTOR

With increasing urbanisation, cities attract and host a large percentage of a country's population. With this concentrated social and economic activity, there is a need to better manage aspects of the environment such as air and water quality, the processing of large volumes of all forms of waste and managing urban amenities. Inspecting environmental practices helps to promote the healthy functioning of urban spaces by identifying environmental challenges and ensuring compliance with environmental laws and regulations.

Environmental practices inspectors examine businesses and industrial sites to ensure compliance with environmental laws and bylaws. They inspect permits and licenses and issue warnings for environmental transgressions. They can conduct follow up interviews with repeat offenders and report them to higher authorities. Some can also investigate the processes and functions of companies to check whether environmental systems and processes are functioning correctly and adhering to regulation levels.

Environmental practices inspectors work between an office environment, documenting information and travelling to sites to carry out inspections. Site inspections can be dangerous depending on the nature of activities where safety gear may have to be worn.

Skills

Environmental practices inspectors require comprehensive knowledge and be able to practically apply environmental laws and regulations. They will also benefit from:

- Critical and analytical thinking ability
- Keen attention to detail
- Strong interpersonal skills
- Good verbal and written communication skills

Tasks

- Inspect facilities and collect samples for testing
- Prepare inspection records and produce and review compliance reports
- Examine legitimacy of permits and licenses
- Investigate health and safety complaints, determining the nature of a violation

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science at NMU, RU, UCT, UJ, UKZN, UMP, UP, UWC and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Environmental Studies at all universities

LLB., LLM. in Environmental Law at NWU, RU, UCT, UKZN, UL, UP, Wits and UWC

Employers

National, provincial and local government.

ENVIRONMENTAL REMEDIATION SPECIALIST

Over two thirds of South Africans live in cities. This spatial concentration of people, economic and social activities in cities increases the need for better planning, housing, green open spaces, economic activity, transport and waste processing amongst others to minimise environmental challenges and risks. Environmental remediation supports urban planning by using engineering strategies and processes to assist in the rehabilitation and prevention of environmental degradation.

Environmental remediation specialists analyse and modify new and existing environmental engineering technologies and apply them in the prevention, control and remediation of environmental challenges. In the development of sites, they conduct pre-assessment studies and recommend measures to prevent environmental impact. If environmental damage has occurred, they monitor and evaluate the site, provide feedback reports and design and implement remedial action plans. Some might develop systems for hazardous waste sites and water treatment facilities.

Environmental remediation specialists regularly collaborate with environmental scientists, hazardous waste specialists, engineers and experts in law and business. They work between an office environment and often travel to sites of investigation to conduct analyses.

Skills

Environmental remediation specialists need extensive knowledge and experience with environmental management and impact assessment techniques and processes and an understanding of engineering principles, along with:

- Understanding of environmental legislation and standards
- Ability to practically apply engineering and mapping principles
- Strong analytical and problem-solving ability
- Good report writing and communication skills

Tasks

- Monitor and evaluate programmes for operational effectiveness and compliance
- Design and oversee the development of systems, processes and equipment
- Provide engineering support for environmental remediation and litigation
- Advise on rehabilitation and preventive programmes

Studies

B.Sc.Eng. in Civil Engineering at UCT, UKZN and Wits

B.Eng. in Civil Engineering at SU, UJ and UP

Diploma, Advanced Diploma, M.Tech in Civil Engineering at CPUT, CUT, DUT, NMU, TUT, UJ, UNISA, VUT and WSU

Employers

National, provincial and local government.

Engineering and environmental consultancies.

Industrial processing and mining companies.

Property development and construction companies.

Waste management companies.

GIS TECHNICIAN

Cities are complex and dynamic networks of physical, social and economic interactions. Understanding the varied layers of urban areas such as demography, density, infrastructure, natural spaces, amongst others, can highlight sustainability opportunities and potential risks in the planning, design and management of the high-density spaces in cities. Geographic information systems or GIS combine topographical, ecological, social and economic data to visualise and map geographic spaces.

GIS technicians build, maintain, modify and assist with the use of geographic information system databases. They create specialised map systems from source documents and research and verify data, transforming data from different sources into standardised computer formats for use in databases and maps. They also resolve database and technical challenges and review existing cartographic designs for accuracy. Some also perform custom application development or provide technical user support.

GIS technicians may assist scientists, land use planners, engineers or related professionals in identifying the spatial needs and challenges of projects. They work predominately in office environments with advanced computer software programs and may travel to the field, if possible, to verify and collect data.

Skills

GIS technicians require an extensive understanding of spatial geography and have a sound and practical knowledge of GIS data and design software. They will additionally benefit from:

- Excellent problem-solving and analytical thinking ability
- Ability to work with and manage large and diverse datasets
- Significant attention to detail
- Strong project management competence

Tasks

- Design and coordinate the development of GIS databases
- Design and prepare graphic representations of GIS data
- Perform geospatial data building, modelling or analysis
- Provide technical support, maintenance and operation of GIS databases, equipment or applications

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geographical Information Systems at UCT and UFH

B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Geographic Information Systems at all universities

Diploma and Advanced Diploma in Geomatics at CPUT and TUT

Employers

National, provincial and local government.

NGOs, community-based and development organisations.

Architectural engineering firms.

Urban planning organisations.

Research institutions.

Private consultancies.

JOURNALIST

Cities are dynamic hubs of physical, social and economic actions and interactions, with fast changing environments, adapting to, for example dense housing that integrates well with surroundings, increasing demand for safe and clean energy, green open spaces, water efficiency, carbon efficient transport, amongst others. Relevant and current information fosters an understanding of environmental trends and patterns that can inform sustainability actions in government, businesses and households. Environmental journalism collects, processes, packages and distributes information to keep people informed about current environmental affairs.

Journalists gather information and prepare stories through varied media to inform the public about local, national and international noteworthy and current events. They collect information through research, observation, sources, briefings, events and interviews and verify data collected before collating it into a format that will be shared. Some investigate specific topics such as environmental incidents and can report on environmental policy changes, disputes as well as environmental wins.

Journalists engage with a variety of stakeholders from citizens to policy makers to obtain information about their topic of interest. They can travel to sites of interest, returning to office environments or research centres to obtain further insight and to develop stories.

Skills

Journalists require a comprehensive understanding of physical and digital media production and communication and the ability to quickly develop clear, concise and objective content. They will also benefit from:

- Excellent communication skills
- Extensive interpersonal and social skills
- Strong research and investigative competence
- A keen attention to detail

Tasks

- Collect information through research, interviews and other investigation methods
- Fact-check, analyse and verify information for accuracy
- Write and assemble material for publication
- Liaise and network with stakeholders of interest

Studies

B.A., B.A. (Hons), M.A. in Journalism at RU, SU, UFS, UJ and Wits

B.A., B.A. (Hons), M.A. in Media Studies at NMU, UCT, UKZN, UL, UNISA and Univen

Diploma, Advanced Diploma, M.Tech in Journalism at CPUT, DUT, TUT and WSU

Employers

National, provincial and local government.

Newspaper and magazine houses.

Radio and television studios.

NGOs, community-based and development organisations and private consultancies.

LAND USE PLANNER

Urban areas increasingly attract large parts of South Africa's population. Adequately addressing the development and regeneration of land, infrastructure, transport, services, waste management and other expanding urban and rural needs requires careful consideration, particularly to tackle fractured land systems and inherited spatial disparities in South Africa. Land use planning plays a pivotal role in regulating the use and development of land and its individual components to create equitable, healthy and sustainable living environments.

Land use planners develop long and short-term plans for land use, identifying areas that require growth, maintenance and renewal. They plan the layout of developments, recommending the implementation of roads, building of schools, clinics and other infrastructure. They liaise with landowners, interest groups and citizens around planning policies and procedures. Land use planners also monitor relevant legislation and make recommendations in policy development and provide guidelines on land use, environmental conservation, housing and transportation.

Land use planners often engage with developers, communities and specialists in engineering, architecture, social science and the environment around land use projects. They work in an office, occasionally conducting field investigations to analyse factors contributing to the development or decline of a land area.

Skills

Land use planners must have a thorough knowledge of land use trends and patterns, urban spatial designs and an understanding of socio-ecological and economic spatial relationships. They can also benefit from:

- Excellent creative problem-solving ability
- Mapping and land use planning ability
- Understanding of land use policies and regulations
- Strong interpersonal and communication skills

Tasks

- Plan the layout and coordinate the development of urban and other land use areas
- Research and report on current and historical spatial relationships
- Review proposals for developments ensuring compliance with regulations
- Consult with landowners, interest groups, citizens and stakeholders

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Urban and Regional Planning at NWU and Wits

B., B. (Hons), M. in Urban and Regional Planning at UFS, UJ, UKZN, UP and Univen

Diploma, Advanced Diploma, MTech in Town and Regional Planning at CPUT and DUT

Employers

National, provincial and local government.

Property development firms.

Research institutions.

Private consultancies.

LANDSCAPE ARCHITECT

Two thirds of South Africa's population live in cities, characterised by dense living and interactions. Green open spaces in cities come at a very high premium and have the merits of supporting spiritual, physical and emotional wellbeing. They also have the potential to improve air quality, reduce urban heat and enable carbon sequestration. In response to these opportunities, landscape architecture involves the design of green open spaces, landmarks and structures to achieve sustainable, functional and aesthetically pleasing spaces.

