

09

Faculty of
Natural and Agricultural Sciences

Annual Report





**Faculty of Natural and
Agricultural Sciences
Annual Report 2009**

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Issued by

Faculty of Natural and Agricultural Sciences
University of the Free State

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Language revision

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Revision of bibliographical data

Mercia Coetzee

Layout and cover design

Chrysalis advertising and publishing

Photographers

Leonie Bolleurs
Stephen Collett
Reinier Brönn

Printing

Bloemfontein Repro Services

The Afrikaans version is available on the
university's website at www.ufs.ac.za

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Preface

From the Dean's Office

It is with great pride and gratitude that I write this preface to the 2009 Annual Report of the Faculty of Natural and Agricultural Sciences because in spite of the ramifications of the global economic downturn on the core business of institutions of higher learning across the world, the Faculty remained steadily on course with respect to its vision and mission. Through dedication and hard work staff and students continued to excel, once again with some notable special achievements, of which a few are highlighted below.

Our student enrolments continued to rise as young men and women both nationally and from other parts of Africa and the rest of the world remain attracted to the diverse and high quality training and research opportunities we offer. To mention but a few, our expertise in plant pathology, lipid biotechnology and nanoscience is world renown, and we are one of only a few South African universities involved in forensic science. We do training and research in disaster risk management and mitigation, and offer a postgraduate course with the largest footprint in Africa. Agriculturally

we have the most specialized group servicing the farming industry, including capacity building programmes for newly settled and prospective emerging commercial farmers. Our building science departments are leaders in the country and are consistently successful in accreditation processes (often unconditionally) by national and international professional bodies.

The highly successful equipment strategy remained on track as we systematically continued to grow our capacity in state-of-the-art equipment, bearing fruit in further improving the quality and quantity of research and training outputs. We are also grateful for a substantial grant received from the Department of Higher Education and Training which will enable us to relieve some of the pressure on our physical facilities and better equip several laboratories. Our cadre of NRF-rated researchers grew including the attainment of B-ratings by a number of staff members. The Strategic Academic Clusters (Water Management in Water-scarce Areas, Technologies for Sustainable Crop Industries in Semi-arid Regions, Materials and Nanosciences,

and Advanced Biomolecular Sciences) also continued to gain momentum as vibrant hubs of multidisciplinary research and training, focusing on key Southern African problems and the expanding of knowledge for greater technological advancement and innovation.

As mentioned earlier, staff and students were once again prominent in focusing national and international attention on the faculty as recipients of significant research awards, the sharing of expertise, their election to high profile academic bodies and the organization of special events. I highlight but a few of these:

- Prof. Esta van Heerden (Department of Microbial, Biochemical and Food Biotechnology) won the 2009 Third World Academy of Science Young Scientist Award.
- At the congress of the South African Society for Plant Pathology Prof. Neal McLaren (Department Plant of Sciences) received the society's award for applied plant pathology research, while Prof. Zakkie Pretorius received the C.H. Persoon medal

(gold), which is the highest award for contributions to this field of study in South Africa. It was only the fifth time since its inception that the award was made.

- Under the leadership of Prof. Jo van As (Department of Zoology and Entomology) a highly successful year long public scientific programme was offered to commemorate Charles Darwin's birthday and the publication of his book, *The Origin of Species*, 150 years ago. It involved lectures by staff from several departments within our faculty, from other faculties, the National Museum (Bloemfontein) and the Central University of Technology.
- Prof. Marian Tredoux (Department of Geology) was nominated Fellow of the Geological Society of South Africa.
- Prof. Gideon Steyl (Department of Chemistry) was awarded the first Jan Boeyens medal for outstanding work in theoretical Chemistry/Physics by a young scientist (younger than 40 years) in the process outclassing nominees from WITS, UP, US and UCT at the locally held international INDABA congress. Prof. André Roodt, Departmental Chairperson, was elected Vice-president of the European Crystallographic Association which has approximately 45 member countries from Europe, Africa and the Middle East.
- Prof. Hendrik Swart, Departmental Chairperson, and Dr Martin Ntwaeaborwa (Department of Physics) were both recipients of NSTF awards, the former for Research Capacity Development and the latter as a Distinguished Young

Black Researcher. At the South African Institute of Physics congress Ms A Dhlamini received the Publication Award for the best publication in a scientific journal, originating from a Ph.D. thesis (Promoters, Proff. HC Swart and JJ Terblans) while Mr. WA Jordaan received it for the best publication in a scientific journal, originating from an MSc. dissertation (Supervisors, Proff. JJ Terblans and HC Swart).

- Prof. Johan Greyling (Department of Animal, Wildlife and Grassland Sciences) received a silver medal for his contribution to research at the Annual Meeting of the SA Society for Animal Sciences in November 2008 and was also re-elected to the SASAS Council. Prof. Hennie Snyman was named Free State's Agriculturalist of the Year by the Central Agricultural Writers Association.
- From the Department of Soil, Crop and Climate Sciences Prof. Cornie van Huyssteen was elected President and Dr. Piet le Roux as Council Member of the Soil Science Society of South Africa.
- Mr. Andries Jordaan, Head of the Disaster Management Training and Education Centre for Africa (DiMTEC) was approached by the government of the Republic of the Congo for assistance with their national disaster management plan, focusing specifically on Brazzaville, as well as the establishment of a disaster management centre.
- The Department of Quantity Surveying and Construction Management received unconditional accreditation

for construction management from the Chartered Institute of Building, as well as confirmation that they complied with the requirements for recognition as an accredited centre. Prof. Verster, the Departmental Chairperson, was elected Vice-President (Education) of the CIOB (Africa).

- The Department of Architecture brought out a special edition of the academic publication *Architecture South Africa*. Craig Atkins was among the top ten students on the shortlist for the Africa Thesis Awards.

The faculty and the university are greatly indebted to these and all the staff members and students who again worked tirelessly to excel and further raise the academic stature of our institution both nationally and internationally. As a faculty we also express our sincere gratitude to our former Dean, Prof. Herman van Schalkwyk, who once again led us with great distinction in 2009. It is now my pleasure to present to you this Annual Report with the hope that it will not only make for informative and stimulating reading but that it will also open up possibilities for mutually beneficial and productive collaboration.



Prof. N.J.L. Heideman
Acting Dean

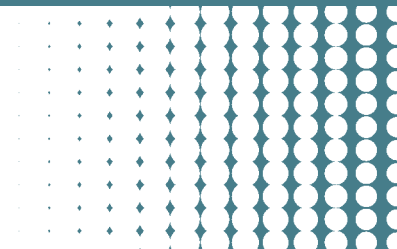
Faculty of Natural and
Agricultural Sciences
University of the Free State



Departments in



Agricultural Sciences



01

Agricultural Economics



Overview

The Department of Agricultural Economics at the University of the Free State (UFS) is proud of its achievements over the past 50 years, especially as far as the training of agricultural students in the areas of research, governance, banking and agri-business is concerned. As part of its half-century celebrations and in an effort to position the department closer to agri-businesses, a bursary programme was launched by the department on 29 October 2009. During this prestigious event more than R500 000 was raised to support 16 students studying in Agricultural Economics.

The agri-businesses involved as sponsors benefit from the programme by having the opportunity to identify promising third-year students as potential employees and exposing them to the business by means of vocational work. By the time the student completes his/her studies, he/she is already acquainted with the business and loyalty towards it already being established.

Agri-businesses serving as sponsors are Omnia, Pioneer Foods, Corporate Guarantee, Free State Cooperative and the National Wool Growers' Association/Cape Wools.



“The aim of the Department of Agricultural Economics is to prepare students who have attained relevant knowledge at the university to make a difference in the work place.”

- Prof. Johan Willemse



M.Sc. students Mr Marvi Khaile (third from the left) and Ms Reneilwe Maenetja (right) meeting with a vegetable producer at the Zanyokwe irrigation scheme.



Understanding the environmental and economic challenges facing the agricultural sector in South Africa puts the department of Agricultural Economics in a pivotal position to make a difference.

Activities and achievements

The Agricultural Economic Association of South Africa held their 47th annual conference in Durban from 21 to 23 September 2009 and 14 students and lecturers from the department participated. Mr JD Delpont won the best final-year student award for Agricultural Economics at the conference. Prof. Zerihun Alemu and Mr Abiodun Ogundeji won the third prize for the best paper. A second prize was awarded to Mr Rueben Mokoena and Profs. André Jooste and Zerihun Alemu for the best publication in a professional journal. The department delivered about one third of the papers at the conference and also organised a conference workshop.

Prof. Giel Viljoen was the co-recipient of the *ATKV-Akademie* prize from the South African Academy of Art and Science, together with Dr Herman Booysen and Prof. Gawie du T de Villiers for the best Afrikaans academic article entitled *Standaard residensiële vloedskadefunksies vir Suid-Afrikaanse toestande* in the journal *Die Suid-Afrikaanse Tydskrif vir Natuurwetenskap en Tegnologie*.

Research in the Department of Agricultural Economics covered topics such as precision agriculture, rural development, market appraisals, flood forecasting



From the left are: Ms Chrisna van Heerden, National Wool Growers'/Cape Wools, Mr Gielie Swart from Corporate Guarantee, Mr Jaco Heckroodt from Free State Co-op Limited, Mr Arno van Vuuren from NWK and Prof. Willemse, Chairperson of the Department of Agricultural Economics, UFS.

and sustainable agriculture, including irrigation decision-making tools.

A research project with the title *Assessment of the contribution of water use to value chains in agriculture: a conceptual framework* is underway. From this research three case studies are being developed by Dr Bennie Grové and Mr Henry Jordaan on emerging farming projects. These cases include the raisin producers at Eksteenskuil in the Northern Cape, the vegetable producers at the Zanyokwe irrigation scheme in the Eastern Cape and the vegetable producers at the Thabina irrigation scheme in Limpopo.

The study focuses on how emerging farmers can be linked to commercial agriculture, since their participation in commercial agriculture will necessarily increase the value of the water they use. Understanding the value chain gives a good idea of how and where emerging farmers can be linked in order to form part of a commercial agricultural value chain.

The agri-business unit is undertaking a number of research projects in collaboration with the potato industry on price volatility, contracts with processors, farmer-controlled businesses, etc. Some of the studies are funded by the National Agricultural Marketing Council (NAMC). Research is also being done in collaboration with the beef industry on premiums for grass-fed beef, the viability of farm feedlots being used on farm maize, etc.

A number of research projects are also done in collaboration with the Protein Research Trust (PRT) on animal feed



During a SAFEFE Board meeting are, from the left: Prof. Claudia Parliament, Ms Winkie Direko, Prof. Klopper Oosthuizen, Dr Patty Elder, Prof. Herman van Schalkwyk, Dr Mafu Rakometsi, and Ms Elzmarie Oosthuizen, who was elected as a board member.

requirements, the oilseed industry and biofuels. The department, in collaboration with the Disaster Management Training and Education Centre for Africa (DiMTEC) at the UFS and the Provincial Department of Agriculture, is conducting research on the drafting of an agricultural disaster management policy.

Presentations on agricultural economics and agricultural markets are done on request at numerous industry conferences and farmers' days (approximately 30 per year). This department also publishes approximately 100 popular scientific articles in most agricultural journals, covering economics and marketing issues. Regular contributions are made to popular publications that include *Landbouweekblad*, *Graan SA*, *SA Koop*, *SA Fruit and Vegetables*, *Food and Packaging Reporter*, as well as the business section of the newspapers *Beeld*, *Die Burger* and *Volksblad*.

The livestock and wildlife unit has done an annual benchmarking study in collaboration with the NAMC and the University of Pretoria, as part of an international industry benchmarking study. Wildlife auction prices are also collected and made available on a database that is used for research and feasibility projects.

Two Safex courses were hosted by the Department of Agricultural Economics and presented by Dr Kit le Clus and Mr Dirk Strydom. The Safex courses focus on how grain markets operate and the major factors that influence grain prices. As part of the course, grain price-hedging contracts are discussed, how it works and how grain is delivered

on Safex. Hedging, as well as the local basis and the location differential are discussed and include examples of basic hedging strategies. The course also covers options on grain futures and how option strategies are used to manage price risk.

