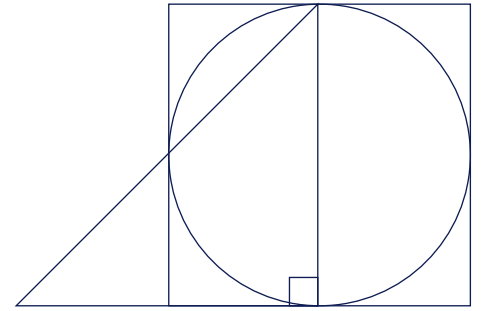


Report

05/06



Faculty of Natural and Agricultural Sciences



Faculty of Natural and Agricultural Sciences

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From the Dean's office



Prof. Herman van Schalkwyk.

The Faculty of Natural and Agricultural Sciences at the University of the Free State (UFS) leads the way in the practising of natural and agricultural sciences in South Africa and the highest levels of quality and credibility are reflected.

Our commitment, however, reaches far beyond just this. It reaches beyond the borders of the country and across continents; its multi-disciplinary and practical approach is vested in all the disciplines presented by the faculty.

In 2005/06 the Faculty experienced significant growth in measurable outputs. A contributing factor was the comprehensive apparatus strategy and plan which was implemented in 2005. With this strategy, university funds were used to leverage other funds in order to obtain huge discounts from suppliers of apparatus. In this way the faculty managed to obtain almost R50 million worth of apparatus in 2005.

The strategy was continued in 2006 when an agreement to the value of R7 542 531 was reached with Shimadzu, according to which apparatus was supplied to the faculty at discount prices. The agreement, which is valid for three years, entails the free replacement of apparatus which is purchased during this period with upgraded versions.

The new apparatus forms part of the UFS vision to compete internationally with quality research outputs in certain niche areas, to provide leadership in advanced training to students from the African continent and to establish the university as a leader among South African universities.

Two researchers with a B rating from the National Research Foundation (NRF) were also appointed. Both of these initiatives bore fruit and in 2006 the faculty increased its total research outputs by

about 13%. As an example, the Department of Chemistry's outputs increased by 100%.

The faculty has been bursting at the seams over the past couple of years. Student figures rose from 3 935 undergraduate, postgraduate and occasional students in 2005, to 4 224 in 2006. There is also strong representivity of students from other African countries and in 2005/06 almost 600 students studied at the faculty.

An extended B.Sc. programme has been presented to students since 2005. The programme aims at providing students who do not comply with all the requirements for the B.Sc. programme with the necessary sub-structure to complete the B.Sc. degree successfully. A preliminary evaluation of the results indicates that the programme is delivering the desired results.


The alignment of the Qwaqwa Campus, which was incorporated into the UFS in January 2003, remains a challenge. Regular discussions are held with staff on the campus in order to make the faculty's programmes more sustainable and to align it with the broader strategic plan of the UFS.

On a national level, the faculty is in the process of making its mark in terms of teaching and community service. In 2005 the faculty again actively began utilising its

experimental farms. A three-way agreement between the UFS, the National Farmers Union (NAFU) and the Mangaung Local Municipality led to the establishment of the Lengau Agricultural Development Centre on the Sydenham Experimental Farm. The centre provides training and mentorship to small-scale upcoming farmers.

To be dynamic and progressive requires innovative thinking. It requires commitment and a desire to deliver excellent teaching and learning opportunities to students. It requires a willingness to form partnerships, and a multi-disciplinary and practical approach to the tertiary education environment in South Africa.

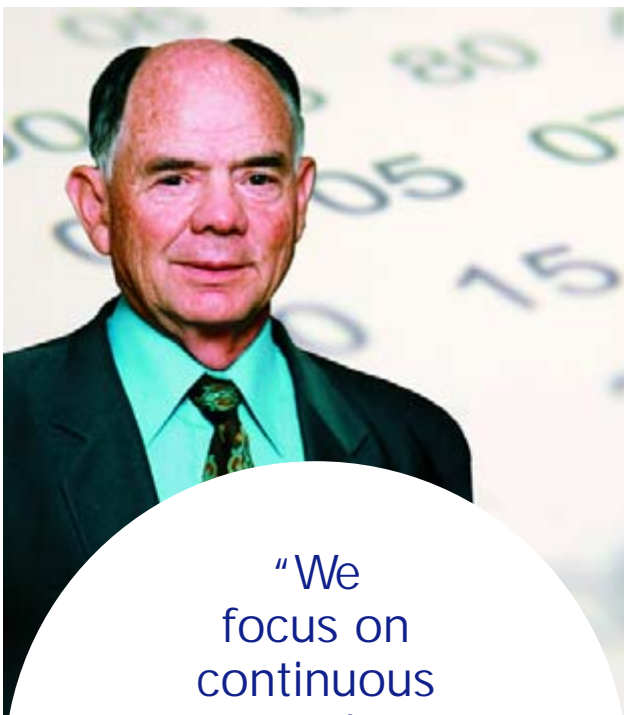
This report covers the faculty's activities in 2005/06. It is a reflection of two years' commitment on the part of a team of skilled and motivated academics and support staff.