Landscape architects advise on, plan and design the construction of public, urban, residential and rural landscapes. They survey a site and conduct preliminary environmental impact assessments and proceed to develop designs based on the projects requirements. They procure the services of relevant contractors and monitor progress, advising on any changes that need to be made. Some can assist in the restoration or regeneration of natural or heritage landscapes and public open spaces.

Landscape architects work closely with landscape gardeners and often consult town planners, surveyors, engineers and other professionals. They work in an office environment drafting designs as well as travel to sites to plan or monitor projects.

Skills

Landscape architects require a solid understanding of architectural principles and spatial and aesthetic awareness and knowledge of plants, soils, water processes and climate, coupled with:

- Strong creative and problem-solving skills
- Creative design and architectural ability
- Extensive planning and organisational competence
- Significant attention to detail

Tasks

- Design and present detailed landscape projects and plans
- Conduct preliminary assessments of a site to determine specifications
- Manage, conduct and monitor work on-site
- Liaise with clients and other stakeholders

Studies

B.Sc. in Landscape Architecture at UP

B.Arch.Stud. specialising in Landscape Architecture at UCT

B.LA. (Hons), M.LA. at UCT and UP

Diploma in Landscape Architecture at CPUT

Diploma and Advanced Diploma in Landscape Technology at TUT

Diploma, Advanced Diploma, M.Tech in Architectural Technology at DUT and NMU

Employers

Provincial and local government.

Architectural firms.

Building contractor and construction companies.

Research institutions.

LANDSCAPE GARDENER

Cities support over 66% of South Africa's population, and are characterised by dense concentrations of people, buildings and activities. With increasing urbanisation and density, green open spaces are critically important for ecological and human wellbeing, by providing for example, areas for leisure, reduction in urban heating, absorption of carbon and reducing air pollution. Landscape gardening contributes to the development and maintenance of functional and beautiful green open spaces.

Landscape gardeners assist in the planning and construction of garden landscapes. They prepare land by conditioning soil, levelling ground and installing and operating irrigation and drainage systems. They also sow, cultivate and propagate plants, trees and shrubs and trim, prune and water trees and shrubbery to keep plants healthy and aesthetically pleasing. Landscape gardeners also treat diseased plants or remove plants that are dead.

Landscape gardeners can work with landscape architects or as part of a crew of groundsmen. They mainly work outside in parks, recreational areas, botanical gardens, apartment complexes, private homes or office parks, for example. They need to wear protective clothing and work may depend on weather conditions.

Skills

Landscape gardeners require an understanding of varied plant and flower species and the properties that govern their development as well as plant maintenance techniques. They will also benefit from:

- Ability to follow garden plans and use gardening equipment
- Physical stamina and strength
- Ability to work as part of a team
- Creative ability

Tasks

- Produce saplings, bulbs, seeds, raising plants from seeds or cuttings
- Plant trees, shrubs, garden plants and grass
- Construct water and other features and facilities within gardens
- Check the health of plants and trees, identifying and treating weeds, pests and diseases

Studies

Diploma and Advanced Diploma in Landscape Technology at TUT

Diploma, Advanced Diploma, M.Tech in Horticulture at CPUT, DUT, TUT and UNISA

Landscape gardeners can benefit from a National Certificate in Landscape Irrigation at National Qualifications Framework Level 1 to 2, accredited by the Agriculture Sector Education Training Authority. Training could also take place on the job with mentoring by an experienced mentor.

Employers

Landscaping and gardening service companies.

Botanical gardens, garden centres and nurseries.

Landscape architecture firms.

Research institutions.

POLICY ANALYST

The South African Constitution defines the right of everyone to an environment that is not harmful to their health or wellbeing, and resources used sustainably for current and future generations. Various acts and policy frameworks provide for an equal focus on ecological health and wellbeing balanced with human health and wellbeing. Policy analysis explores environmental, economic and social opportunities and impacts to assist decision-making that will benefit the environment, the economy and people.

Policy analysts collect and analyse policy data to produce intelligence and information on environmental, economic and social challenges. They study elements of laws, policies and amendments to policies and present information regarding policy opportunities and challenges. They also examine and interpret policies to identify trends and make recommendations on policies to ensure effective planning and development.

Policy analysts mainly work in an office environment as part of a team and often collaborate with businesses, scientists, engineers, legislators and other professionals to craft policy recommendations.

Skills

Policy analysts require an in-depth knowledge of policy design, development and processes and a thorough understanding of the socio-economic, political and environmental landscape, along with:

- Extensive research ability
- Excellent analytical and critical thinking skills
- Interpret and identify relationships and patterns objectively
- Strong written and verbal communication skills

Tasks

- Research, evaluate and monitor policies and legislation to determine impacts, challenges and opportunities
- Formulate and distribute synthesised policy reports
- Develop policies to assist the implementation and modification of operations
- Liaise with stakeholders to determine policy needs, opportunities and concerns

Studies

B.A. in Policy Studies at UNISA

B.A., B.A. (Hons), M.A. in Politics, Philosophy and Economics at NWU, SU, UCT, UJ, UKZN, UNISA, UP and Wits

B.A., B.A. (Hons), M.A. in Political Studies at all universities.

Employers

National, provincial and local government.

NGOs, community-based and development organisations.

Private consultancies.

Research institutions.

TRANSPORT ANALYST

South Africa's transport system is vast and includes roads, railways, airports and harbours that contribute 9% to GDP. Efficient and functional networks for transport provide people with mobility, access to employment, resources, medical care, recreational activities, and support economic growth and development. Well-designed transport systems can also minimise environmental and social impacts and improve health and wellbeing. The analysis of transport systems supports the effective and sustainable means of moving people and goods and services across and between countries.

Transport analysts conduct studies in the use and operation of transport systems. They collect and analyse statistics and information such as traffic flow, crash statistics and air quality, for example. They develop transport models and simulations to predict future needs and opportunities for more efficient and effective operations. They can also develop safety plans by marking evacuation routes or ensure infrastructure is capable of handling heavy loads safely, for example.

Transport analysts can confer with government authorities, communities and engineers in the effective management of transport systems. They primarily work in an office environment but may need to travel to sites to assess transport functions or analyse disruptions.

Skills

Transport analysts require knowledge of varied transport infrastructure and regulations and practical mathematical and modelling ability, also benefitting from:

- Critical problem-solving and analytical thinking
- Superior organisation and data management skills
- Keen attention to detail
- Strong interpersonal and communication skills

Tasks

- Plan and advise on routing and control of transport systems
- Compile and analyse data on the interrelated factors impacting the transport system
- Review and evaluate environmental impact reports
- Provide advice on urban and regional planning issues and proposals

Studies

B.Com., B.Com. (Hons), M.Com. in Logistics at SU, UJ and UNISA

B.Com., B.Com. (Hons), M.Com. in Transport Economics at NMU, NWU, SU, UJ and UNISA

Diploma, Advanced Diploma, M.Tech in Logistics and Transport Management at CUT, NMU and VUT

Employers

National, provincial and local government.

Logistics and transportation companies.

Private consultancies.

Research institutions.

CHEMICAL ENGINEER

South Africa generates approximately 50 million tonnes of general waste a year including large amounts of plastic that pollutes the environment and especially our oceans. Chemical engineering concerns the processing of materials through chemical techniques and have a big role to play to assist in finding ways of processing waste into useful materials and products.

Chemical engineers design and prepare specifications for chemical processes, systems and the construction and operation of commercial-scale chemical plants. They also supervise industrial processing, fabrication and manufacturing of products undergoing physical and chemical changes and related technologies. Chemical engineers can also provide input into and design chemical recycling techniques to upcycle waste that is safe and reusable.

Chemical engineers collaborate with chemists, biochemists and other engineers, scientists and technicians. They mostly work in offices and laboratories and sometimes work onsite at industrial plants or factories in hazardous conditions with chemicals.

Skills

Chemical engineers must have a thorough understanding of chemistry and chemical processing principles and be proficient with popular engineering software and automated chemical equipment. They will also benefit from:

- Creative problem-solving skills
- Excellent analytical and logical reasoning ability
- Project management
- Written and verbal communication and presentation skills

Tasks

- Perform tests through the stages of production
- Specify chemical production methods, materials and quality standards
- Design chemical plant equipment and devise new chemical processes
- Perform laboratory studies in the manufacture of new products and test proposed processes

Studies

B.Sc.Eng. in Chemical Engineering at UCT and Wits

B.Eng. in Chemical Engineering at NWU, SU, UKZN and UP

Diploma, Advanced Diploma, M.Tech in Chemical Engineering at CPUT, DUT, MUT, TUT, UJ, UNISA and VUT

Employers

National, provincial and local government.

Chemical process companies.

Design and construction organisations.

NGOs, development organisations and private consultancies.

Research institutions.

CHEMICAL WASTE CONTROLLER

To promote sustainability we need practical, creative and innovative strategies to process waste, particularly the 66.9 million tonnes of hazardous waste produced annually, that if left untreated can be a health hazard and cause long-term environmental degradation. Chemical waste control is the management and processing of chemical waste substances to minimise harm to human health and the environment.