Quarterly Agricultural Market Outlook Workshops are held by Prof. Johan Willemse and Ms Lize Terblanche on the Main Campus. These workshops are always very well attended by farmers and agri-businesses alike (80-120 attendees). Farmers from as far afield as KwaZulu-Natal and Polokwane attend and a relaxed atmosphere with open discussion and live interaction is experienced at these workshops. During 2009 guest speakers included the chairperson of ABSA, Prof. Gill Marcus, Mr Daan Louw, a market analyst, Mr Igno van Niekerk, a strategist from Liberty Life and Dries Danhausser, a trader from Sharemax Securities. The results of the discussions and identified future trends are made available on the website of the department.

The 17th International Farm Management Association (IFMA) conference was hosted in Illinois, Bloomington at the Illinois State University. In July 2009 Prof. Johan Willemse and Mr Dirk Strydom, together with Dr Wimpie Nell and Mr Petso Mokhatla, attended the conference where various peer-reviewed papers were presented. Mr Mokhatla made a presentation to the Farm Financial Standard Council (FFSC) on invitation and covered the topic *Financial challenges and risks of commercial and emerging farmers in South Africa*.



Under the directorship of Prof. Klopper Oosthuizen from the Department of Agricultural Economics, the South African Foundation for Economic and Financial Education (SAFEFE) facilitated the training of 520 teachers from across the country in KwaZulu-Natal and Mpumalanga. This is done in collaboration with Prof. Claudia Parliament from the University of Minnesota in the United States of America (USA).

SAFEFE also had its first board meeting on 6 November 2009 at Roodevallei Country Lodge in Pretoria. Ms Elzmarie Oosthuizen was elected to the board of SAFEFE and Ms Ina Combrinck

was appointed secretary of the board. Two provincial coordinators will also be elected as members of the board on an annual basis. For 2010 Mrs Sam Motaung (Free State) and Dr Abby Mushunje (Eastern Cape) were elected.

A group of 50 trainers consisting of subject advisors in economics and management sciences as well as lecturers from different universities completed their training in Polokwane in June 2009. All nine provinces were represented and the training was conducted by outstanding professors from four international universities, namely the University of Minnesota, Florida State University,

Colorado State University and the National Technical University of Kharkiv, Ukraine.

Ms Elzmarie Oosthuizen and Ms Ina Combrinck participated in the annual conference of the Council for Economic Education (CEE), the National Association of Economic Educators and the Global Association of Teachers of Economics in Washington DC, United States from 8 - 11 October 2009.

Networking

During May and June 2009 students and lecturers from the University of Minnesota visited the Department of Agricultural Economics. On arrival at the



Main Campus of the UFS they were introduced to students, staff and lecturers at a function. A mini-conference was held where the department's different research areas were presented. Topics covered during their visit were, amongst others, Risk Management, HIV/AIDS, research projects and a lecture given by Prof. Johan Willemse on the topic *The South African economy and the agricultural sector*.

The visitors from the University of Minnesota paid a visit to Glen. They met with Dr Jack Armour of Free State Agriculture who is a former student and lecturer from our department. He is now the

Operations Manager: Land Reform and AgriBEE, Farm Management, Municipal Liaison and Resource Conservation.

The department was joined by the visitors from the University of Minnesota on a seven-day study tour. The tour included visits to GWK at Douglas, the Landzicht Wine Cellar, Oppermansgronde and the agricultural school at Jacobsdal. A tour of the Basotho Cultural Village near Golden Gate in the eastern Free State as well as a visit to the Qwaqwa Campus of the UFS was also included. Furthermore, Ms Jane McPherson from GrainSA organised visits to various emerging farmers and small-scale farmers. A visit to the

faculty's experimental farm completed the tour. As an immediate consequence, Dr Bennie Grové visited the University of Minnesota for six weeks to collaborate on research projects with Ph.D. students from their department. A follow-up visit from the University of Minnesota is planned for 2010.

The second USA teachers' exchange programme took place in July/August 2009 when 24 teachers from different states of the USA visited the Free State and KwaZulu-Natal.

They visited schools and other institutions that conduct educational programmes in farming, as well as community members.



Research outputs

Research articles

Alemu, Z.G. 2009. How successful the Agricultural Development Led Industrialization Strategy will be leaving the existing landholding system intact- a major constraint for the realization of ALDI's targets? *Ethiopian e-journal for research and foresight* 1(1): Inaugural issue.

Alemu, Z.G., Maine, N., Lowenberg-DeBoer, J. & Nell, W.T. 2009. Impact of variable-rate application of nitrogen on yield and profit: a case study from South Africa. *Journal of Precision Agriculture* Electronic: 10.1007/s11119-009-9139-8.

Alemu, Z.G., Magingxa, L.L. & Van Schalkwyk, H.D. 2009. Factors influencing market access for smallholder irrigators in South Africa. *Development Southern Africa* 26(1): Electronic.

Book

Van Schalkwyk, H.D. & Alemu, Z.G. 2009. *Market integration in Mozambican maize markets*. Ethiopia: OSSREA.

Report

Grove, B. 2009. *Integrating and updating of SAPWAT and PLANWAT to create a powerful and user friendly irrigation water planning tool*. Report to the Water Research Commission (WRC), Pretoria, South Africa.

Conference contributions

Grové, B. & Oosthuizen, L.K. 2009. *Long-run irrigation water derived demand for alternative farm developing scenarios*. Paper presented at the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern

Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Idsardi, E., Jordaan, H. & Van Schalkwyk, H.D. 2009. *A characterisation of success factors of projects funded by the Comprehensive Agricultural Support Program in the Free State Province*. Paper presented at the 43rd Annual Conference of the South African Society for Agricultural Extension (SASAE): Partnerships in Agricultural development, Madiba Banquet Hall, Potchefstroom, South Africa. 12-15 May.

Jordaan, H. & Grové, B. 2009. *Institutional economic analysis of raisin production and marketing in South Africa: Learning from Eksteenskuij raisin producers*. Paper presented at the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Jordaan, H., Grové, B. & Khaile, P.M. 2009. *Assessment of the contribution of water use to value chains in agriculture: The case of Eksteenskuij raisin producers*. Paper presented at the workshop on "Productive water use, food value chains and mainstreaming emerging farmers" held during the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Jordaan, H., Grové, B. & Khaile, P.M.E. 2009. *Assessment of the contribution of water use to value chains in agriculture: A conceptual framework*. Paper presented at the workshop on "Productive water use, food value chains and mainstreaming

emerging farmers" held during the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Jordaan, H., Grové, B. & Khaile, P.M.E. 2009. *Assessment of the contribution of water use to value chains in agriculture: The case of Eksteenskuij raisin producers*. Paper presented at the workshop on "Productive water use, food value chains and mainstreaming emerging farmers" held during the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Khaile, M.P., Jordaan, H., Grové, B. & Matthews, N. 2009. *Assessing factors affecting the technical efficiency of emerging raisin producers in Eksteenskuij in the Northern Cape Province, South Africa*. Paper presented at the 2nd Annual Orange River Basin Symposium: Current challenges faced in the Basin, Centre for Environmental Management, University of the Free State, Bloemfontein, South Africa. 11-12 November.

Mare, F., Taljaard, P. & Jordaan, H. 2009. *Consumer preference for beef with specific reference to fat colour: The case of Cape Town, South Africa*. Paper presented at the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Matthews, N. & Grové, B. 2009. *Environmental efficiency of alternative irrigation practices*. Paper presented at the 2nd Annual Orange River Basin Symposium: Current challenges faced in the Basin, University of the Free State, Centre for Environmental Management, Bloemfontein, South Africa. 11-12 November.

Strydom, D., Meyer, F., Taljaard, P. & Willemse, B.J. 2009. *The impact of maize-based ethanol production on the competitiveness of the South African animal feed industry*. Paper presented at the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Strydom, D., Meyer, F., Taljaard, P., Strauss, P. & Willemse, B.J. 2009. *The economic impact of ethanol production on the South African animal feed industry*. Proceedings of the 17th Bi-Annual International Farm Management Association (IFMA) Congress: Agriculture - Food, Fiber and Energy for the Future, Bloomington/Normal, Illinois, USA. 19-24 July. pp. 649-668.

Strydom, D., Van Niekerk, H., Jordaan, H. & Willemse, B.J. 2009.

The evaluation of factors effecting longer term farm contracts in the frozen fries processing industry. Paper presented at the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Taljaard, P., Alemu, Z.G., Jooste, A. & Jordaan, H. 2009. *The impact of the Namibian small stock marketing scheme on South Africa*. Paper presented at the 47th Annual Conference of the Agricultural Economics Association of South Africa (AEASA): Promoting the competitiveness of South African agriculture in a weakened global economy, Southern Sun Elangeni Hotel, Durban, South Africa. 21-23 September.

Van Niekerk, H., Taljaard, P., Grové, B. & De Waal, H.O. 2009. *Factors affecting small stock predation in the Free State Province of South Africa*. Paper presented at the Southern African Wildlife Management Association Symposium (SAWMA): Wildlife Management – Ensuring Sustainability, Protea Hotel Black Mountain, Thaba Nchu, South Africa. 13-16 September.

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Associate Professors: Profs. Zerihun Alemu, André Jooste

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Lecturers: Messrs Henry Jordaan, Dirk Strydom, Frikkie Mare, Abiodun Ogundeji, Mss Nicky Matthews, Lize Terblanche and Ms Leandre du Preez

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02

Animal, Wildlife and Grassland Sciences



Overview

The mission of the Department of Animal, Wildlife and Grassland Sciences remains focused on the transfer of current knowledge and the creation of new knowledge and technologies through scientific research. The interaction between the different disciplines within the department (Animal Nutrition, Animal Breeding, Animal Physiology, Grassland Science and Wildlife Management), the industry and the community served, led to the strengthening and expansion of partnerships that have extended the capacity of the department as well as the Faculty of Natural and Agricultural Sciences.

The contribution of the department to increased sustainable animal production

and wildlife management in the central parts of South Africa bears witness to the fact that this is indeed a centre of excellence at the University of the Free State (UFS). The general research planning of the department focuses on efficient, sustainable and economical animal production for the provision of high-quality animal products, taking into consideration public and animal health, as well as the conservation of natural resources. Wildlife and the management thereof as an enterprise is an aspect that receives more and more attention these days.

The structuring of the department into various disciplines has created centres of excellence and facilitates teaching, research and community service.



*“Sustainable animal production helps
feed and uplift the nation.”*

- Prof. Johan Greyling



*Grassland Science
field surveys being
conducted in
Lesotho.*



This has also been complemented by interdisciplinary actions within the department, as well as between departments at the UFS and other institutions. It is clear from the research outputs that the Department of Animal, Wildlife and Grassland Sciences has an extensive research programme, with specialisation in the different disciplines.

Limited research funds remain a big challenge. Funding is therefore generated from external institutions that have a vested interest in the work being done by the department. The National Research Foundation (NRF) remains the main sponsor supporting research, while additional funds have been generated from Voermol Feeds, Nutrifeds, Supreme Chickens, Cape Mohair and Wool, the National Lucerne Organisation, Pfizer, Meadow Feeds and the National Wool Growers' Association. Rhine Ruhr (Foss Instruments) also made equipment worth approximately R2 million available for feed analyses at the department. This creates the opportunity for routine feed analyses and the possible generation of income from outside the university.

Activities and achievements

In 2009, 83% of the department's academic staff made scientific contributions locally and abroad. Conferences at which contributions were made include the SA Grassland Society, the SA Wildlife Management Association, the SA Society for Animal Science, the SA Feedlot Association and the European



Prof. Hennie Snyman (right) receiving the National Agriculturist of the Year award.

Society for Animal Production (Spain), as well as Animal Breeding and Genetics (Australia). At the conference of the SA Society for Animal Science, 13,5% of the total contributions came from the department, demonstrating the impact of the department on the entire animal production industry in South Africa. A highlight for the department was the naming of Prof. Hennie Snyman as the South African Agriculturist of the Year – an excellent achievement and advertisement for the department, faculty and university and recognition for his research over the years with regard to sustainable natural resource (pasture) utilisation and rehabilitation.