Prof. Herman van Schalkwyk

Dean: Faculty of Natural and Agricultural Sciences
University of the Free State

Mathematical Statistics



"We focus on continuous research on statistical inference with a strong Bayesian flavour."

Prof. Daan de Waal.

Overview

During 2005 the department presented courses in Mathematical Statistics, Statistics and Actuarial Science to approximately 2 000 students per semester, 30 of which were postgraduate students. The department had an additional 1 000 students registered in e-degree courses and also on the Kimberley, Qwaqwa and Vista Campuses. A total of 80 courses were presented, with eight Ph.D. and eight master's students registered.

During 2006 a total of 200 more students than the previous year registered for courses in Mathematical Statistics, Statistics and Actuarial Science. One hundred and forty-two of these students were postgraduate students. An additional 760 students were registered in the department in e-degree courses, as well as on the Vista, Qwaqwa and Kimberley Campuses. A total of 61 courses were presented and 11 Ph.D. and six master's students were registered.

Research in the department, not only during 2006, but also on an ongoing basis, focuses on statistical inference with a strong Bayesian flavour. The emphasis lies in areas such as Survival Analysis (Prof. Max Finkelstein), Extreme Value Analysis (Prof. Daan de Waal), Linear Mixed Models (Prof. Abrie van der Merwe) and Change Point Analysis (Prof. Piet Groenewald). Other research fields of interest include Data Mining (Dr Isabelle Garisch) and Time Series (Dr Martin van Zyl).

The modelling of water inflow in the Gariep Dam in the Free State Province for hydro power stimulation through Eskom is done continuously in the Risk Laboratory.

Projects that have been running for some time are the Eskom-related research projects that form part of the activities of the Risk Laboratory, and the projects of the Flemish South African co-operation agreement between the UFS, the North-West University the Katholieke Universiteit Leuven and Diepenbeek University.

The Water Research Commission (WRC) project, with respect to the radar data on the inflow of water into the Caledon River, begun in January 2001 in co-operation with Eskom and the weather office in Bethlehem. This project will continue to exist.

“Prof. Finkelstein was announced a 2005 South African Statistical Association Fellow at the 52nd Annual Conference of the South African Statistical Association.”

Prof. Daan de Waal participated in an international research project in Belgium in association with Proff. Jan Beirlant and Jef Teugels of the Katholieke Universiteit of Leuven on extreme values modelled. This project will continue for the next three years (2005 – 2007). Prof. De Waal also visited Leuven in May 2005 where he delivered a paper entitled: *Choice of the threshold through the entropy of the Dirichlet process when applying Peaks over Thresholds (POT)*.

Prof. Finkelstein is involved in an ongoing project with the Max Planck Institute for Demographic Research on models of biological aging and with the St. Petersburg Elektropribor Institute on reliability of complex systems.

Prof. De Waal was appointed as member of the South African Council for Statistics for a period of three years by Mr Trevor Manuel, Minister of Finance. Prof. Finkelstein was

announced a 2005 South African Statistical Association Fellow at the opening ceremony of the 52nd Annual Conference of the South African Statistical Association held at Rhodes University in Grahamstown.

During 2005/06 staff members from the department actively participated in seminar lectures, research projects, departmental technical reports and national and international conferences and workshops. The department also received a number of visitors that presented seminar lectures.

In 2005 the staff numbered 19 full-time members, five part-time members and three assistants. However, Prof. Groenewald and Dr Piet Steyn retired at respectively 27 and 21 years of service to the department and Dr Albertus Pretorius, Senior Lecturer and Director of the Actuarial Programme, resigned.

Dr Carin Lombaard obtained her Ph.D. in 2006.