Chemical waste controllers identify hazardous chemical substances and suggest options for recycling, removing, storing or disposing of chemical waste in a safe and legal manner. They can assist in environmental remediation strategies by evaluating and coordinating the storage and handling of hazardous waste and the clean-up of contaminated soil or water.

Because of the environment in which they work, chemical waste controllers wear personal protective equipment, particularly safety glasses and gloves. They work between laboratory and office spaces, testing chemical materials and reporting on their findings and proposed actions.

Skills

Chemical waste controllers need to have a good understanding of chemistry and the laws and regulations that guide toxic waste disposal. They will also benefit from:

- Excellent attention to detail
- Good problem-solving skills
- Practical laboratory skills and experience
- Written and verbal communication and presentation skills

Tasks

- Identify hazardous substances like asbestos, lead paint, oil spills, chemicals and radioactive material
- Advise on clean-up and management procedures of hazardous substances
- Store and transport chemical waste and other hazardous materials
- Define and advise on disposal techniques of hazardous materials

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Chemistry at all universities

Diploma, Advanced Diploma, M.Tech in Chemistry at CPUT, DUT, MUT, TUT, VUT and WSU

Employers

National, provincial and local government.

Chemical disposal companies.

Waste management companies.

HAZARDOUS MATERIALS REMOVAL WORKER

South Africa produces large volumes of hazardous waste with only 6% such as waste oils, being recovered and treated for new use. This poses a significant threat to human health and wellbeing and if not disposed of appropriately can seriously compromise the natural environment and ecosystem functioning. Careful handling and disposal of hazardous waste materials is governed by regulation to avoid compromising public health or impacting the natural environment.

Hazardous materials removal workers identify, remove, pack, transport and dispose of hazardous waste materials. They remediate and dispose of harmful materials such as asbestos, nuclear and radioactive waste, arsenic, lead and other materials, complying with safety laws, regulations and procedures. They also analyse, record and report levels of toxicity of these hazardous waste materials.

Hazardous materials removal workers work in varying conditions depending on the type of materials, from homes and businesses to landfills, nuclear facilities and other power plants. They can work as part of a team and because of the hazardous materials with which they work, are required to wear fully enclosed protective suits for several hours at a time.

Skills

Hazardous materials removal workers need to have an extensive knowledge of the properties of toxic materials and require a complete understanding of safety regulations and procedures. They will benefit from:

- Strong attention to detail around work processes
- Quick decision-making competence
- Basic measuring and mathematical skills
- Physical stamina and good health

Tasks

- Plan procedures and dispose of hazardous materials that are flammable, corrosive, reactive or toxic
- Load and transport contaminated waste to designated sea or ground locations
- Clean contaminated equipment or areas
- Record numbers of containers stored at disposal sites, specifying amount, equipment used, and waste disposed

Studies

Hazardous materials removal workers can benefit from a General Education and Training or Further Education and Training Certificate or a National Certificate in Environmental Practice at National Qualifications Framework Level 1 to 4 offered at Technical and Vocational Education and Training Colleges. Training takes place on the job with mentoring by an experienced mentor.

Employers

National, provincial and local government.

Waste management companies.

Power utility and mining companies.

RECYCLING COLLECTOR

South Africa is fast running out of landfill capacity to manage its 54 million tons of waste generated annually. Despite various recycling initiatives over the past two decades, only 7.5% of South Africans recycle domestic waste. Improved recycling opportunities not only reduces the demand for landfill sites, but also minimises environmental impact and decreases the unsustainable need for materials. Recycling collection is key to supporting increased recycling, repurposing and reuse.

Recycling collectors collect household, commercial and industrial waste for recycling and reuse. They collect recyclable materials such as paper, plastic, glass, metal and electronic waste, for example. Some informal recycling collectors manually collect materials for sale to bigger recycling companies. Formal recycling companies collect waste at designated points and process these materials in recycling plants.

Recycling collectors work in varied spaces, following established routes through residential streets, business and industrial spaces. They can work long hours and be exposed to dangerous materials.

Skills

Recycling collectors require a good understanding of the type of materials that can be recycled. They will additionally benefit from:

- Good navigation of street and city areas
- Physical stamina and strength
- Extremely safety conscious

Tasks

- Collect and load recycling materials into collection bins or vehicles
- Return empty recycling bins
- Manually sort recycling materials into appropriate categories
- Offload recycling materials at formal collection sites

Studies

No formal qualification is required; however, training is attained on the job amongst other experienced collectors.

Employers

Recycling centres.

Waste management companies.

WASTE MATERIALS PLANT OPERATOR

Approximately 4.8 million tonnes of solid waste makes its way to landfill sites in South Africa, many of which are fast reaching maximum capacity. One of the processes to reduce the load on landfill sites is the incineration of waste. Medical waste is the most common waste incinerated followed by industrial and certain household wastes, with treatment capacity currently able to process 4 700 tonnes of waste per month. The efficient and safe operation of waste material plants is necessary to avoid health impacts for people and prevent harmful contaminants from entering the environment.

Waste materials plant operators operate machinery that disposes of solid waste through incineration processes. They manage the operation of multiple hearth incinerator furnaces and related equipment, controlling burners and temperature as well as regulating the length of burning cycles. They also monitor all processes, making routine adjustments and noting maintenance concerns, to ensure operation procedures are followed.

Waste materials plant operators can work within a team of waste collectors, engineers, technicians and mechanics. They can be exposed to dangerous materials and equipment and are required to wear protective clothing.

Skills

Waste materials plant operators must have a good understanding of the processes and machinery to dispose of varied waste types, additionally benefitting from:

- Good physical stamina
- Excellent health, safety and environmental awareness
- Ability to troubleshoot basic machinery issues
- Problem-solving capabilities

Tasks

- Control the operation of multiple hearth incinerator furnaces and related equipment
- Inspect equipment and monitor operating conditions
- Complete and maintain plant logs, records and reports
- Perform security and safety checks

Studies

Waste materials plant operators can benefit from a General Education and Training or Further Education and Training Certificate or a National Certificate in Environmental Practices at National Qualifications Framework Level 1 to 4 offered at Technical and Vocational Education and Training Colleges.

They can also benefit from a General Certificate in Waste Treatment offered at the Institute of Waste Management of Southern Africa. Training could also take place on the job with mentoring by an experienced operator.

Employers

Provincial and local government.

Waste management companies.

WASTE RECYCLER

Over 54 million tonnes of waste is generated and sent to landfills in South Africa annually, most of which are fast reaching their capacity. Recycling waste materials addresses the challenges of decreasing landfill capacity, as well as threats to the environment through for example, greenhouse gas emissions and leached waste. The recycling sector is fast growing in South Africa and provides over 58 000 people with income-generating opportunities.

Waste recyclers salvage materials from industrial, commercial and private establishments for resale. They weigh and record incoming recyclable materials and assist in the process of selling these materials to recycling companies. They can use metal cutters and burners to dismantle larger items such as e-waste. For logistical purposes, some operate machinery to crush recycling materials into bales.

Waste recyclers work in teams to sort through and organise waste material into recycling categories. They can work long hours and be exposed to hazardous materials.

Skills

Waste recyclers require a good knowledge of the different types of recyclable materials. They will additionally benefit from:

- Ability to safely operate and maintain recycling equipment
- Physical stamina and strength
- Excellent safety, health and environmental awareness
- Ability to work long hours

Tasks

- Weigh and record incoming recycling materials
- Grade and sort materials according to quality and value
- Clean and bale materials to transport and sell to recycling plants
- Operate machinery to stack or load sorted materials

Studies

No formal qualification is required; however, training is attained on the job amongst other experienced recyclers.

Employers

Recycling centres.

Waste management companies.

WASTE MANAGEMENT PRACTITIONER

A steady increase in the demand for goods and services generates more and more waste. South Africa is fast running out of landfill space to effectively manage its large volumes of waste generated and requires more effective ways of managing waste, through waste reduction, re-use and recycling. Waste management includes various approaches to managing and disposing of all forms of waste.

Waste management practitioners organise and coordinate waste disposal, collection, reuse and recycling activities in an efficient and environmentally friendly manner. They supervise the transportation of waste and manage budgets as well as ensure that all waste activities comply with health, safety and environmental laws and regulations. Some also investigate cases of illegal dumping and environmental crimes related to waste management.

Waste management practitioners can collaborate with environmental enforcement specialists and occasionally engage with communities to understand waste management needs. They can spend their time between offices and waste management sites such as landfills for regular inspections.

Skills

Waste management practitioners need to be fully aware of the sources and varied types of waste generated and have a comprehensive knowledge of health, safety and environmental laws and regulations related to waste management. They will also benefit from:

- Problem-solving and decision-making skills
- Good organisational and administrative ability
- Leadership and management competence
- Effective verbal and written communication skills

Tasks

- Oversee and inspect waste disposal sites and recycling facilities
- Manage teams of refuse and recycling collectors ensuring health, safety and environmental laws and regulation compliance
- Manage budgets and organise the safe transportation of waste
- Assist in the development, promotion and implementation of waste disposal schemes

Studies

B. in Environmental Health at NMU and UJ

Diploma and Advanced Diploma in Environmental Health at CPUT, CUT, MUT and TUT

Employers

National, provincial and local government.