The department is deeply involved in the industry. Members of the department are formally involved with the following institutions: Breed Plan (Prof. Frikkie Nesor), Voermol Feeds (Prof. Johan Greyling, Mr Foch de Witt), Red Meat Producers Organisation (RPO) (Prof. HO de Waal), National Lucerne Organisation (Prof. Hentie van der Merwe, Dr Gerrie Scholtz), Meadow Feeds (Prof. Hentie van der Merwe), Free State Game Association (Profs. Nico Smit and HO de Waal), SA Society for Animal Science (Prof. Johan Greyling, Dr Luis Schwalbach), Grassland Society of South Africa (Prof. Hennie Snyman), National Wool Growers' Association (Prof. HO de Waal), Southern African Wildlife Management Association (Prof. Nico Smit) and the Industrial Development Cooperation (IDC) (Prof. HO de Waal and Dr Luis Schwalbach)

Partnerships also exist with the Agricultural Research Council (ARC) – Irene, Grootfontein, Western Cape, the Department of Agriculture, Pfizer, Nutrifeds, Supreme Chickens, Ramsem AI Station,

Taurus AI Cooperative, Breed Societies, World Poultry Association, SA Veterinary Association and the Arid Zone Forum. Of the 18 lecturers/researchers in the department, six are NRF-rated scientists. Several members serve on the editorial boards of national and international scientific accredited journals such as *Small Ruminant Research*, *Livestock Science*, *SA Journal of Animal Science*, *SA Journal of Grassland Science* and the *Journal of Arid Environments*.

Research

In the disciplines of **Grassland Science and Wildlife Management**, several focus areas have been addressed. *Seriphium plumosum*, otherwise known as “Slangbos” or “Bankrotbos”, is regarded as a serious threat to sustainable animal production on natural pastures in large areas of South Africa, lowering the productivity with as much as 70%. Through intensive research, Prof. Hennie Snyman unravelled the dynamics of this intruder bush and made various recommendations to solve this problem. This issue was addressed at several farmers’ and information days, as well as in scientific and popular publications.

A study has just been completed in which different techniques of cultivating pastures were evaluated to determine the production potential in a practical and scientific way. Using these techniques, available fodder production for animals can be estimated and used in a fodder-flow programme. Currently Mr Paul Malan, under the guidance of Prof. Hennie Snyman, is undertaking a Ph.D. study to investigate the water use and production potential of Karoo shrubs. Prof. Nico Smit completed a

study evaluating the impact of different management practices on the rangelands in Namibia. The diverse and complex causes of the contrasts and the ecological and socio-economic consequences of different management practices were successfully analysed. Practical recommendations regarding rangeland management practices were made to ensure sustainable livestock production within the resource-limited ecosystems of central Namibia.

In another study, bush encroachment in the Mixed Bushveld of the Limpopo Province is being addressed. Many efforts to restore bush encroachment have failed due to a lack of knowledge regarding a practical, long-term approach to the problem, which in the long run has aggravated the problem. The approach in this study was to restructure the encroached areas through tree-thinning operations to achieve sustainable restoration. The tree-thinning success was measured by evaluating the density of re-encroachment and structure of the woody plants. Furthermore, the recording of the leaf dry-matter production of the woody plants, the phenology patterns of the different tree species, the browsing capacity and various aspects regarding species composition, veld condition and grass-tree interactions were monitored. In the same discipline the effect of long term burning on the edaphic components, grass cover and the structure of the woody plants is being investigated in collaboration with the Nelson Mandela Metropolitan University (NMMU).

In the discipline of **Animal Nutrition**, research trials are currently being conducted by Prof. Hentie van der Merwe

and two M.Sc. students to evaluate the degradable protein requirements of beef cattle that consume winter forage from the false or pure grass veld types. Potato hash silage as an alternative feed resource for livestock production and the evaluation of methionine supplementation in the diets of lactating lambs are also trials being conducted under the supervision of Prof. van der Merwe. The use of different saturated lipid levels in ruminant, broiler and layer diets is a joint research project being undertaken by Prof. Van der Merwe, Mr Foch de Witt and Mr Ockert Einkamerer, together with two Ph.D. and four M.Sc. students. The effect of milling index and the physical form of maize grain on digestibility in sheep is being investigated by Mr Ockert Einkamerer.

The development and maintenance of Near Infrared Spectrophotometer (NIRS) calibrations in the analysis of various feed-stuffs are currently being undertaken by the postdoctoral researcher, Dr Gerrie Scholtz. Further research on lucerne includes the nutritive value (quality) of SA Mediago Sativa hay (lucerne) and its chemical composition. The role of *Opuntia ficus-indica* (cactus pear) as an alternative drought feed supplement and its digestibility and nutritive value in sheep was investigated by Prof. HO de Waal. Cactus pears are very efficient users of water and also effective in terms of valuable renewable plant production, while producing high dry-matter yields per unit area, yielding 25 000 to 30 000 kg fresh fruits/ha. When cladodes are harvested as animal feed, the plants may yield approximately 400 000 kg fresh cladodes/ha. It is customary to feed fresh *Opuntia* cladodes to animals as a



Prof. HO de Waal busy with livestock production training in Hopetown as part of the Nguni project.

supplement, but the high water content of cladodes does, however, pose challenges in terms of the handling, transport, storage and utilisation thereof in balanced animal diets. A research programme was thus launched to evaluate the use of sun-dried *Opuntia* cladodes in balanced sheep diets. The basic characteristics of sun-dried and coarsely ground *Opuntia* cladodes have subsequently been studied by three M.Sc. (Agric) students to establish its potential use as an animal feed.

In a fourth M.Sc. study that was conducted in Namibia, good progress has been made with the process to commercialise *Opuntia* as part of balanced feedlot diets for sheep. This process will now be accelerated for broader application in the arid western parts of Southern Africa. In another study by Prof. HO de Waal, the habits and behaviour of the black-back jackal and caracal were monitored in an effort to combat the big financial losses being incurred by livestock farmers due to the damage being caused by these predators.



Prof. Johan Greyling (second from the left) involved in the judging of the Voermol Cattle Farmer of the Year competition.

In the discipline of **Animal Breeding**, determining breeding value estimations in different breeds and species continued. In addition to this, the advantages of crossbreeding, the effect of inbreeding in the Dormer sheep breed, genotype x environment interactions for calf-growth traits and aspects such as genetic parameters for subjectively assessed wool and conformation traits in the Merino sheep were also investigated. A unique study was undertaken to determine the genetic diversity of native chickens in North-West Ethiopia using micro-satellite markers (Profs. Frikkie Nesar, Japie van Wyk and Mr Mike Fair).



In a Ph.D. study, Mr Mike Fair is currently investigating the genetic and environmental modelling of ostrich females.

In the discipline of **Animal Physiology** several research projects regarding the cryopreservation of buck, ram, boar and even cockerel semen have been supervised by Prof. Johan Greyling and Dr Luis Schwalbach. *In vitro* embryo production techniques in sheep and cattle are also being established by Mr Benedict Raito, junior lecturer in the department, while the effect of exogenous anabolic steroids (testosterone) on the performance of young bucks have also been investigated, with a definite androgenic effect being recorded on testes growth (Mr Thapelo Makae). All factors affecting fertility in farm animals, namely nutritional status, seasonality, age, parity, stage of

lactation, etc., are being investigated by the Animal Physiology discipline.

Community service

Community service was performed by a large academic contingent from the department in the form of lectures as far afield as Namibia, Lesotho, the North-West Province, Mpumalanga, the Northern Cape, the Eastern Cape, KwaZulu-Natal and Limpopo, serving on technical committees of breed societies (Profs. Japie van Wyk and Frikkie Nesor), the training of livestock (Nguni) farmers in the Free State and Northern Cape (Prof. de Waal, Dr Schwalbach and Mr Combrinck) and supporting them with technical advice and assistance. To date the Nguni project under the supervision of Prof. HO de Waal has provided 360

cows and 72 bulls (monetary value of several million rand) to 36 farms (more than 100 individuals) in the Northern Cape, with a further 13 potential farms already identified. The Free State Nguni project, which was initiated much later, currently involves eight farms (80 Nguni cows and ten bulls). Together, these Nguni projects of the University of the Free State, the Department of Agriculture and the Industrial Development Cooperation (IDC) are growing from strength to strength and are empowering selected black livestock farmers.

Cattle and sheep artificial insemination (AI) courses were once again presented to students and farmers in conjunction with the Glen Agricultural Development Institute (Prof. Johan Greyling, Dr Luis Schwalbach and Mr Thapelo Makae).



Similarly, lucerne grading courses and the judging of lucerne quality were undertaken (Prof. Hentie van der Merwe, Dr Gerrie Scholtz). The Animal Breeding team (Profs. Japie van Wyk, Frikkie Nesor and Mr Mike Fair) organised a two day workshop on Random Regression, attended by researchers, Ph.D. students and academics of several universities. Members of the department were also involved in the judging of the black Stud Beef Farmer of the Year, the Commercial Beef Farmer of the Year, the Stud Beef Farmer of the Year (Profs. Frikkie Nesor and Johan Greyling), Sheep Farmer of the Year (Prof. Johan Greyling), the New Harvest project and the National Commercial Black Farmer of the Year competition (Prof. Hentie van der Merwe). An extensive Wetlands Restoration Project in Lesotho involving the Centre for Environmental Management, Plant and Soil Sciences and Grassland Science (Prof. Nico Smit and Mr Gideon Janse van Rensburg) is currently being conducted to help Lesotho address the problem of overgrazing and degradation of the wetlands.

The Department of Animal, Wildlife and Grassland Sciences with its wide spectrum of research programmes is the largest animal production department at any university in South Africa – accommodating several postgraduate students of various countries in Africa (e.g. Botswana, Lesotho, Ethiopia, Namibia, Nigeria, Mozambique, Swaziland and the Congo). These students are ultimately seen as the department's products and the quality of the students being produced by the department is widely recognised and appreciated.

Research outputs

Research articles

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Professors Extraordinary: Profs. Amie Aucamp, Gert Erasmus, James Hayes, Michiel Scholtz

Associate Professor: Prof. HO de Waal

Senior Lecturers: Dr Luis Schwalbach, Mr Wikus Vorster (contract)

Lecturers: Messrs Foch de Witt, Mike Fair, Paul Malan, Ockert Einkamerer

Junior Lecturers: Messrs Thapelo Makae, Benedict Raito

Researcher: Dr Gerrie Scholtz



03 Plant Sciences

Overview

The **Botany** division within the Department of Plant Sciences had a very productive year.

Prof. Johan Grobbelaar was invited by Arizona Public Services to partake in a workshop on the growth and use of algae for bio-energy production. This forms part of a R600 million United States of America (USA) Department of Energy project. He is also involved with Xtrata at their Boshhoek smelter on the use of algae for CO₂ sequestration as well as with Net Energy based at Witbank. He was invited by the journal *Photosynthesis Research* to write a review article on the *Potential and constraints of microalgal photosynthesis*

and served his tenth year on the editorial panel of the *Journal of Applied Phychology*.

As part of the SA/Germany Science, Research and Technology Cooperation agreement, Mr Hendri Pretorius paid a research visit to the Department of Plant Biochemistry and Technology, Münster University (WWU), Germany under the mentorship of Prof. Bruno Moerschbacher from 15 November 2009 to 28 February 2010. The purpose of the visit was to study the role of various oxygenated lipids in the defence reactions of plants against various pathogens.

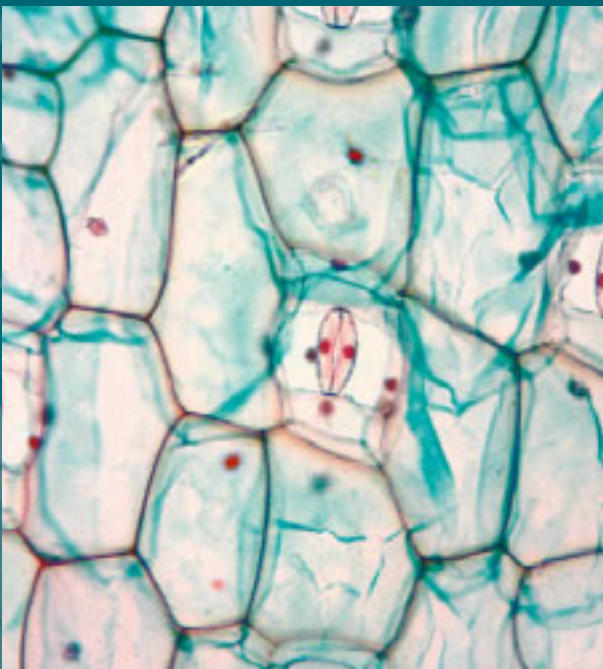


“Students and staff participated in local and international congresses/workshops.”

– Prof. Sakkie Pretorius



Prof. Renée Prins, Sakkie Pretorius, Ms Cornel Bender and Ms Gloudi Agenbag (PhD student) during a visit to Greytown, KwaZulu-Natal.



Prof. Amie van der Westhuizen also visited the same institution on two occasions. During his first visit from 18 to 28 November 2009 he presented a poster at the “Deutsche Phytomedizinische Gesellschaft – Arbeitskreise Mykologie und Wirt-Parasit-Beziehungen” Workshop, Kaiserslautern. He also visited Prof. Jutta-Ludwig Müller of the “Lehrstuhl für Pflanzenphysiologie, Technische Universität Dresden”, Germany and editor-in-chief of the *Journal of Plant Growth Regulation* and Dr Michael Walter of the “Leibniz-Institut für Pflanzenbiochemie” Halle (Saale), Germany.

Prof. Dieter von Willert, a renowned plant ecophysiological, former professor of the Botany Department, University of Münster, Germany visited the department from 13 to 15 October 2009 and delivered an inspiring lecture on *Thirty years of ecophysiological field research in Southern Africa - from CAM to Devil's Claw*.

Dr Lintle Mohase obtained a MA (higher education) in April 2009 with a mini-dissertation entitled *Quality assurance in postgraduate studies: Student-related factors influencing completion rates*. She also participated as a panellist in the academic dialogue “Is overpopulation deterring development”, organised by the Research Directorate of the University of the Free State (UFS) in November 2009. Her input was from a natural scientist/crop production/botany perspective. The audience was a mix of academics, students and guests from the Department of Social Development.



From the left are: Profs. Sakkie Pretorius, Renée Prins and Dr Cobus le Roux (ARC) during a visit to CIMMYT in Obregon, Mexico.

Dr Botma Visser attended a Wheat Rust Control workshop at the UFS where he presented a lecture on *Genetic comparison of Ug99 with selected South African races of Puccinia graminis f.sp. tritici*. He was also invited to present the guest lecture at the Annual Postgraduate Symposium of the Department of Botany and Plant Biotechnology, University of Johannesburg with the title “Research at South African Universities: adapt or die?”

Mss Lize Joubert and Magdil Pienaar attended a workshop at Kirstenbosch presented by the South African National Biodiversity Institute (SANBI), in collaboration with Oxford University in the United Kingdom (UK). The workshop provided basic training in the use of the herbarium management and database software, BRAHMS. This software is currently being implemented in plant taxonomic research at SANBI and will in future be used for taxonomic research at the UFS. Mss Joubert and Pienaar also attended an introductory phylogenetics workshop hosted by the Forestry and Agricultural Biotechnology Institute (FABI). The workshop dealt with basic principles and procedures for phylogenetic analysis of molecular data. Training in the basic software was also provided. Skills developed during the course will be used to establish and develop molecular phylogenetic training and research in our department.



During a visit to the International Livestock Research Institute (ILRI) in Nairobi, Kenya to attend a short statistical course on the analysis of diallel plant breeding data and to discuss the results obtained by a Ph.D. student. From the left are: Dr Hernan Ceballos (course presenter of CIAT in Cali, Colombia), Mr Heneriko Kulembeka (Ph.D. student, Plant Breeding), Prof. Liezel Herselman (study leader) and Dr Morag Ferguson (co-study leader, ICRISAT-Nairobi).

Mr Herman Fourie, B.Sc. Honours student of Prof. PJ du Preez, received the award for the best B.Sc. Honours presentation at the Annual Postgraduate Symposium of the Department of Botany and Plant Biotechnology, University of Johannesburg.

Prof. Maryke Labuschagne did an oral presentation and Dr Angie van Biljon a poster presentation at the Xth International Gluten Workshop held in September 2009 in Clermont Ferrand, France. Prof. Labuschagne was re-elected as South Africa's representative at the American Association of Cereal Chemists International. She also presented a three-day training course in plant-breeding programme management and statistical analysis at Instituto De Investigação Agrária De Moçambique (IIAM) in Mozambique for 13 researchers from across the country.

Prof. Liezel Herselman did a week-long training course in diallel analysis at International Institute for Tropical Agriculture (IITA) in Nairobi, Kenya. Prof. Labuschagne visited International Maize and Wheat Improvement Center (Centro Internacional de Mejoramiento de Maíz y Trigo) (CIMMYT) (Harare and Kenya) as well as IITA and the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) (Nairobi, Kenya) for research planning and student follow-up. She attended a meeting of the Generation Challenge Programme of the Gates Foundation in Malawi in April 2009, and from this meeting two Ph.D. students were admitted to Plant Breeding, sponsored by the Gates Foundation.

Prof. Wijnand Swart, Chairperson of the Centre for Plant Health Management (CePHMa) in the Department of Plant Sciences, visited the Cornell International Institute for Food, Agriculture and Development (CIIFAD) in the United States of America (USA) during April 2009. He was part of a delegation from the UFS that discussed potential institutional cooperation with Cornell

University. The topic of Prof. Swart's paper was *Soil quality: A South African perspective*. A delegation from the Autonomous University of Chapingo (UACH) in Texcoco, Mexico visited CePHMa to hold exploratory discussions with various scientists. The visit builds on an institutional agreement that was signed between CePHMa and

the University of Chapingo in 2006. The Mexican delegation was hosted by Prof. Swart, Cluster Director: Technologies for Sustainable Crop Industries in Semi-arid regions. Discussions focused mainly on opportunities for collaborative research and student exchange between the aforementioned institutions and the University of Chapingo. Prof. Swart



MSc student, Ruth Musane, in the field sampling mango leaf material.

attended the First International Cornell Soil Health Train-the Trainer Workshop at Cornell University in the USA from 10 to 14 August 2009.

Prof. Sakkie Pretorius continued his research on wheat rusts which included an invitation to the Borlaug Global Rust Initiative Technical Workshop in Obregon, Mexico and visits to Zambia, Kenya and China regarding stem rust surveillance, disease scoring/training and stripe rust resistance breeding,

respectively. In August 2009, Prof. Pretorius and Ms Corniel Bender presented a three-week training course in cereal rust pathology to four scientists from Kenya and Ethiopia. Assisted by Ms Bender, Prof. Renée Prins (affiliated staff member) and Gloudi Agenbag (Ph. D. student), Prof. Pretorius successfully carried out several field experiments in 2009. These included phenotyping of two segregating populations for mapping durable resistance to stripe rust in wheat, screening of cultivar resistance

to three rust pathogens and evaluation of international germplasm collections. Furthermore, Prof. Pretorius and Dr Prins hosted a productive wheat rust workshop at the UFS with the primary objective of coordinating and improving research collaboration in this field locally. The workshop was attended by all role players in wheat breeding in South Africa. Funding for the cereal rust programme was obtained from the Winter Cereal Trust, National Research Foundation (NRF), Cornell



Prof. Sakkie Pretorius (far right) during a visit to China for the International Stripe Rust Workshop.

University and Biotechnology and Biological Sciences Research Council (BBSRC) / Department for International Development.

Prof. McLaren renewed a number of projects with the Protein Research Foundation and Sorghum Trust related to soybean rust and *Sclerotinia* stem rust epidemiology and management of sorghum diseases and grain moulds. Funding from INTSORMIL for collaboration in the Southern African Regional Programme was also renewed. Dr John Leslie, INTSORMIL Principal Investigator (Kansas State University, USA) and Dr Gary Peterson, Southern Africa Regional Coordinator (Texas A&M University, USA), visited Prof. McLaren to discuss the progress and extension of the local programme, including the renewal of a Ph.D. study subsequent to the graduation of Dr Leo Mpfu in September 2009 whose studies were supported by INTSORMIL. They were accompanied by Dr Medson Chisi, a sorghum breeder from Zambia. Prof. McLaren also served as a member of the Protein Research Foundations Soybean Working Group, Soybean Rust Task Team, and Sclerotinia Working Group and the Sorghum Trust Research Evaluation Group and Sorghum Forum.

Students and staff participated in local and international congresses/workshops. The Christiaan Hendrik Persoon Medal, an award by The Southern African Society for Outstanding Achievement in Plant Pathology was awarded to Prof. Pretorius at the South African Society of Plant Pathologists (SASPP) congress in January 2010. Prof. Neal McLaren received the Applied Plant Pathology Award.



Scott Sydenham, Plant Breeding Ph.D. student in molecular plant breeding lab.

Staff matters

The year also saw a number of staff changes. Prof. Verhoeven and Dr Venter retired, while Ms Kriel resigned. Prof. Swart was appointed as the Strategic Academic Cluster Director: Technologies for sustainable crop industries in semi-arid regions.

Research outputs

Research articles

- Botha, C., McLaren, N.W. & Swart, W.J.** 2009. Evaluation of greenhouse inoculation techniques used to screen for *Sclerotinia* stem rot resistance in soybeans. *South African Journal of Plant and Soil* 26(1): 48-50.
- Brand, R.F., Du Preez, P.J. & Brown, L.R.** 2009. A classification and description of the shrubland vegetation on Platberg, Eastern Free State, South Africa. *Koedoe* 51(1): 90-100.
- Chase, B.M., Meadows, M.E., Scott, L., Thomas, D.S.G., Marais, E., Sealy, J. & Reimer, P.J.** 2009. A record of rapid Holocene climate change preserved in hyrax middens from southwestern Africa. *Geology* 37(8): 703-706.
- Coetzee, R., Herselman, L. & Labuschagne, M.T.** 2009. Genetic diversity analysis of kanaf (*Hibiscus cannabinus* L.) using AFLP (amplified fragment length polymorphism) markers. *Plant Genetic Resources: Characterization and Utilization* 7(2): 122-126.
- Dessalegn, Y., Herselman, L. & Labuschagne, M.** 2009. Comparison of SSR and AFLP analysis for genetic diversity assessment of Ethiopian arabica coffee genotypes. *South African Journal of Plant and Soil* 26(2): 119-125.
- Grobbelaar J.U. & Smith, V.R.** 2009. Chemical and biological properties of glacial lakes on sub-Antarctic Marion Island: Comparing data spanning 35 years. *Verhandlungen Internationale Vereinigung für Theoretische und Angewandte Limnologie* 30: 1124-1126.
- Grobbelaar, J.U.** 2009. Factors governing algal growth in photobio-reactors: The "open" versus "closed" debate. *Journal of Applied Phycology* 21: 489-492.
- Grobbelaar, J.U.** 2009. From laboratory to commercial production: A case study of a *Spirulina* (*Arthrospira*) facility in Musina, South Africa. *Journal of Applied Phycology* 21: 523-527.
- Grobbelaar, J.U.** 2009. Upper limits of photosynthetic productivity and problems of scaling. *Journal of Applied Phycology* 21: 519-522.
- Jin, Y., Szabo, L.J., Rouse, M.N., Fetch, T., Pretorius, Z.A., Wanyera, R. & Njau, P.** 2009. Detection of virulence to resistance gene *Sr36* within the TTKS race lineage of *Puccinia graminis* f.sp. *tritici*. *Plant Disease* 93(4): 367-370.
- Kawuki, R.S., Ferguson, M., Labuschagne, M.T., Herselman, L. & Kim, D.-J.** 2009. Identification, characterisation and application of single nucleotide polymorphisms for diversity assessment in cassava (*Manihot esculenta* Crantz). *Molecular Breeding* 23: 669-684.
- Kena, M. & Swart, W.J.** 2009. Microbial activity and fungal composition of composted animal manure suppressive to soil-borne pathogens. *Lesotho Journal of Agricultural Sciences* 2:1-19.
- Labuschagne, M.T., Elago, O. & Koen, E.** 2009. Influence of extreme temperatures during grain filling on protein fractions, and its relationship to some quality characteristics in bread, biscuit, and durum wheat. *Cereal Chemistry* 86(1): 61-66.
- Labuschagne, M.T., Elago, O. & Koen, E.** 2009. The influence of temperature extremes on some quality and starch characteristics in bread, biscuit and durum wheat. *Journal of Cereal Science* 49: 184-189.
- Liu, Y. & Labuschagne, M.T.** 2009. The influence of environment and season on stalk yield in kenaf. *Industrial crops and products* 29: 377-380.
- Marais, F., Marais, A., McCallum, B. & Pretorius, Z.** 2009. Transfer of lead rust and stripe rust resistance genes *Lr62* and *Yr42* from *Aegilops neglecta* Req. ex Bertol. to common wheat. *Crop Science* 49: 871-879.
- Neumann, F.H., Kagan, E.J., Stein, M. & Agnon, A.** 2009. Assessment of the effect of earthquake activity on regional vegetation – High-resolution pollen study of the Ein Freshka section, Holocene Dead Sea. *Review of Palaeobotany and Palynology* 155: 42-51.
- Norström, E., Scott, L., Partridge, T.C., Risberg, J. & Holmgren, K.** 2009. Reconstruction of environmental and climate changes at Braamhoek wetland, eastern escarpment South Africa, during the last 16,000 years with emphasis on the Pleistocene-Holocene transition. *Palaeogeography, Paleoclimatology, Palaeoecology* 271: 240-258.
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- Rossouw, L., Stynder, D.D. & Haarhof, P.** 2009. Evidence for opal phytolith preservation in the Langebaanweg 'E' Quarry Varswater formation and its potential for palaeo-habitat reconstruction. *South African Journal of Science* 105: 223-227.
- Solomon, K.F. & Labuschagne, M.T.** 2009. Morpho-physiological response of durum wheat genotypes to drought stress. *South African Journal of Plant and Soil* 26(3): 141-156.
- Swart, W.J.** 2009. Strategies for the management of cactus pear diseases: A global perspective. *Acta Horticulturae* (ISHS) 811: 207-216.