Private waste management companies.

Recycling centres.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

WASTE MATERIAL SORTER

Just under 54 million tonnes of waste, including plastic, paper, glass and other general waste go to South African landfills annually. 60% of this waste produced at source can be recycled. Waste sorters play a big role in supporting a culture of recycling by identifying and sorting different items that can be recycled, reused and repurposed from that which needs to be disposed of in a landfill site.

Waste material sorters identify, classify and sort a variety of mixed waste materials. They offload and transport materials to a sorting area and manually sort materials into correct containers according to grades and types to be sent to different recycling plants for further processing. Some can operate and perform general maintenance on baling machines that compress materials to be easily handled, transported and stored.

Waste material sorters sometimes work in sorting facilities, classifying incoming waste. Some work in open spaces or plants. They could work individually or in teams with other sorters and require protective clothing due to the hazardous nature of their work.

Skills

Waste material sorters need a good knowledge of the types of materials that can be recycled or reused and can additionally benefit from:

- Physical stamina and endurance
- Ability to work methodically
- Awareness of health and safety
- Ability to troubleshoot basic machinery issues

Tasks

- Sort materials according to recycling grades and types
- Wash recyclable materials when necessary
- Inspect and perform maintenance and repairs on recycling equipment
- Clean the recycling work area, removing potential safety hazards

Studies

No formal qualification is required; however, training can be achieved on the job amongst other experienced sorters.

Employers

Material recovery facilities.

Recycling centres.

Waste management companies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

BIOFUELS ENGINEER

More than 75% of South Africa's primary energy needs are provided through coal generated power, with significant contributions to carbon emissions and greenhouse gasses. As the threat and pressures of climate change increases, innovation is needed to explore renewable sources of energy. Biofuels engineering investigates the uses and implementation of fuels derived from plant sources such as sugar and starch crops to provide cleaner, renewable energy.

Biofuels engineers research, design and develop products, tools, procedures and processes that generate biofuels for electricity and powering vehicles and machinery. They consider all the complex factors that go into the production of alternatives to fossil fuels and work to redirect established scientific principles for producing energy into innovative technological solutions.

Biofuels engineers primarily work in offices and sometimes research laboratories and may spend time in environments such as manufacturing plants and crop farms.

Skills

Biofuels engineers must have strong mathematical competence, a comprehensive knowledge of scientific principles and its application and competent in the use of engineering and design software. They will additionally benefit from:

- Extensive analytical and logical reasoning ability
- Creative problem-solving
- Strong attention to detail
- Sound project management skills

Tasks

- Evaluate the benefits and challenges of alternative energies and experiment with new products and technologies
- Analyse existing biofuels systems providing solutions to optimise production or develop new systems
- Research the economic and environmental factors in the production of biofuels
- Oversee prototype processes and supervise subsequent projects

Studies

B.Sc.Eng. in Bio-resources Engineering at UKZN

B.Sc.Eng. in Chemical Engineering at UCT and Wits

B.Eng. in Chemical Engineering at NWU, SU, UKZN and UP

Diploma, Advanced Diploma, M.Tech in Chemical Engineering at CPUT, DUT, MUT, TUT, UJ, UNISA and VUT

Employers

National, provincial and local government.

Biofuels, renewable and private energy companies.

Research institutions.

BIOMASS PLANT TECHNICIAN

South Africa's energy provision is dominated by large-scale coal operations. Moving toward cleaner and sufficient energy provision to meet the country's domestic and economic needs, requires the exploration of innovative, alternative energy sources such as biomass, for example. Operating within a biomass plant involves working with varied plant matter that can be used directly or converted into biofuel for power generation.

Biomass plant technicians provide technical support and services in the installation and operation of biomass power plant processes, systems, facilities and equipment. They control and adjust the production of biofuels and perform routine maintenance to the mechanical and electrical equipment used. They also calculate and load biomass feedstock, maintain records and report on the quality and quantity of daily production.

Biomass plant technicians typically work in small teams with other plant personnel, working between the plant site and an office to complete reports. They work under relatively dangerous conditions and are required to wear protective clothing and equipment.

Skills

Biomass plant technicians require good technical knowledge of biomass properties, mechanical and production processes as well as a thorough understanding of plant safety and regulations, coupled with:

- Machine and mechanical operating capability
- Good problem-solving and analytical thinking ability
- Strong organisational competence
- Written and verbal communication skills

Tasks

- Operate, inspect, maintain and repair biomass processing equipment
- Calculate, measure, load, mix and process varied biomass materials
- Record operational and production data
- Troubleshoot equipment faults and contact specialist contractors for support

Studies

Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control at CPUT, MUT, VUT and WSU

Biomass plant technicians can also benefit from a National Certificate in Fossil Power Plant Operations at National Qualifications Framework Level 1 to 4 offered at TECHNISA, accredited by the Energy and Water Sector Education and Training Authority. Training could also take place on the job with mentoring by an experienced technician.

Employers

Biomass power production plants.

ELECTRICAL ENGINEER

Electricity powers the daily lives of people and is the foundation of all social and economic activity. All aspects of production and consumption across all value chains rely on electrical power, for production, manufacture, transport, storage, amongst other support services. Electrical engineering involves the design, building and maintenance of electrical systems for the generation and use of electrical energy.

Electrical engineers design, develop and supervise the manufacture, installation, operation and maintenance of equipment, machines and systems for the generation, distribution, utilisation and control of electrical power. They test equipment, solve operating problems and estimate the time and cost of electrical engineering projects. Electricity generation in South Africa is heavily dependent on coal, with significant environmental impacts. There is a concerted drive to steer South Africa towards increasing renewable electricity generation.

Often working as part of a team of specialised engineers, electrical engineers can work in between offices, power plants and substations. They could also work in production and manufacturing plants.

Skills

Electrical engineers must have extensive mathematical ability and a comprehensive knowledge of the processes of electricity generation. They will also benefit from:

- Very strong analytical and logical reasoning competence
- An extensive knowledge of electricity use contexts
- Creative problem-solving skills
- Competence in the use of popular engineering and design software

Tasks

- Advise on and design electrical equipment, power stations and systems
- Supervise, control and monitor the operation of electrical systems
- Establish control standards and procedures to monitor performance and safety of varied electrical systems
- Determine manufacturing methods, maintenance and repair of electrical systems

Studies

B.Eng. in Electrical Engineering at SU, UJ and UP

B.Sc.Eng. in Electrical Engineering at UCT, UKZN and Wits

Diploma, Advanced Diploma, M.Tech in Electrical Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

National, provincial and local government.

Construction, production and manufacturing companies.

Renewable and private energy organisations.

Research institutions.

ELECTRICIAN

More than 84% of South African households are connected to the national grid with the aim of further increasing access to electricity. To support its commitment to reducing carbon emissions by 2050, South Africa is also committed to clean energy and moving away from coal fired power provision. Safe and equitable access to clean energy requires efficient and well-trained electrical service providers and tradesmen.

Electricians install, test, connect, commission, maintain and modify a multitude of electrical equipment, wiring and control systems. They detect and repair faulty light and other electrical power systems. Some also work with and advise on renewable technologies and energy efficient electrical systems such as wind turbines and solar panels, for example.

Electricians work both indoors and outdoors and are often exposed to hazardous conditions, equipment and situations. They can work jointly with building contractors and building maintenance managers to ensure correct electrical installations and repairs.

Skills

Electricians need a comprehensive knowledge of electrical circuits and systems as well as understand the laws and regulations that govern electricity provision, along with:

- Strong logical reasoning and problem-solving competence
- Ability to read and interpret technical electrical drawings
- Good physical stamina
- Good verbal and written communication ability

Tasks

- Install, maintain and repair electrical wiring systems and equipment
- Plan the layout and installation of electrical wiring, equipment and fixtures
- Inspect electrical systems to identify hazards and defects
- Troubleshoot and diagnose electrical system faults and failures

Studies

Diploma, Advanced Diploma, M.Tech in Electrical Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

National Vocational Certificate in Electrical Engineering Studies at National Qualifications Framework Level 2, 3 and 4 offered at majority of Technical and Vocational Education and Training Colleges.

National Vocational Certificate in Electrical Infrastructure Construction at National Qualifications Framework Level 2, 3 and 4 offered at most Technical and Vocational Education and Training Colleges.

Vocational registration of electricians is a requirement for practice.

Employers

Local government.

Manufacturing and mining companies.

Private electrical service companies.

ENERGY EFFICIENCY TECHNICIAN

South Africa remains highly dependent on coal fired electrical power, despite its commitment to the Paris Agreement and reducing greenhouse gases to net zero by 2050. The exploration of cleaner renewable energy options will support a transition to a carbon neutral economy with decreasing reliance on coal fired electricity and its environmental and health impacts. Energy efficiency involves the adaptative measures and technologies used to reduce energy consumption.

Energy efficiency technicians evaluate electrical installations, equipment and processes to determine the amount of energy used and lost to improve energy usage and recommend and install energy conserving measures. They audit the ventilation, heating and cooling, lighting and power systems during building construction and at manufacturing plants. Some can be consulted to provide energy usage goals for businesses and analyse costs and benefits of energy saving devices.