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Grobbelaar, J.U. 2009. Turbidity. In: *Encyclopaedia of Inland Freshwaters* edited by G.E. Likens. Oxford: Elsevier Ltd. pp. 699-704.

Rossouw, J.D., Pretorius, Z.A., Silva, H.D. & Lamkey, K. 2009. Breeding for resistance to *Stenocarpella* ear rot in maize. In *Plant Breeding Reviews Vol 31* edited by J. Janik. Chicago: Wiley-Blackwell. pp. 223-245.

Conference contributions

Agenbag, G.M., Boyd, L., Pretorius, Z.A. & Prins, R. 2009. *Fine mapping of durable resistance to stripe rust in the South African wheat cultivar, Kariiega, using an expressed sequence tag (EST) marker strategy.* Paper presented at the 46th Congress

of the Southern African Society for Plant Pathology (SASPP) and the 6th Congress of the African Mycological Association (AMA), Villa Via Hotel, Gordon's Bay, South Africa. 25-28 January.

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Botha, C., McLaren, N.W. & Swart, W.J. 2009. *Epidemiology of Sclerotinia stem rot in South Africa.* Paper presented at the 46th Congress of the Southern African Society for Plant Pathology (SASPP) and the 6th Congress of the African Mycological Association (AMA), Villa Via Hotel, Gordon's Bay, South Africa. 25-28 January.

Botha, C.F., Du Preez, P.J. & Scholtz, N. 2009. *Phyto-indicator species on uranium-ore bodies in the "Karoo Uranium Province", Beaufort-West district, South Africa.* Poster presented at the Uranium Mini-conference of the Geological Society of Namibia, Ministry of Fisheries and Marine Resources Aquarium Auditorium, Swakopmund, Namibia. 22-23 October.

Collins, N.B., Du Preez, P.J., Mucina, L. & Le Roux, P.A.L. 2009. *Classification of the valley bottom and depression wetlands of the Free State Province at the plant community level.* Paper presented at the 2009 South African Wetlands Indaba of the Western Cape Wetlands Forum, Club Mykonos, Langebaan, South Africa. 28-30 October.

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temperatures in Southern Africa. Paper presented at the Southern African Society for Quaternary Research (SASQUA) 2009 Congress: Understanding Quaternary Change – Southern Hemisphere Perspectives, Phantom View River Resort and Conference Venue, Knysna, South Africa. 6-10 September.

Du Preez, P.J. 2009. *Macrophyte diversity in unique rock pool systems on inselbergs in the Eastern Free State.* Paper presented at the 2009 South African Wetlands Indaba of the Western Cape Wetlands Forum, Club Mykonos, Langebaan, South Africa. 28-30 October.

Du Preez, P.J. 2009. *Identification of riparian vegetation drivers.* Paper presented at the Workshop on 'Environmental Water Requirements in Non-perennial Systems, Phase 3, Mokololo, Swart-Doorn and Touws Rivers', Centre for Environmental Management, University of the Free State, Bloemfontein, South Africa. 13 November.

Du Preez, P.J. & Fourie, H. 2009. *Floristic classification of Florisbad wetland, Free State Province.* Poster presented at the 2009 South African Wetlands Indaba of the Western Cape Wetlands Forum, Club Mykonos, Langebaan, South Africa. 28-30 October.

Fernández-Jalvo, Y., Scott, L., Carrión, J.S., Gil-Romera, G., Brink, J.S., Neumann, F. & Rossouw, L. 2009. *Pollen Taphonomy of hyaena coprolites: An experimental approach.* Paper presented at the Scientific Meeting on Hyena Dens (and other carnivores) in Archaeological Sites of the Iberian Peninsula (Reunión de científicos sobre cubiles de hyena (y otros grandes carnívoros) en los yacimientos arqueológicos de la Península Ibérica), Museo Arqueológico Regional de la Comunidad de Madrid, Spain. 21-23 January.

Fetch, T., Jin, Y., Park, R.F. & Pretorius, Z.A. 2009. *Race*

nomenclature systems: Can we all speak the same language? Invited paper presented at the 8th International Wheat Conference and the Borlaug Global Rust Initiative (BGRI) 2009 Technical Workshop, Ciudad Obregon, Mexico. 17-20 March.

Grobbelaar, J.U. 2009. *Open pond systems for algal biotechnology.* Paper presented at the Workshop on Biofuels from Algae, Phoenix, Arizona, USA. 15-17 August.

Grobbelaar, J.U. 2009. *Toxin production by Microcystis: What is new?* Paper presented at the Southern African Society of Aquatic Scientists (SASAqS) 2009 Magaliesberg Congress: Beyond Rapid Assessments – Time for an Aquatic Research Renaissance in South Africa, Magaliesberg Conference Centre, Broederstroom, South Africa. 21-24 June.

Grobbelaar, J.U. & Smith, V.R. 2009. *Influence of climate change on the freshwaters of Marion Island.* Paper presented at the Southern African Society of Aquatic Scientists (SASAqS) 2009 Magaliesberg Congress: Beyond Rapid Assessments – Time for an Aquatic Research Renaissance in South Africa, Magaliesberg Conference Centre, Broederstroom, South Africa. 21-24 June.

Joubert, L. & Verhoeven, R.L. 2009. *Leaf micromorphology and anatomy of Cryptolepis (Apocynaceae, Periplocoideae) in southern Africa.* Paper presented at the 35th Annual Conference of the South African Association of Botanists (SAAB) and the International Workshop on Phosphate as a Limiting Resource: From molecules to mountains – Spanning the organizational hierarchy, Stellenbosch University, Stellenbosch, South Africa. 19-22 January.

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Mutegi, E., Sagnard, F., Labuschagne, M.T. & Herselman, L. 2009. *Crop-to-wild gene flow: Environmental risk assessment and implications for the release of GM sorghum in Kenya.* Poster presented at the Biosciences eastern and central Africa (BeCA), the International Livestock Research Institute (ILRI) and the Syngenta Foundation for Sustainable Agriculture Partnership Conference: From technology to product development for the African farmer, BeCA-ILRI Hub, Nairobi, Kenya. 29 April.

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Neumann, F., Scott, L., Stager, C. & Smith, M. 2009. *Holocene vegetation history at Lake Sibaya and Lake Teza.* Paper presented at the 5th European Geosciences Union (EGU) Alexander von Humboldt International

Conference: Iphakade: Climate Changes and African Earth Systems – past, present and future, University of Cape Town, Cape Town, South Africa. 12-16 January.

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Park, R.F., Fetch, T., Jin, Y., Prashar, M. & Pretorius, Z.A. 2009. *Using race survey outputs to protect wheat from rust.* Invited paper presented at the 8th International Wheat Conference and the Borlaug Global Rust Initiative (BGRI) 2009 Technical Workshop, Ciudad Obregon, Mexico. 17-20 March.

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Pretorius, Z.A. 2009. *Stripe rust resistance breeding and research in South Africa.* Invited paper presented at the International Stripe Rust Workshop, Yangling, Shaanxi, China. 24-27 November.

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analysis: An efficient tool for unravelling complex disease resistance in plants. Paper presented at the 46th Congress of the Southern African Society for Plant Pathology (SASPP) and the 6th Congress of the African Mycological Association (AMA), Villa Via Hotel, Gordon's Bay, South Africa. 25-28 January.

Scott, L. 2009. *Palynological indications of environmental change in Southern Africa during the late Tertiary and Quaternary.* Paper presented at the ROCEEH Workshop (The Role of Culture in Early Expansions of Humans: Interaction Between Environment and Human Expansions, Iziko South African Museum, Cape Town, South Africa. 23-24 February.

Scott, L. 2009. *Plant microfossil research (palynology) at the University of the Free State.* Paper presented at a Palaeontology Consultation Session with the Department of Science and Technology, Emperor's Palace, Johannesburg, South Africa. 9 October.

Scott, L. & Rossouw, L. 2009. *Plant microfossil research in Southern Africa.* Paper presented at the 1st Annual Workshop in Connection with Research Collaboration Between the University of the Free State and the National Museum, Oliewenhuis, Bloemfontein, South Africa. 7 August.

Scott, L., Brook, G.A. & Rossouw, L. 2009. *Wonderwerk Cave palynology.* Paper presented at the Wonderwerk Cave Workshop, Kuruman, South Africa. 20-21 June.

Scott, L., Brook, G.A., Gil-Romera, G., Rossouw, L., Norström, E. & Marais, E. 2009. *Some long pollen sequences from South Africa.* Paper presented at the Southern African Society for Quaternary Research (SASQUA) 2009 Congress: Understanding Quaternary Change – Southern Hemisphere Perspectives, Phantom View River Resort and Conference Venue, Knysna, South Africa. 6-10 September.

Swart, W.J. 2009. *Soil quality: A South African perspective*. Invited paper presented at the Cornell International Institute for Food, Agriculture and Development (CIIFAD) Forum, Ithaca, New York, USA. 6 April.

Swart, W.J. 2009. *Soil quality: A South African perspective*. Paper presented at the International Soil Health Workshop hosted by University of the Free State Strategic Research Cluster 4: Technologies for Sustainable Crop Industries in Semi-arid Regions, University of the Free State, Bloemfontein, South Africa. 30 September-2 October.

Sydenham, S.L., Herselman, L., Prins, R. & Pretorius, Z.A. 2009. *Pyramiding leaf, stem and stripe rust resistance genes/QTL into a single wheat genotype*. Paper presented at the 46th Congress of the Southern African Society for Plant Pathology (SASPP) and the 6th Congress of the African Mycological Association (AMA), Villa Via Hotel, Gordon's Bay, South Africa. 25-28 January.

Terblanche, J.D., Swart, W.J. & Thompson, G.J. 2009. *Evaluation*

of crops for rhizosphere suppression of Ralstonia solanacearum. Paper presented at the 46th Congress of the Southern African Society for Plant Pathology (SASPP) and the 6th Congress of the African Mycological Association (AMA), Villa Via Hotel, Gordon's Bay, South Africa. 25-28 January.

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Van Biljon, A. & Labuschagne, M.T. 2009. *Relationship between high- and low molecular weight glutenin subunits and quality in a doubled haploid population of bread wheat*. Poster presented at the Xth International Gluten Conference, Diocesan Center, Clermont-Ferrand, France. 7-9 September.