Energy efficiency technicians work alongside electrical engineers and technicians as well as building owners and managers. They often work in an office environment and travel to conduct site inspections of homes, businesses and industrial environments to determine causes of energy wastage and make recommendations for efficient use.

Skills

Energy efficiency technicians require a technical knowledge of energy saving technologies and electrical equipment and an understanding of energy efficiency compliance regulations. They will further benefit from:

- Methodological problem-solving skills
- Ability to read and interpret building plans and schematics
- Ability to use design and energy modelling software
- Good verbal and written communication skills

Tasks

- Monitor the manufacture, installation, utilisation, maintenance and repair of electrical systems
- Provide technical support in electrical equipment research and development
- Assemble and install energy saving systems
- Plan installation methods, checking completed installations for safety compliance

Studies

B.Eng. in Electrical Engineering at SU, UJ and UP

B.Sc.Eng in Electrical Engineering at UCT, UKZN and Wits

Diploma, Advanced Diploma, M.Tech in Electrical Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

Provincial and local government.

Energy provision and service companies.

NPOs and private consultancies.

GEOTHERMAL TECHNICIAN

South Africa's coal reserves are estimated at 53 billion tonnes, providing 77% to power generation. There is however increasing pressure, both domestic and globally to explore alternative energy sources for the country's domestic and economic needs while meeting its sustainable growth requirements with minimal environmental impact. Geothermal power is produced using heat in the form of steam or hot water to produce electrical energy.

Geothermal technicians perform technical activities for the generation of power from geothermal energy sources. They install, test and maintain commercial geothermal heat pumps and monitor and take readings of the equipment, making necessary adjustments to increase performance and energy outputs. They are also responsible for inspecting machinery, making basic repairs and calling in more specialised technicians to address serious challenges. They can also provide reports and suggestions based on current performance of geothermal machinery.

Geothermal technicians work in small teams with other plant personnel. They mainly work outdoors in relatively harsh conditions and are required to use protective clothing and equipment on site.

Skills

Geothermal technicians require solid technical knowledge of geothermal power production processes and a thorough understanding of health and safety regulations. They will additionally benefit from:

- Good problem-solving and analytical skills
- Strong organisational competence
- Machine and mechanical operating capability
- Written and verbal communication skills

Tasks

- Operate, inspect and maintain geothermal plant equipment
- Test water sources for factors such as flow volume or contamination
- Record operational and production data making needed adjustments
- Troubleshoot equipment faults, contacting specialist contractors for support

Studies

B.Eng. in Electrical Engineering specialising in Energy Systems at SU, UJ and UP

B.Sc.Eng in Electrical Engineering specialising in Power Systems at UCT, UKZN and Wits

Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control at CPUT, MUT, VUT and WSU

Geothermal technicians can also benefit from a National Certificate in Fossil Power Plant Operations at National Qualifications Framework Level 1 to 4 offered at TECHNISA, accredited by the Energy and Water Sector Education and Training Authority. Training could also take place on the job with mentoring by an experienced technician.

Employers

Geothermal power production manufacturers.

HYDRO POWER PLANT CONTROLLER

South Africa's energy system is dominated by large-scale coal operations. Global and local pressure is however prompting a move towards cleaner power production to sustain the country's economic and domestic needs. Hydropower, energy generated from moving water, is being explored as a viable alternative to burning fossil fuels. South Africa currently has a mix of small hydroelectricity stations that contributes 2.2% electrical power to the national grid with the potential to produce more.

Hydro power plant controllers provide technical support and services in the installation, operation and maintenance of hydropower plant processes, systems, facilities and equipment. They start up and power down electrical generation systems, monitor and adjust equipment to ensure optimal performance. They also keep records of ongoing power plant operations to identify processes that can be improved.

Hydro power plant controllers work in small teams with other plant personnel and supervisors and work between electrical control rooms and the power plant floor. They can be required to work long hours and wear protective clothing.

Skills

A technical understanding of electricity generation equipment and processes is required by hydro power plant controllers, coupled with:

- Ability to read and interpret electrical readings and meters
- Problem-solving and troubleshooting skills
- Safety conscious with a keen attention to detail
- Good written and verbal communication

Tasks

- Operate and control hydropower systems and equipment
- Monitor equipment and troubleshoot when challenges arise
- Clean and maintain equipment to prevent failure and deterioration
- Complete station records, logs and reports

Studies

Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control at CPUT, MUT, VUT and WSU

Hydro power plant controllers could benefit from a National Certificate in Hydro Power Plant Process Control Operations at National Qualifications Framework Level 2 to 4, accredited by the Energy and Water Sector Education and Training Authority. Training could also take place on the job with mentoring by an experienced mentor.

Employers

Hydropower generation plants.

NUCLEAR POWER PLANT CONTROLLER

Coal fired power stations currently dominate electrical power generation in South Africa. There is however increasing domestic and global pressure, to explore alternative energy sources to meet needs for sustainable growth. Nuclear energy currently contributes 3% to the national power grid. Expanding the scope of nuclear power generation requires the safe control of nuclear energy and its radioactive deposits to ensure minimal impact to the environment and human health and wellbeing.

Nuclear power plant controllers provide technical support and service in the installation, operation and maintenance of nuclear power plant processes, systems, facilities and equipment. They monitor performance indicators and record and review components, adjusting fission rates, pressure, water, temperature and flow rates, for example. They also run scheduled tests on all equipment to ensure safe and efficient nuclear operation.

Nuclear power plant controllers work as part of a team in control rooms, occasionally inspecting the plant for equipment testing. They can work long hours as nuclear reactors require constant attention and are required to wear strict protective clothing.

Skills

Nuclear power plant controllers require a comprehensive knowledge of nuclear energy reactors and power generation processes. They will also benefit from:

- Excellent problem-solving ability
- Ability to keep accurate and consistent records
- Keen attention to detail and an awareness for safety
- Physical and mental endurance

Tasks

- Control start-up and shutdown of nuclear power plant equipment
- Operate and control nuclear power generating systems
- Inspect, clean and maintain plant equipment and machinery
- Monitor and troubleshoot challenges found in nuclear operating systems

Studies

Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control at CPUT, MUT, VUT and WSU

Nuclear power plant controllers will also benefit from a National Certificate in Nuclear Power Plant Process Control Operations at National Qualifications Framework Level 3 to 5, accredited by the Energy and Water Sector Education and Training Authority and Eskom. Training could also take place on the job with mentoring by an experienced mentor.

Employers

Nuclear power generation plants.

POWER GENERATION OPERATIONS MANAGER

South Africa produces over 47 000 megawatts, mostly through coal generation, with significant impact on the environment especially through high levels of greenhouse gas emissions. Through the Paris Agreement, South Africa is committed to reducing its emissions, through renewable energy sources. The safe and effective operation of diverse energy generating plants will ensure sustainable, sufficient and varied power generation to meet the country's short and long-term energy needs.

Power generation operations managers plan, direct and coordinate the work activities and resources of power generation and ensure that targets are met. They carry out regular plant inspections to ensure plans are on schedule as well as inspect production equipment and machinery, making sure repairs and maintenance are carried out. They also set work schedules, evaluate employee performance and enforce safety protocols. Some are involved in the strategic planning and development for new power generating plants.

Power generation operations managers work with engineering technicians and professionals to optimise energy production. They spend a large amount of time on the plant floor inspecting and managing operational challenges. They work long hours and are required to wear protective clothing.

Skills

Power generation operations managers require extensive experience and knowledge in power generation, including plant operations and equipment, along with:

- Strong managerial and business experience
- Creative problem-solving and analytical thinking ability
- Understanding of labour legislation and safety regulations
- Good written and verbal communication skills

Tasks

- Control the operation of the production plant and establish operation procedures
- Determine, implement and monitor production strategies, polices and plans
- Establish and manage budgets, identifying opportunities to increase business success
- Oversee the acquisitions and installation of new plant and equipment

Studies

B.Sc.Eng. in Electrical Engineering at UCT, UKZN and Wits

B.Eng. in Electrical Engineering at SU, UJ and UP

Diploma, Advanced Diploma, M.Tech in Electrical Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

National, provincial and local government.

Biofuel, renewable and private energy companies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

RENEWABLE ENERGY ENGINEER

South Africa is highly dependent on fossil fuel for its power generation, which results in high levels of carbon emissions. As a signatory to the Paris Agreement, it is committed to reducing greenhouse gas emissions by 2050. Geographically, the country is well placed for generating renewable energy with its abundance of natural resources, sun and wind. These alternative energies will provide a diverse mix of cleaner energy to meet the country's needs while meeting its global emission reduction targets.

Renewable energy engineers research and design renewable energy technologies, equipment and power generation plants. They plan and oversee the installation of renewable energy power plants, decide on the most ideal location and ensure that the sites operation meets engineering and environmental standards. They can also develop and improve existing procedures and assess and review energy production systems and technologies, advising on methods and techniques to reduce energy costs and improve energy efficiency.

Renewable energy engineers work in multidisciplinary teams with engineering technologists and technicians and can consult with geophysicists, geologists and climate change scientists. They work mainly in an office environment and occasionally travel to plant sites to oversee installations or address operational challenges.