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Associate Professors: Profs. Johann du Preez, Liezel Herselman

Affiliated Associate Professors: Profs. Koos van Rensburg (ARC-GCI), Renée Prins (Cen Gen)

Lecturers: Drs Lintle Mohase, Gerhard Potgieter, Angie van Biljon, Andor Venter, Botma Visser, Mss Lize Joubert, Wilmarie Kriel, Adrie Minnaar-Ontong

Professional and technical staff: Mss Cornel Bender, Magdil Pienaar, Roelien van der Merwe, Mr Hendri Pretorius

Research fellow: Prof. Johan Venter

Administrative and Support Staff:

Mss Sadie Geldenhuys, Nelmarie Janse van Rensburg, Erna van Deventer, Zeldá van der Linde, Hilda Dlamini Lillian Molosi, Messrs Gerald Moshodi, Dirk Jansen, Petrus Foko, Simon Phenetti

Qwaqwa Campus:

Lecturers: Dr Erwin Sieben, Mr Robert Lentsoane, Ms Joyce Moloji

Junior Lecturer: Mr Raymond Pitso

Research Fellow: Prof. Rodney Moffett

Assistants: Messrs Pheelo Mojau, Ngaka Mzizi



04 Soil, Crop and Climate Sciences

Overview

The Department of Soil, Crop and Climate Sciences specialises in the disciplines of Agrometeorology, Agronomy, Horticulture and Soil Science, contributing to the agricultural programme of the Faculty of Natural and Agricultural Sciences. In addition to undergraduate and postgraduate teaching in the four disciplines, the department also contributes to teaching at the Centres for Sustainable Agriculture and Rural Development, Environmental Management, Disaster Management and the Department of Quantity Surveying and Construction Management at the University of the Free State (UFS).

Over the past few years the department has shown growth not only in the number of undergraduate students but also in the number of postgraduate students. In 2009, 20 master's and 15 doctoral students were enrolled. Approximately 40% of these students come from Botswana, Eritrea, Ethiopia, Germany, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Swaziland, the United States, Zambia and Zimbabwe. Six master's and five doctoral students graduated.

During 2009 the department improved its infrastructure for teaching and research. Approximately R1 million was



“Research projects undertaken by honours students provided interesting results and further research on these aspects will be undertaken.”

- Prof. Chris du Preez

Left: Pearl millet ready for harvest in the field experiment at the Kenilworth experimental station.

Middle: Micro-meteorological instruments in a maize field with in-field rainwater harvesting treatments at the Kenilworth experimental station.

Right: Measurement of leaf water potential in a millet-field experiment by Cinisani Tfwala, a master's student.



*Amaranthus stress
experiment at the Kenilworth
experimental station.*



spent on the upgrading of laboratories and equipment worth R1,6 million was bought.

Activities and achievements

Research in the department is aimed at various aspects of the soil-crop-atmosphere system. Approximately R3 million was spent on research in 2009, of which only 10% came from the Central Research Fund of the UFS. The rest of the funding came from institutions such as the National Research Foundation (NRF), Water Research Commission (WRC), Protein Research Trust (PRT), British Royal Society, Monsanto, McCain Foods SA (Pty) Ltd., Omnia Fertilizer Ltd., Syngenta and Agrarforum. Research findings were published in research articles and presented at conferences. These are outlined in the research outputs section later on.

Agrometeorology has enjoyed great successes during the year. Apart from an increase in the number of final-year students and the initiation of an exciting new project, Mr Stephan Steyn obtained his master's degree.

The new project is funded from the joint research grant under the NRF/JSPS (South Africa/Japan) Scientific Cooperation Agreement. The project is undertaken in cooperation with Dr Mitsuru Tsubo of the Arid Land Research Centre at Tottori University in Japan and will address an integrated drought



Millet water stress experiment at the Kenilworth experimental station.

early warning system for dry grasslands in South Africa. Two staff members, Mr Stephan Steyn and Prof. Sue Walker, accompanied by Mr Terry Newby and Mrs Christien Engelbrecht of the Institute of Soil, Climate and Water of the Agricultural Research Council (ARC), attended the launch workshop for the project in Tottori, Japan. They also used the opportunity to establish a network of contacts for future projects. An exchange programme was also initiated during this visit which will involve a doctoral and postdoctoral student of the UFS each receiving a grant/fellowship

for a three-month study period from January to March 2010.

Furthermore, Agrometeorology continues to work with the University of KwaZulu-Natal (UKZN) on two WRC projects, namely *Applications of rainfall forecasts for agriculturally related decision making in selected catchments* together with the Department of Bio-resources, Engineering and Environmental Hydrology, as well as *Water use of drought tolerant food crops* in co-operation with the Department of Crop Sciences. The latter project held a symposium on *Underutilized indigenous and*

traditional crops: agronomy and water use in Stellenbosch in January 2009, at which UFS researchers presented two papers. The field project on pearl millet and amaranthus at Kenilworth experimental site is progressing well and provides an opportunity for two postgraduate students working on an irrigation experiment to compare crop production under different amounts of irrigation in order to investigate the crop physiological response to water stress.

Prof. Sue Walker was an invited speaker for the Beyond the Box panel at the South African Society of Atmospheric

Sciences (SASAS) conference held in September 2009. She presented an entertaining presentation entitled *Friend or foe of the environment*, providing a challenge to all, whether visionaries or activists or scientists or entrepreneurs, to harness the environmental resources for a better destiny for all. Since this is an important conference for atmospheric scientists in South Africa to showcase their work, a total of six other papers and posters were also presented by UFS Agrometeorology postgraduate students and researchers.

As climate change and variability increasingly come into the public focus, there have been many opportunities to investigate and discuss the impacts of this on agriculture. One of the third-year Agrometeorology undergraduate classes was changed to focus on climate change and variability and its impact on and implications for agriculture. The hope is that this will develop into a class that attracts students from across the whole faculty. The IRDC capacity-building project on climate change and variability in Zimbabwe and Zambia continued. The doctoral students made good progress with their field projects and on-farm trials, as well as crop-climate modelling and dissemination of Agrometeorology services to smallholding farmers. They also used crop models in community meetings to show the advantage of a range of alternative cropping practices under different rainfall regimes.

Prof. Walker presented a paper on the *Mujika Community climate cropping systems modelling exercise* at the AgSAP Integrated Assessment of Agriculture and Sustainable Development Conference held in The Netherlands

in March 2009. She also presented a paper on *Agricultural interventions for adaptations to climate change* at the Advanced International Training Programme on Climate Change – Mitigation and Adaptation that was funded by the Swedish Meteorological and Hydrological Institute and the Swedish International Development Cooperation Agency (SIDA). This training programme was held in Namibia during May 2009.

Prof. Walker attended the International Commission on Irrigation and Drainage (ICID) conference in New Delhi, India as a member of the working group on Global Climate Change and Agricultural Water Management (WG-CLIMATE) and representative of South Africa. There was also a visit to the Wageningen University and Research Centre in The Netherlands to renew contacts with others working in similar fields to Agrometeorology. A return visit was also undertaken to the University of Nottingham in the United Kingdom to continue the discussion and lay the groundwork for the undergraduate student exchange programme to be implemented during 2010.

Mr Stephan Steyn also travelled to St Petersburg in Russia to participate in the CALmet VIII Conference on meteorological education during June/July 2009, where he presented a paper on Agrometeorology classes at the UFS entitled *Accommodating various learning styles in a synoptic Meteorology module*. Valuable contacts were made with other lecturers and trainers in meteorology across the world. Following this visit, the department has implemented blended learning in the form of online COMET modules into various undergraduate Agrometeorology classes at the UFS.

Agrometeorology was the host to two NRF-DST (Department of Science and Technology) interns who had both studied Hydrology and Water Resources at the University of Venda (UniVen). They have gained valuable experience in conducting field experiments and each presented part of their UniVen projects at the Hydrological Congress in Pietermaritzburg. The department also hosted a START postdoctoral fellow, Dr Sithabiso Gandure, who is funded by the African Climate Change Fellowship Programme. He is working on the community perceptions and opinions concerning climate change in the area of Thaba Nchu.

Postgraduate students and researchers also participated and delivered papers in several other national conferences including the Orange River Symposium, ARC-Response Farming Workshop and the annual combined congress of the South African Society of Crop Production (SASCP), the Soil Science Society of South Africa (SSSSA), the Weed Science Society of South Africa (WSSSA) and the Southern African Society for Horticultural Sciences (SASHS). Mr Nape, an honours student, presented a paper on *The proposed use of seasonal forecasts to improve maize production in the Free State* at the 11th SAGA Biennial Technical Meeting and Exhibition in Swaziland in September 2009. This was part of the Inkaba ye Africa joint project with Germany, which has since developed into a new project called GESAMT. During May 2009, a planning workshop was held at Gobabeb Desert Research Station in Henties Bay, Namibia. This was attended by Profs. Sue Walker and Cornie van



Huyssteen with the objective to plan for further projects for the phase concerned with the “skin of Africa” that includes both the soil and the atmosphere.

Mr Stephan Steyn was awarded a prize for his paper presented at the Student Symposium of the South African Academy for Science and Art in Bloemfontein in October 2009, entitled *Afskaling van globale sirkulasie modelvoorspellings na daaglikse reënval in die Bo-Olifantsrivier opvanggebied*.

Students and staff of Agronomy and Horticulture presented their research findings at a number of conferences and symposia throughout the year, including the combined congress of the SASCP, SSSSA, WSSSA and SASHS. Dr Elmarie van der Watt received the SASCP Daan Retief Trophy for an exceptional paper by a younger member of the society at the combined congress for her paper entitled *Yield increases in rain-fed maize in light of increasing input costs*. The co-authors of this paper were Prof. Seef Pretorius and Mr Riaan Buitendag. Dr Marieta Cawood was awarded the prize for best poster at the South African Association of Botanists conference held in Stellenbosch. Her poster was titled *Induction of defence responses and resistance to wheat leaf rust by plant extracts*. The co-authors of this study were Profs. Pretorius and Amie van der Westhuizen from the Department of Plant Sciences.

Research on the chloracetanilide herbicides is continuing, concentrating on factors that can cause herbicides to damage crops on which they are registered. Work on cultivar differences with respect to acetochlor damage on maize

Pearl millet at harvest stage during the field experiment at the Kenilworth experimental station.

has led to a contract from Monsanto to conduct a more in-depth investigation. The investigation into the allelopathic effect of *Amaranthus cruentus* on a number of vegetable and field crops provided some interesting results, proving the presence of allelopathic compound. This work is continuing with more detailed investigations. The work on the effect of the microencapsulated formulation of alachlor on sunflowers has prompted a great deal of interest and has opened a number of interesting research directions.

Some of the research projects undertaken by honours students provided interesting results and further research on these aspects will be undertaken. The effect of planting depth on maize sensitivity to acetochlor and the effect of soil temperature on germination and emergence of sunflower in particular will be investigated in greater depth.

Dr Ceronio visited the University of Minnesota in the United States of America as part of the UFS delegation to open discussions on possible academic and research collaboration. Prof. Seef Pretorius was invited by Plum Agrochemical Consulting and Service (Pty) Ltd. as guest speaker during their annual pesticide trade fair in Jinan City, Shandong Province, China. The title of his keynote lecture was *Action mechanisms in crops towards inducing resistance against abiotic and biotic stress conditions in crops*. The same paper was read at the Northwest A & F University, Yangling, China. He also received an extended invitation by the Qingdao Agricultural University, College of Agronomy and Plant Protection, Chengyang Province, China to address

postgraduate students on natural product research during December 2009.

Prof. Pretorius also addressed the American Seed Trade Association regarding the potential to treat seeds of different crops with compounds isolated from wild plants with the aim of increasing both seed and seedling vigour in Chicago, United States of America.

Dr Ceronio conducted a training session on frost damage of wheat for a crop insurance company. This resulted from field claims and uncertainty amongst assessors on the specific symptoms found. From these sessions it was evident that barley is becoming an important cash crop encountering the same damage as wheat. With insufficient data and information under South African conditions urgent research is needed.

Horticultural research was mostly concentrated on the training of students for higher degrees. Work on the fertilisation of a number of vegetable crops and the cultivar evaluation of cactus pear is ongoing.

The team involved with research in crop and stress physiology, including Prof. Seef Pretorius, Dr Elmarie van der Watt, Dr Marieta Cawood, Dr Botma Visser and Prof. Amie van der Westhuizen, confirmed induced disease resistance in wheat against leaf rust (*Puccinia triticina*) through foliar applications of an *Agapanthus Africanus* extract. For this purpose a comparison was made between the response of a susceptible (Thatcher) and resistant (Thatcher/Lr15) wheat cultivar to treatments with the extract. The treatment resulted in the reduction of pustule and necrotic

lesion formation in both wheat cultivars. Furthermore, germination of *P. triticina* spores was either completely inhibited or further germ-tube development was blocked. Foliar application of the extract activated β -1,3-glucanase, chitinase and peroxidase enzyme (PR-protein) activities significantly in both susceptible and resistant wheat cultivars, whether uninfected or infected. A 31 kDa protein was shown to be induced and, by using a polyclonal antibody; its identity was confirmed as β -1,3-glucanase. RT-PCR revealed the expression of three defence-related genes, *PR2*, *PR3* and *PR9*, encoding for the PR-proteins mentioned earlier. The active compound was isolated and purified from the *Agapanthus Africanus* and identified by means of NMR-spectroscopy as a saponin. Numerous manuscripts are currently prepared for publication in accredited journals. It is also envisaged to develop and commercialise a natural product to be applied in agriculture.

Research by the Soil Scientists on irrigation and salinity of soils is entering a new phase through a project funded by the Free State Department of Agriculture, namely *Application of electromagnetic induction technology for characterizing salinity and water logging in irrigated fields*. A salinity monitoring system was developed by using electromagnetic induction and global positioning system technology. Prof. Leon van Rensburg is currently testing the system and at the same time he is training two members of the Oppermans community to use it properly.

The Water Cluster of the UFS provided funds to support Mr Ben Schoonwinkel in his study of water logging and the

impact thereof on crop yields. This research links strongly with the current WRC-funded project *Managing salinity associated with irrigation in selected areas of South Africa*. The project ends in March 2010 and a report on best management practices of salinity under irrigation will soon be available thereafter. Staff members involved are Profs. Chris du Preez, Leon van Rensburg and Alan Bennie, and Messrs Johan Barnard and Jason Sparrow.

The second phase of the research project titled *The fate of organic matter in cultivated plinthic soils, reverted to perennial pasture* progressed smoothly under the leadership of Prof. Wulf Amelung of the University of Bonn in Germany. Prof. Du Preez is a member of this team that is financed by the Research Foundation of Germany. A third phase entitled the *Vulnerability and resilience of soils under different rangeland use* will start in 2010. In conjunction with this research,

Prof. Du Preez and Ms Elmarie Kotzé investigated the influence of cultivation practices on the organic matter content of a plinthic soil in a long-term experiment of the Agricultural Research Council's (ARC) Small Grain Institute at Bethlehem, Eastern Free State.

Prof. Du Preez is also a member of a team conducting research on the modelling of non-point pollution of water by agriculture. Researchers from five univer-



sities, namely the Universities of KwaZulu-Natal, Pretoria, Stellenbosch, the Free State and the Western Cape, as well as two ARC Institutes (Plant Protection and Soil, Climate and Water) have been co-opted due to the multidisciplinary nature of the work. This project is managed by Sigma Beta Consulting Engineers and is nearing its completion.

Until recently, hydrological models either ignored the role of soil, or treated it as a uniform system. To address this aspect, the WRC funded a multidisciplinary team including researchers from Rhodes University, University of KwaZulu-Natal and the Council for Scientific and Industrial Research (CSIR) to bridge the gap known internationally as hydro-pedology. The local pedology team, consisting of Dr Pieter le Roux, Profs. Cornie van Huyssteen, Leon van Rensburg, Malcolm Hensley and Messrs Bataung Kuenene and Johan van Tol proved through the project entitled *Hydropedological interpretation of soils in selected catchments with the aim of improving efficiency of hydrological models* that soil properties play an important role in hydrology. South African hill slopes show typical hydrological responses and can therefore be classified on a hydrological basis. The improved understanding of flow paths of water in soil and rock of hill slopes can aid in the understanding

and minimising, if not preventing, some types of pollution, both point source and non-point source. The research was presented in several congress papers and received awards twice.

The pedology team also researched the hydro-pedology of the pollution process of heavy metals in a contaminated Mpumalanga hill slope and the hydro-pedology of selected wetlands in Lesotho.

Prof. Cornie van Huyssteen was the President of the Soil Science Society of South Africa (SSSSA). He also served as Chairman of the Soil Survey Society of South Africa and on the Editorial Committee of the *South African Journal of Plant and Soil*.

The best paper on Soil Science that appeared in the *South African Journal of Plant and Soil* during 2008 was one by Ms Elmarie Kotze. The paper was titled *The influence of long-term wheat residue management on acidity and some macronutrients in an Avalon soil*. Her co-author was Prof. Chris du Preez.

Dr Piet le Roux attended a workshop of the Joint Research Commission of Soil Atlas for Africa on invitation in Cameroon. Several case studies by UFS staff will be included in the atlas that is due to be published.

Research outputs

Research articles

Allemann, J.A. & Ceronio, G.M. 2009. Effect of microencapsulated alachlor on South African sunflower (*Heliantus annuus* L.) cultivars. *South African Journal of Plant and Soil* 26: 110-118.

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Conference contributions

Allemann, J.A. & Ceronio, G.M. 2009. *Effect of microencapsulated alachlor on South African sunflower (Heliantus annuus L.) cultivars.* Paper presented at the Combined Congress 2009: Combined Congress of the Soil Science Society of South Africa, the South African Society of Crop Production, the Southern African Society for Horticulture Sciences and the Southern African Weed Science Society, University of Stellenbosch, Stellenbosch, South Africa. 20-22 January.

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Lecturers: Drs Gert Ceronio, Gesine Engelbrecht, Mss Anneline Bothma-Schmidt, Linda de Wet, Elmarie Kotzé

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Statistical Data

Faculty of Natural and Agricultural Sciences

Student figures: 2008-2009

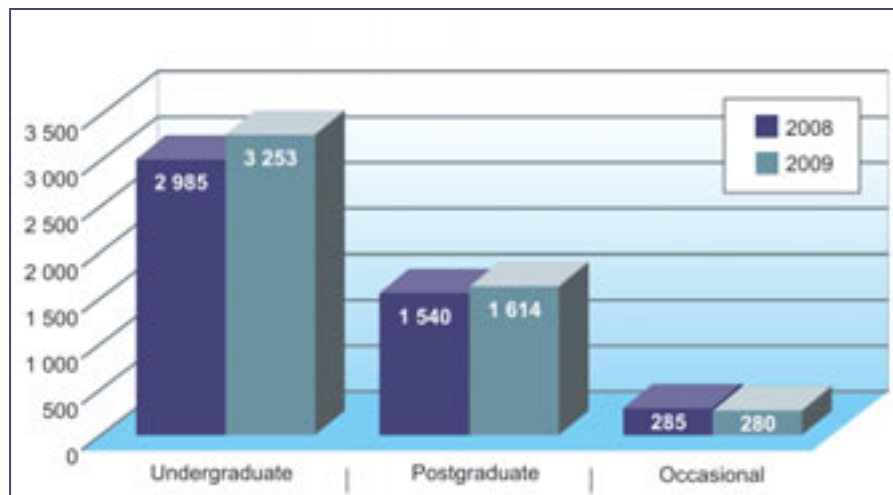
Year	Description	Female					Male					Total				
		Black	Coloured	Asian	White	Total	Black	Coloured	Asian	White	Total	Black	Coloured	Asian	White	Total
2008	Undergraduate	806	30	16	448	1300	860	21	22	782	1685	1666	51	38	1230	2985
	Postgraduate	298	19	24	257	598	458	21	19	444	942	756	40	43	701	1540
	Occasional	128	4	0	9	141	132	1	1	10	144	260	5	1	19	285
TOTAL		1232	53	40	714	2039	1450	43	42	1236	2771	2682	96	82	1950	4810
2009	Undergraduate	980	34	14	465	1493	901	27	19	813	1760	1881	61	33	1278	3253
	Postgraduate	304	13	21	268	606	494	20	25	469	1008	798	33	46	737	1614
	Occasional	116	2	0	16	134	125	1	0	20	146	241	3	0	36	280
TOTAL*		1400	49	35	749	2233	1520	48	44	1302	2914	2920	97	79	2051	5147

*2009 Final HEMIS figures not yet available

International students

Nationality	Year	
	2008	2009
Asian countries	24	21
Botswana	23	26
Democratic Republic of the Congo	1	-
European countries	12	11
Lesotho	146	151
Malawi	5	5
Mauritius	3	3
Mozambique	7	5
Namibia	65	83
North America	5	7
Other African countries	71	72
Swaziland	6	8
Zambia	8	8
Zimbabwe	62	64
Total	438	464

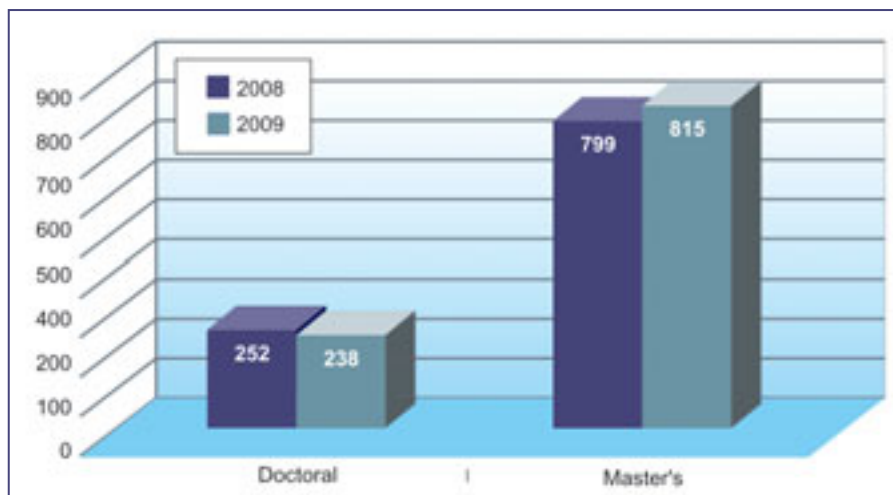
Comparison for the Faculty of Natural and Agricultural Sciences: 2008-2009



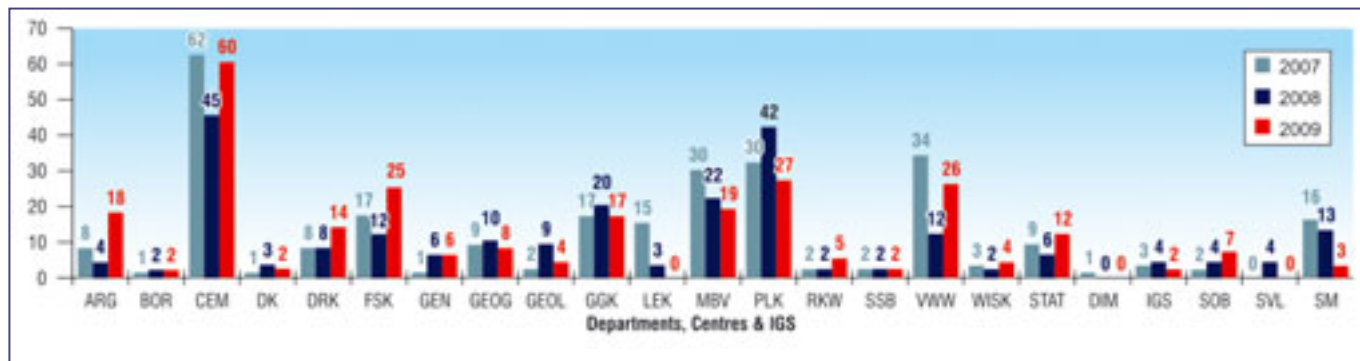
Student figures Post-/Undergraduates

	2008	2009
Undergraduate	2985	3253
Postgraduate	1540	1614
Occasional	285	280
Total	4810	5147
	2008	2009
Doctoral	252	238
Master's	779	815
Total	1031	1053