Skills

Renewable energy engineers need extensive experience and a comprehensive knowledge of electrical engineering and will also benefit from:

- Strong mathematical competence
- Creative problem-solving and analytical thinking ability
- Ability to coordinate and manage complex projects
- Understanding of current energy policies and legislation

Tasks

- Advise on and design power plants and systems
- Supervise, control and monitor the operation of electrical generation, transmission and distribution systems
- Determine manufacturing methods for electrical systems
- Establish control standards and procedures to monitor performance and safety of electrical generating and distribution systems

Studies

B.Sc.Eng. in Electrical Engineering at UCT, UKZN and Wits

B.Eng. in Electrical Engineering at SU, UJ and UP

Diploma, Advanced Diploma, M.Tech in Electrical Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

National, provincial and local government.

Construction, production and manufacturing companies.

Renewable and private energy organisations.

Private consultancies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

SOLAR POWER PLANT TECHNICIAN

While coal still dominates the South African energy mix, renewable energy is increasingly being explored, such as solar energy, which currently contributes 558 megawatts to the national grid. As a signatory to the Paris Agreement, South Africa needs to shift from high carbon coal emitting towards renewable energy, to reduce carbon emissions and support measures to address climate change. The efficient and effective operation of solar power plants will contribute to this shift and enable increasing use of renewable, solar powered energy.

Solar power plant technicians provide technical support and services in the installation, operation and maintenance of solar power plant processes, systems, facilities and equipment. They start up and operate power generating systems such as turbines and generators, making adjustments when needed, and monitor electrical, mechanical and electronic equipment to ensure optimal performance. They also keep operational logs and reports and perform preventative maintenance and repairs where deterioration or failure has occurred.

Solar power plant technicians work alongside supervisors and other plant personnel to assess equipment operating systems. They carry out numerous inspections of the power plant throughout the day and may be exposed to hazardous equipment and situations.

Skills

Solar power plant technicians need a technical knowledge of the generation and production of solar energy and understand plant health and safety regulations, coupled with:

- Machine and mechanical operating capability
- Logical troubleshooting and problem-solving skills
- Strong organisational and analytical thinking competence
- Written and verbal communication skills

Tasks

- Operate and control power generating systems and equipment
- Monitor equipment performance, taking corrective action if needed
- Maintain station records, logs and reports
- Clean, maintain and perform repairs on power plant equipment

Studies

Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control at CPUT, MUT, VUT and WSU

Solar power plant technicians can also benefit from a National Certificate in Electrical Engineering at National Qualifications Framework Level 2 to 4 offered at most Technical and Vocational Education and Training Colleges. Training could also take place on the job with mentoring by an experienced technician.

Employers

Public power utilities.

Private solar power companies.

WIND ENERGY ENGINEER

South Africa's energy sector is largely fuelled by coal generated electricity. As a signatory to the Paris Agreement, it has to significantly reduce greenhouse gas emissions by 2050. To enable this shift, renewable energies are increasingly being explored. Wind energy in particular has high potential for electricity generation, particularly in the well positioned coastal areas of the Western and Eastern Cape. Wind energy engineering involves the process of designing and implementing wind farms for the production of clean electrical energy.

Wind energy engineers design, build and monitor wind turbines and wind farms. They analyse annual wind speed and direction data to determine the best location for a wind farm and design and develop the electrical systems, specifications and materials for wind technology components. They plan and oversee the installation of wind turbines and coordinate operations to meet engineering and environmental standards. They also analyse performance data and strategise to maximise operation costs and energy generation.

Wind energy engineers consult with climatologists, geophysicists and other engineering professionals on the development and running of a wind farm. They work in offices and research and development laboratories and travel to sites to oversee the construction and inspection of wind turbines and related processes.

Skills

Wind energy engineers require a solid understanding and experience in the practical application of electrical or mechanical engineering and aerodynamic principles, along with:

- Excellent analytical and logical reasoning competence
- Creative problem-solving skills
- Competence in popular engineering and design software
- Knowledge of current energy legislation and policies

Tasks

- Advise on and design wind power stations and systems
- Supervise, control and monitor the operation of electrical generation, transmission and distribution
- Establish control standards and procedures to monitor performance and safety
- Determine maintenance and repair of existing power generation systems

Studies

B.Eng. in Electrical or Mechanical Engineering at NWU, SU, UJ and UP

B.Sc.Eng. in Electrical or Mechanical Engineering at UCT, UKZN and Wits

B.Sc.Eng. in Aeronautical Engineering at Wits

Diploma, Advanced Diploma, M.Tech in Electrical or Mechanical Engineering at CPUT, CUT, DUT, MUT, UNISA, VUT and WSU

Employers

Wind energy providers.

Manufacturing companies.

Energy agencies, partnerships and consultancies.

EARTHMOVING PLANT OPERATOR

The mining sector employs over 450 000 South Africans and supports the livelihoods of many more. Improved and safe management of mining operations can significantly reduce the impact on the natural environment- particularly land, water and air quality - as well as those whose livelihoods it supports. Earthmoving entails the moving of large quantities of soil in the early stages of excavation projects and minerals during operations.

Earthmoving plant operators operate heavy machinery to excavate earth, ore and rock in mining operations. They also move and load earth, rock and debris and further level, smooth and compact surfaces before, during and after mining. In addition to mining, they could also be involved in the building of roads, railways, water supply infrastructure, dams, treatment plants and agricultural earthworks.

Earthmoving plant operators can work as part of a larger mining or construction team, often for long hours and in relatively dangerous conditions. Regularity of work and income is highly dependent on weather conditions.

Skills

Earthmoving plant operators must have an understanding of large earthmoving machinery, the ability to safely operate these and excellent hand-eye coordination. They will additionally benefit from:

- Ability to read and understand blueprints and specifications
- Understanding of extraction processes and procedures
- Endurance to withstand difficult and harsh work conditions
- Working well as part of an interdependent team

Tasks

- Select, fit and remove attachments from plant machinery
- Operate plant machinery to excavate, grade, level, smooth and compact earth or similar materials
- Monitor and adjust controls of plant machinery
- Maintain and perform minor adjustments and repairs

Studies

Earthmoving plant operators require a valid heavy vehicle driver's license and can also benefit from a General Education and Training or National Certificate in Construction in Plant Operations at National Qualifications Framework Level 2 and 3, offered at Azandie Consulting, Eastcape Training Centre, License Wise, Proud Afrique and Skills College.

Employers

Mining and construction companies.

GEOLOGICAL SURVEYOR

South Africa has a diversity of geological materials such as gold, diamonds, platinum and coal. Mining contributes over 8% to the national economy and is a key employer. Mining activities do however significantly impact the natural environment, through water pollution, biodiversity loss and land use change. Geological surveys investigate features above and beneath a landscape to understand the scope of resources and the implications of mining them.

Geological surveyors plan, direct and conduct surveys to determine, delineate, plan and precisely position tracks of land, natural and constructed features, coastlines, marine flows and underground works. They map mineral deposits and investigate the commercial potential of mining, assessing the risks and predicting environmental impacts as a result. They record the extent of extraction and can assist in restoration once an area has been exhausted.

Geological surveyors engage with urban planners, engineers and other development professionals. They can work in offices developing reports as well as often travel to onsite locations to survey the landscape.

Skills

Geological surveyors require an extensive knowledge of mineral economics, mineral properties and land use planning legislation. They will also benefit from:

- Good analytical thinking and problem-solving skills
- Strong scientific and mathematical ability
- Ability to interpret maps, charts and graphical data
- Good verbal and written communication and presentation skills

Tasks

- Survey, measure, calculate and describe land surfaces
- Design, compile and revise maps, charts and other surveying documents
- Research and report on the development of surveys and land information systems
- Maintain technical liaison with relevant specialists

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Surveying at UCT and UKZN

Diploma and Advanced Diploma in Surveying at MUT and TUT

Diploma and Advanced Diploma in Geomatics at CPUT and TUT

Employers

National, provincial and local government.

Construction and mining companies.

Private consultancies.

GEOLOGIST

The South African landscape consists of diverse geological features that contain ancient fossils and rich resource deposits. The identification and sustainable management of these resources are essential to create a thriving economy as well as ensure healthy environments. Geology involves the science of the physical structure, substances, history and processes acting on the earth.

Geologists explore and estimate resource deposits such as coal, metal, petroleum and natural gas for proposed mining operations. They also study the composition, structure and other physical attributes of the earth and advise construction and mining companies on mitigating risks and potential land impacts. They also plan environmental protection measures by forecasting changes in the landscape caused by for example climate change, to reduce the impact of natural disasters on both people and the natural environment.

Geologists can perform long hours of fieldwork above and below ground that can be physically taxing. They additionally work in laboratories and offices, testing material samples and reporting on findings.

Skills

Geologists must have a thorough geological knowledge of varied ores, soils, minerals and rock types as well as the ability to conduct extensive and complex fieldwork and research. They will also benefit from:

- Ability to use geological mapping software
- Excellent analytical skills
- Knowledge of related policy and regulations
- Good verbal and written communication and presentation skills

Tasks

- Study the composition and processes impacting varied earth surfaces
- Identify and survey geological risks and opportunities
- Locate and map the nature and extent of varied resource deposits
- Measure seismic, gravitational, thermal, and other forces impacting the earth

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geology at NMU, NWU, RU, SU, UCT, UFH, UFS, UJ, UKZN, UL, UP, UWC and Wits

B., M. in Mining and Environmental Geology at Univen

Diploma, Advanced Diploma, M.Tech in Geology at TUT

Employers

National, provincial and local government.

NGOs, development organisations and private consultancies.

Research institutions.

GEOPHYSICIST

Mining is a key contributor to the national economy with 53 different minerals mined in the South African landscape. The nature of mining activities poses significant risk to the natural environment as well as the mining workforce and surrounding communities. Geophysics explores mineral deposits and related physical processes and properties in the landscape to reduce geological uncertainty and minimise safety, health and environmental risks.

Geophysicists study the composition, structure and other physical attributes of the earth. They locate mineral deposits and detect, monitor and forecast seismic, magnetic, electrical, thermal and oceanographic activity, identifying potential environmental hazards. They also evaluate sites to determine if proposed projects are suitable and safe for mining, construction and related activities.

Geophysicists work independently or as part of a geoscience team, engaging with varied professionals. They can work in a variety of environments including the field doing earth studies, laboratories and an office environment for report writing.

Skills

Geophysicists need an excellent understanding of physical science in relation to earth systems and processes, coupled with:

- Knowledge of the laws and regulations for mineral exploration
- Ability to model various scenarios and test hypotheses
- Strong analytical and problem-solving ability
- Project management competence

Tasks

- Estimate the weight, size and mass of the earth and the composition and structure of its interior
- Study and measure physical properties and their interrelationships
- Locate and determine the nature and extent of earth resources
- Conduct research and improve or develop concepts, theories and operational methods

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Geophysics at Wits

B.Sc., B.Sc. (Hons), M.Sc. in Physics at all universities

B.Sc., B.Sc. (Hons), M.Sc. in Geology at NMU, NWU, RU, SU, UCT, UFH, UFS, UJ, UKZN, UL, UP, UWC and Wits

Employers

National, provincial and local government.

Research institutions.

Construction and mining companies.

Private consultancies.

HYDROGEOLOGIST

Mining is a key contributor to the national economy, GDP and employment in South Africa. Mining activities however, impact significantly on land use change, and particularly impact the quality and quantity of groundwater. Hydrogeology examines the distribution and movement of groundwater in the soil and rocks of the earth's crust, to better understand potential impact and access to these water sources.

Hydrogeologists investigate the occurrence and exploration opportunities and challenges of groundwater according to geographical formations, surface water flow and man-made influences. They study and collect data on the flow and quality of groundwater systems and model future behaviour and impacts on aquifer systems. They can also advise on the decision-making processes for aquifer subdivisions, rivers and irrigation strategies ensuring compliance with environmental legislation.

Hydrogeologists can liaise with environmental engineers, ecologists and other professionals in investigating groundwater systems. They typically work between on-site locations, assessing water systems and geological structures of interest, and a laboratory and office environment.

Skills

Hydrogeologists need to have an extensive knowledge of geological characteristics and groundwater principles and can further benefit from an understanding of water policies and regulations, and:

- Excellent research capabilities
- Analytical with excellent critical thinking skills
- Strong problem-solving ability
- Good verbal and written communication and presentation skills

Tasks

- Assess sites and perform and analyse groundwater sampling
- Create, test and interpret prediction models and maps
- Undertake environmental impact assessments and create remediation project plans
- Advise and support compliance with regulations, laws and standards

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Hydrogeology at UFS, UP and Wits

B.Sc., B.Sc. (Hons), M.Sc. in Hydrology at NWU, UKZN, Univen and Unizulu

Employers

National, provincial and local government.

Research institutions.

Mining and construction companies.

MATERIALS ENGINEER

Valuable minerals and materials such as coal, platinum, gold, diamonds, chrome, vanadium and titanium are available in the South African landscape. A wide range of products are produced from these minerals and materials, especially in the evolving technological revolution. To support sustainability, materials engineering comprises of the study and design of new materials made from natural or man-made materials.

Materials engineers plan and direct the engineering and commercial application of materials, manufacturing processes, products and related technologies. They evaluate the properties and structures of all materials and make recommendations for the most appropriate use. They can test a product's quality and endurance, identify potential faults and develop solutions. Some can design processing plants and equipment to enable the manufacture of new materials.

Materials engineers can collaborate with plant designers and other engineering professionals in enabling the correct design and manufacture of new materials. They can work in research and development laboratories, office environments or in a supervisory role in production plants.

Skills

A deep knowledge of chemical and material properties is needed by materials engineers and an understanding of engineering modelling and design. They will also benefit from:

- Ability to conceptualise abstract ideas
- Strong problem-solving ability
- Excellent analytical competence
- Good verbal and written communication and presentation skills

Tasks

- Conduct and supervise tests on raw materials or finished products to ensure quality
- Monitor material performance and evaluate material deterioration
- Evaluate technical specifications and economic factors relating to process or product design objectives
- Analyse product failure data and test results

Studies

B.Sc.Eng. in Metallurgical Engineering at Wits

B.Eng. in Metallurgical Engineering at UP

Diploma, Advanced Diploma, M.Tech in Metallurgical Engineer at TUT, UJ and VUT

Employers

Research institutions.

Plastic, computer and electronic, ceramic, glass and steel product manufacturers.

METALLURGIST

South Africa possesses large reserves of chromium, iron, uranium, platinum, vanadium, titanium, lead, zinc, manganese and many other metals used in the production of goods. Most of these mineral reserves are found in ores that are complex in nature. To extract these useful metals from the ore, research is necessary to ensure efficient and sustainable processes of mineral extraction and production. Metallurgy involves the investigation, purification and production of mined metals.

Metallurgists research and design methods to separate metals from ore and process them into valuable products. They test ores to determine the best way to recover metals efficiently and effectively and oversee processes of extracting metals from ore. They also produce commercial metal products through casting, alloying, heat treating or welding refined metals, alloys and other materials, amongst others. Some might also focus on identifying changes in metal under particular conditions and investigate where and why metallurgical failure has occurred.

Metallurgists can work with mining engineers, geologists and other geophysical specialists around the mining of metals. They can work in a laboratory, metal treatment plant, refinery, mining sites or manufacturing production plants shaping metals to create new products.

Skills

Metallurgists require a thorough understanding of the physical and chemical properties of metals, compounds and alloys. They will further benefit from:

- Strong mathematical and engineering competence
- Excellent analytical and problem-solving ability
- Critical thinking around design and processing techniques
- Sound attention to detail

Tasks

- Conduct research and investigate metal and alloy properties
- Design processes and methods for metal extraction and alloying
- Test and develop the manufacture and processing of metal products
- Compile reports to advise on process performance and shortcomings

Studies

B.Eng. in Metallurgical Engineering at UP

B.Sc.Eng. in Metallurgical Engineering at Wits

B.Sc., B.Sc. (Hons), M.Sc. in Chemistry at all universities

Diploma, Advanced Diploma, M.Tech in Metallurgical Engineer at TUT, UJ and VUT

Employers

Metal, iron and steel manufacturing companies.

Metal ore mining companies.

Research institutions.

MINE DESIGN AND PLANNING MANAGER

The minerals and mining sector is a major contributor to the South African economy and provides employment for over 450 000 people. Production and safety risks in the mining industry can be minimised through well designed and effectively operated mines. This could also ensure optimal performance, production and utilization of resources and minimise operational challenges that could impact surrounding communities and the environment. Mine design and planning considers geological, engineering, physical, social and economic factors in designing and operating a mine.

Mine design and planning managers plan, organise, direct, control and coordinate complex operations and resources to establish safe, optimal and economically viable mining strategies. They set up production quotas, plan extraction sites and develop processes for the removal of raw materials. They also select and train mining personnel in required safety procedures as well as establish and maintain detailed budgets for mining projects.

Mine design and planning managers work with engineers, geologists, miners and other personnel involved in the planning and operation of a mine. They work on site to evaluate mining production activities, and in an office environment to develop reports and plans of action.

Skills

Mine design and planning managers need extensive experience in the design and planning of mines as well as a solid knowledge of mining operations and procedures, also benefitting from:

- Practical and spatial competence in design and planning
- Risk management and business experience
- Excellent and immediate problem-solving ability
- Strong interpersonal and people management skills

Tasks

- Control the operation of a plant and quality procedures
- Evaluate efficiency of production sites to determine adequacy of procedures and processes
- Establish and manage budgets, adjusting processes and resources to minimise costs
- Confer with other managers to set and develop processes to achieve production quotas

Studies

B.Eng. in Mining Engineering at UP

B.Sc.Eng. in Mining Engineering at Wits

B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Mining Geology at NMU, NWU, RU, SU, UCT, UFH, UFS, UJ, UKZN, UL, UP, UWC and Wits

Diploma and Advanced Diploma in Mining Engineering at UNISA

Employers

National government.

Mining companies.

Private consultancies.

MINING ENGINEER

South Africa's mining industry makes a significant contribution of around 8.2% to the national economy through extraction, processing and export of, amongst others manganese, platinum, gold, diamonds and chromite ore. Extraction of materials and minerals is costly, dangerous, particularly in the case of underground mining and blasting and impacts the environment and land use. Mine engineering supports efficient and safe systems and processes of mineral extraction to minimise environmental and social risk.