Comparison for the Faculty of Natural and Agricultural Sciences: 2008-2009



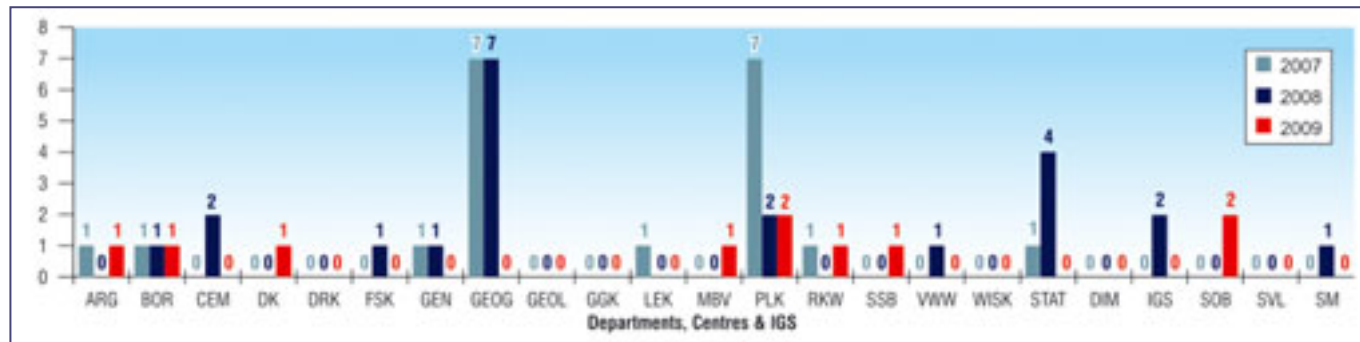
Accredited articles



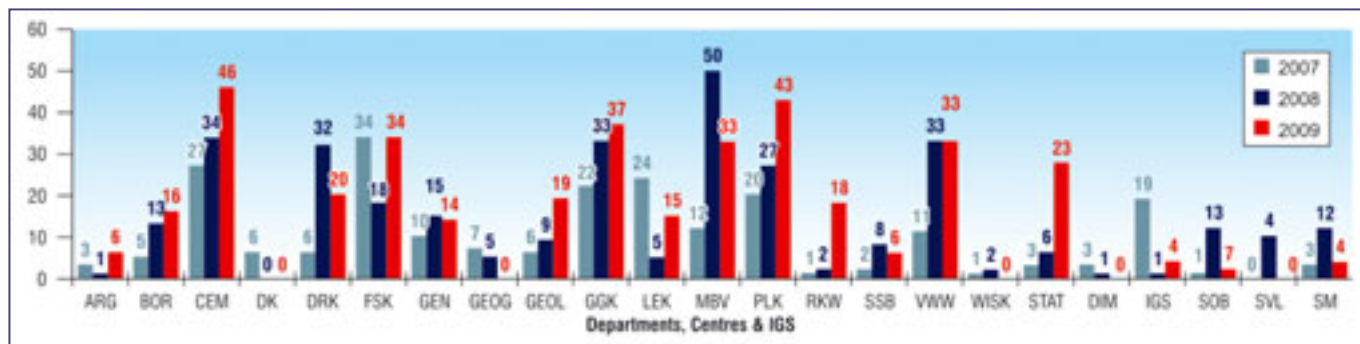
List of abbreviations

ARG	Department of Architecture	DK	Dean's Office	LEK	Department of Agricultural Economics	SRB	Disaster Management Training and Education
BOR	Department of Quantity Surveying and Construction Management	DRK	Department of Zoology and Entomology	MBV	Department of Microbial, Biochemical and Food Biotechnology	Centre for Africa (DiMTEC)	
CEM	Department of Chemistry	FSK	Department of Physics	PLK	Department of Plant Sciences	VWW	Department of Animal, Wildlife and Grassland Sciences
SM	Centre for Microscopy	GEN	Department of Genetics	RKW	Department of Computer Science and Informatics	STAT	Department of Mathematical Statistics and Actuarial Science
SVL	Centre for Sustainable Agriculture and Rural Development	GEOG	Department of Geography	SSB	Department of Urban and Regional Planning	WISK	Department of Mathematics and Applied Mathematics
		GEOL	Department of Geology				
		GGK	Department of Soil, Crop and Climate Sciences				
		IGS	Institute for Groundwater Studies				

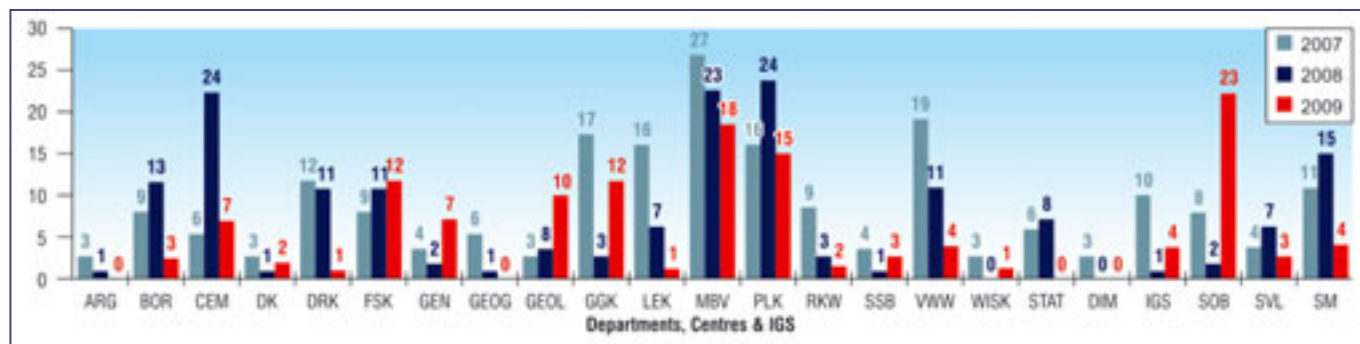
Books



Local conferences



Overseas conferences contributions





26 Glossary

Glossary

A

ADF -	Amsterdam Density Functional Programme
ADSARD -	Advanced Diploma in Sustainable Agriculture and Rural Development
AGM -	Annual General Meeting
AI -	Artificial Insemination
ARC -	Agricultural Research Council
ASQAQs -	Association of South African Quantity Surveyors
ASOCSA -	Association of Schools of Construction of Southern Africa
ASSA -	Actuarial Society of South Africa
ASSA -	Astronomical Society of Southern Africa
ASSAf -	Academy of Science of South Africa

B

BGR -	German Federal Survey of Geology
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C

CANSA -	Cancer Association of South Africa
CCEM -	Centre for Confocal and Electron Microscopy
CCTC -	Center for Theoretical and Computational Chemistry
CEE -	Council for Economic Education
CENSARD -	Centre for Sustainable Agriculture and Rural Development
CePHMa -	Centre for Plant Health Management
CHESD -	Centre for Higher Education and Studies and Development
CHPC -	National Centre for High Performance Computing
CIDB -	Construction Industry Development Board
CIIFAD -	Cornell International Institute for Food, Agriculture and Development
CIOB -	Chartered Institute of Building
CLSM -	Confocal laser scanning microscope
CMW -	Cape Mohair and Wool
CNRS -	French National Centre for Scientific Research
COE -	Centre of Excellence
COLA -	Conference on Laser Ablation
CPU -	Central Processing Unit

CSIR -	Council for Scientific and Industrial Research Organisation
CUT -	Central University of Technology

D

DFG -	Deutsche Forschungsgemeinschaft
DiMTEC -	Disaster Management Training and Education Centre for Africa
DMISA -	Disaster Management Institute of Southern Africa
DRR -	Disaster Risk Reduction
DSC -	Differential Scanning Calorimetry
DST -	Department of Science and Technology
DWAF -	Department of Water Affairs and Forestry

E

EAAP -	European Association for Animal Production
ECA -	European Crystallographic Association
EPWP -	Expanded Public Works Programme

F

FAO -	Food and Agricultural Organisation
FFSC -	Farm Financial Standard Council
FLIP -	Facilitation Learning in Practice
FMP -	Facilities Management Programme
FP7 -	European Funding Program Seven

G

GIS -	Geographical Information Systems
GMI -	Groundwater Management Institute
GOOT -	Grow our Own Timber
GOL -	Government of Lesotho

H

HPC -	High Performance Computing
HRTEM -	High Resolution Transmission Electron Microscopy

I

IBREAM SA -	Institute for the Breeding of Rare and Endangered African Mammals
ICARD -	International Conference on Acid Rock Drainage
ICEC -	International Cost Engineering Council
ICPOES -	Inductively Coupled Plasma Optical Emission Spectroscopy
ICSU -	International Council for Science
ICY -	International Yeast Commission
IDC -	Industrial Development Corporation
IDP -	Internationally Displaced Persons
IFMA -	International Farm Management Association
IGS -	Institute for Groundwater Studies
INTSORMIL -	International Sorghum and Millet Research Support Programme
IPMP -	Intensive Project Management Programme
IRDP -	Institutional Research and Development Programme

K

KIST -	Korea Institute of Science and Technology
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L

LRAD -	Land Redistribution for Agricultural Development
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M

MANIT -	Maulana Azad National Institute of Technology
MCA-L -	Millennium Challenge Account-Lesotho
MCC -	Millennium Challenge Corporation
MNS -	Material and Nanosciences Cluster
MOU -	Memorandum of Understanding
MS -	Mass Spectrometry
MSA -	Masters degree in Sustainable Agriculture
MSDN -	Microsoft Developer Network
MUCPP -	Mangaung University Community Partnership Programme

N

NAMC -	National Agricultural Marketing Council
NECSA -	South African Nuclear Energy Corporation
NEP -	National Equipment Programme
NGO -	Non-Governmental Organisation
NIRS -	Infrared Spectrophotometer
NMMU -	Nelson Mandela Metropolitan University
NNSCF -	National Nano-Surface Characterisation Facility
NRF -	National Research Foundation
NSTF -	National Science and Technology Forum
NUFU -	Norwegian Council of Universities Committee for Development, Research and Education
NWS -	New World Sanitation

P

PEGG -	Primate Ecology and Genetics Group
PHP -	Peoples' Housing Process
PRT -	Protein Research Trust

R

RICS -	Royal Institute of Chartered Surveyors
RPO -	Red Meat Producers' Organisation

S

SA -	South Africa
SAAWK -	South African Academy of Sciences
SAB -	The South African Breweries Limited
SACAP -	South African Council for the Architectural Professions
SACLA -	Southern African Computer Lecturers Association
SACPCMP -	South African Council for the Project and Construction Management Professions
SACPVP -	South African Council for the Property Valuation Profession
SACQSP -	South African Council for the Quantity Surveying Profession

SADC -	Southern African Development Community
SAFEFE -	South African Foundation for Economic and Financial Education
SAFOI -	South African Fryer Oil Initiative
SAGA -	South African Geophysical Association
SAIA -	South African Institute of Architects
SAIP -	South African Institute of Physics
SAJAH -	South African Journal of Art History's
SANBI -	South African National Biodiversity Institute
SANPAD -	South Africa-Netherlands Research Programme on Alternatives in Development
SAPOA -	South African Property Owners' Association
SAQA -	South African Qualifications Authority
SASAS -	South African Society for Animal Science
SASAS -	South African Society of Atmospheric Sciences
SASCP -	South African Society of Crop Production
SASHS -	Southern African Society for Horticultural Sciences
SASPP -	Southern African Society for Plant Pathology
SASQUA -	Southern African Society for Quaternary Research
SASS -	South African Scoring System
SAWMA -	South African Wildlife Management Association
SEM -	Scanning Electron Microscope
SIDA -	Swedish International Development Cooperation Agency
SIFE -	Students in Free Enterprise
SKA -	Square Kilometre Array
SOI -	Southern Oscillation Index
SSSSA -	Soil Science Society of South Africa

T

TAD -	Teaching Astronomy for Development
TEM -	Transmission Electron Microscope

TGA -	Thermal Gravimetric Analysis
THRIP -	South African National Research Foundation Thrust for Industry-Related Projects
TRAC -	Trans African Concessions (Pty) Ltd
TUT -	Tshwane University of Technology

U

UACH -	Autonomous University of Chapingo
UCT -	University of Cape Town
UEC -	Unit for Earth Construction
UFS -	University of the Free State
UJ -	University of Johannesburg
UK -	United Kingdom
UKZN -	University of KwaZulu-Natal
UMN -	University of Minnesota
UN -	United Nations
UNU -	United Nations University
UNU-EHS -	United Nations University's Institute for Environment and Human Security
UP -	University of Pretoria
UPS -	Uninterrupted Power Supply
US -	United States
USA -	United States of America
USGS -	United States Geological Survey
UWC -	University of the Western Cape
UWM -	University of Milwaukee-Wisconsin

V

ViE -	Vice-Rectorate in Europe
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W

WCAP -	World Conference on Animal Production
WITS -	University of the Witwatersrand
WRC -	Water Research Commission
WSSSA -	Weed Science Society of South Africa
WVI -	World Vision International
WWU -	Muenster University

X

XPS -	X-ray photon spectroscope
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