Mining engineers plan and direct the engineering aspects of locating, extracting, processing and transporting materials and minerals from the earth. They assess the feasibility, safety and productivity of new mine sites, highlighting potential extraction, economic and environmental risks. They then design the mine and develop and implement relevant systems, machinery and equipment needed, continuously monitoring and evaluating operational performance. Some assist in the selection and training of miners and ensure they follow strict health and safety precautions.

Mining engineers consult with geologists, geophysicists, economists and other professionals when evaluating and planning mines and mining operations. They work between an office environment and visiting mine sites to assess the effectiveness of designs and operations.

Skills

Mining engineers require a strong and practical understanding of the application of mine engineering principles, engineering modelling and design, coupled with:

- Logical and creative problem-solving ability
- Grasp of mine safety, health and environmental regulations
- Strong project and organisation management
- Good verbal and written communication skills

Tasks

- Examine deposits or mines to evaluate profitability and risk
- Develop mine designs and systems needed for extraction
- Design and implement suitable methods and equipment for extraction
- Establish operation safety standards and procedures

Studies

B.Sc.Eng. in Mining Engineering at Wits

B.Eng. in Mining Engineering at UP

Diploma and Advanced Diploma in Mine Engineering at UNISA

Employers

National, provincial and local government.

Mining companies.

Mine equipment manufacturers.

Research institutions.

Private consultancies.

MINING TECHNICIAN

South Africa's mineral and mining sector contributes significantly to the national economy and employs over 450 000 people. The process of extracting valuable minerals and metals from diamonds and gold, to reserves of iron ore, platinum and others, is labour intensive and poses significant environmental, safety and health risks. Technical prowess and accuracy is needed in the mining environment to minimise impacts during exploration, extraction, processing and transportation in mining operations.

Mining technicians provide technical assistance and research around location, extraction, transportation and equipment used in the extraction of minerals and metals. They conduct topographical surveys and collect and prepare rock samples to determine chemical and physical properties to inform the most efficient extraction of minerals. They also monitor the use of equipment and assist in enforcing strict occupational health, safety and environmental regulations.

Mining technicians assist mining engineers, metallurgists, production supervisors and other professionals with mineral exploration processes. They work above and below ground under dangerous working conditions and occasionally work in a laboratory environment to test mineral samples.

Skills

Mining technicians need an extensive and sound knowledge of rock and mineral characteristics, physical properties and extraction processes and procedures. They will also benefit from:

- Ability to research and conduct land surveys
- Grasp of mine health, safety and environmental regulations
- Good problem-solving and analytical skills
- Physical stamina and endurance to withstand harsh work conditions

Tasks

- Assist in planning and designing a mine, mine shafts, tunnels and underground facilities
- Conduct research and geological and topographical surveys
- Collect, prepare and test rock, mineral and metal samples
- Monitor technical, regulatory health, safety and environmental aspects in mining processes

Studies

B.Sc.Eng. in Mining Engineering at Wits

B.Eng. in Mining Engineering at UP

Diploma and Advanced Diploma in Mining Engineering at UNISA

Employers

National, provincial and local government.

Mining companies.

OCCUPATIONAL HEALTH AND SAFETY ADVISOR

The South African mining industry employs around 450 000 people and contributes approximately 8.2% to the national economy. The nature of mining is potentially highly dangerous. Good health and safety is critical to managing a wide range of hazards and risks. Health and safety within mines, coupled with strict monitoring of health and safety regulations is essential to ensuring the health and wellbeing of miners and sustainability of employers to secure jobs and livelihoods.

Occupational health and safety advisors develop, implement and evaluate risk management policies and programmes. They conduct environmental impact assessments and observe employee safety practices and proceed to develop methods to minimise environmental impact and ensure employee safety. They also instruct and train employees in safety procedures and investigate potential incidents to highlight challenges in current safety plans.

Occupational health and safety advisors work closely with a company's personnel to ensure a safe and healthy work environment. They often travel to sites of inspection, returning to an office to evaluate the working conditions of an operation.

Skills

Occupational health and safety advisors require a comprehensive knowledge and understanding of environmental and health and safety requirements, standards and regulations, along with:

- Critical problem-solving and analytical competence
- Good organisational skills and keen attention to detail
- Strong interpersonal skills
- Good verbal and written communication and presentation skills

Tasks

- Conduct risk assessments and investigate particular incidents of concern
- Develop internal strategies, polices and occupational procedures
- Advise on and implement safe occupational practices
- Train and monitor personnel on working operations and procedures

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Health at UP

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Management at UFS, UJ, UNISA and UP

B.Sc. in Environmental Health at NMU and UJ

Diploma and Advanced Diploma in Environmental Health at CPUT, CUT, MUT and TUT

Employers

National, provincial and local government.

Mining companies.

Manufacturing and construction companies.

Power generation plants.

Private consultancies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

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- Good verbal and written communication and presentation skills

Tasks

- Conduct risk assessments and investigate particular incidents of concern
- Develop internal strategies, polices and occupational procedures
- Advise on and implement safe occupational practices
- Train and monitor personnel on working operations and procedures

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Health at UP

B.Sc., B.Sc. (Hons), M.Sc. in Environmental Management at UFS, UJ, UNISA and UP

B.Sc. in Environmental Health at NMU and UJ

Diploma and Advanced Diploma in Environmental Health at CPUT, CUT, MUT and TUT

Employers

National, provincial and local government.

Mining companies.

Manufacturing and construction companies.

Power generation plants.

Private consultancies.

WWF

Forestry, Fisheries and the Environment
Higher Education and Training

khetha

PETROLOGIST

South Africa is rich in geological resources with a unique set of geological environments. These contain metamorphic, igneous and sedimentary rocks containing precious sources of natural gas, water, metals and minerals amongst others. These rock types not only hold valuable resources but can also offer insight into how the climate and landscape changes over time. The examination of individual rocks and their properties through petrology, can help guide the safe extraction of resources and determine areas in need of conservation.

Petrologists examine rocks to determine their exact composition and can identify the best means to extract the minerals and resources within. They observe and collect samples from rock structures and conduct detailed analyses on its geochemical, geological and geophysical properties. They develop geological maps and reports and advise on rock protection strategies or can assist in the development of efficient extraction methods. Some create detailed records used to identify changing climate and geomorphological patterns.

Petrologists work predominately in the field around rock formations and structures to collect data, returning to a laboratory to classify and analyse rock findings. They work with other geological professionals and can liaise with mining engineers in the operationalisation of mines.

Skills

Petrologists require a comprehensive understanding of the characteristics and chemical compositions of rocks and the varied forces shaping the earth surfaces. They will also benefit from:

- Extensive research, field and laboratory competence
- Geological modelling and mapping ability
- Strong analytical and observation skills
- Good verbal and written communication and presentation skills

Tasks

- Locate and map the nature of varied resource deposits
- Collect and test samples to determine composition, structure and genesis of rocks and minerals
- Record genetic classification of rocks and reconstruct geological history
- Report findings and advise on economic exploitation and composition of rocks

Studies

B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Petrology at NMU, NWU, RU, SU, UCT, UFH, UFS, UJ, UKZN, UL, UP, UWC and Wits

B., M. in Mining and Environmental Geology at Univen

Diploma, Advanced Diploma, M.Tech in Geology at TUT

Employers

Research institutions.

Mining companies.

Museums.

Private consultancies.

ROCK ENGINEERING MANAGER

South Africa is rich in a variety of minerals and materials with reserves of diamonds, gold, iron ore, platinum, manganese, chromium and copper amongst others, which are accessed through complex underground mining extraction processes. The stability of rocks during and after excavations is a key risk factor for the biophysical environment, surrounding communities and the health and safety of workers. By understanding the properties of rock, the design of safe and stable excavations in mining is made possible.

Rock engineering managers plan, organise, direct, control and coordinate rock engineering and related functions to ensure safe and optimal extraction of ore reserves. They locate and evaluate an excavation site and determine the equipment, personnel and budget needed to safely extract all potential minerals. They also supervise extraction processes and advise on equipment, maintenance or upgrades as well as personnel health and safety procedures.

Rock engineering managers liaise with geologists, geophysicists, mine planners, mining engineers and other professionals to determine the best means to extract materials. They predominately work on mine sites, returning to an office to evaluate and plan excavation processes.

Skills

Rock engineering managers need an understanding of rock mechanics and the forces that shape them and experience in effective mineral extraction techniques, coupled with:

- Risk management and business experience
- Excellent analytical thinking and problem-solving skills
- Grasp of mining, safety, health and environmental regulations
- Good interpersonal and communication skills

Tasks

- Evaluate and plan extraction sites, establishing budgets, production quotas and other requirements
- Control the operation of plant and quality procedures
- Oversee the acquisition and installation of new plant and equipment
- Oversee the selection, training and performance of personnel

Studies

B.Sc.Eng. in Mining Engineering at Wits

B.Eng. in Mining Engineering at UP

Diploma and Advanced Diploma in Mine Engineering at UNISA

Rock engineering managers can also benefit from a Chamber of Mines Rock Mechanics Certificate offered by UNISA, accredited by the South African National Institute for Rock Engineering.

Employers

National government.

Mining companies.

Mine equipment manufacturers.

Private consultancies.