The department celebrated its 50th birthday in November 2006 during a gala event in the Centenary Complex on the Main Campus in Bloemfontein. Prof. Daan de Waal, Departmental Chairperson, addressing guests.



Academic staff

Main Campus

Professors: Prof. Daan de Waal, Max Finkelstein, Piet Groenewald, Abrie van der Merwe, Robert Schall

Senior Lecturers: Drs Isabelle Garisch, Albertus Pretorius, Piet Steyn, Martin van Zyl

Lecturers: Messrs Delson Chikobvu, Dries Naudé, Kobus Bekker, Michael von Maltitz (contract appointment), Sean van der Merwe (contract appointment), Mss Carin Lombaard, Linda van der Merwe, Andrehette Nel

Part-time Lecturers: Dr Cay van der Merwe, Mss Maryn Brussow, Ingrid Erasmus, Lizanne Raubenheimer, Wallina Oosthuizen, Elizabeth Ntja, Messrs Frans Koning, Thomas Kotelo

Vista Campus

Professors: Prof. Jacobus de Wet

Lecturers: Dr Inet Kemp

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Research outputs

Publications

- De Waal, D.J. & Van Gelder, P.H.A.J.M. 2006. Modelling of extreme wave heights and periods through copulas. Accepted for publication in *Extremes* 8(4).
- Finkelstein, M.S. 2005. Lifesaving explains mortality decline with time. *Mathematical Biosciences* 196(2): 187-197.
- Finkelstein, M.S. 2005. On some reliability approaches to human aging. *The International Journal of Reliability, Quality and Safety Engineering* 12(4): 337-346.
- Finkelstein, M.S. 2005. On stochastic comparison of population densities and life expectancies. [Online]. *Demographic Research* 13(6): 144-161.
- Finkelstein, M.S. 2005. Stochastic modeling of a human life span: A reliability oriented approach. *Communications in Dependability and Quality Management* 8(3): 39-44.
- Finkelstein, M.S. 2005. Why the mixture failure rate is bent down. *South African Statistical Journal* 39: 23-34.
- Finkelstein, M.S. 2006. On relative ordering of mean residual lifetime functions. *Statistics and Probability Letters* 76: 939-944.
- Finkelstein, M.S. & Esaulova, V. 2005. On the weak IFR aging of bivariate lifetime distributions. *Applied Stochastic Models in Business and Industry* 21: 265-272.
- Finkelstein, M.S. & Esaulova, V. 2006. Asymptotic behaviour of a general class of mixture failure rates. *Advances in Applied Probability* 38: 244-262.
- Finkelstein, M.S. & Esaulova, V. 2006. Mixture failure rate ordering. *Communications in Statistics, Theory and Methods* 35: 11.
- Finkelstein, M.S. & Vaupel, J. 2006. The relative tail of longevity and the mean remaining lifetime. [Online]. *Demographic Research* 14(6): 111-138.
- Groenewald, P.C.N. & Mokgathe, L. 2005. Bayesian computation for logistic regression. *Computational Statistics and Data Analysis* 48: 857-868.
- Van der Merwe, A.J. & Bekker, K.N. 2006. A Bayesian analysis with the Bühlmann-Straub credibility model in the case of normality. *Journal of Actuarial Practice* 13: 33-60.
- Van der Merwe, A.J. & Bekker, K.N. 2006. A computational Bayesian approach to the balanced Bühlmann credibility model. Accepted for publication in *South African Statistical Journal*.
- Van der Merwe, A.J. & Delpont, D.H. 2006. Credibility intervals for the ratio of means of two populations which contains Zero and Log-normally distributed observations. *Journal for New Generation Science* 4(2): 66-77.
- Van der Merwe, A.J., Pretorius, A.L. & Meyer, J.H. 2005. Tolerance intervals for the unbalanced one-way random effects model using a Bayesian procedure. Accepted for publication in *Journal of Quality Technology*.
- Van der Merwe, A.J., Pretorius, A.L. & Meyer, J.H. 2006. Bayesian tolerance intervals for the unbalanced one-way random effects model using a Bayesian procedure. *Journal of Quality Technology* 38(3): 280-293.

Chapters in books

- Finkelstein, M.S. 2005. Mortality in varying environment. In: *Probability, statistics and*

modeling in public health, edited by M. Nikulin, D. Commenges & C. Huber. New York: Springer. pp. 145-157.

Finkelstein, M.S. 2005. On simple systems with continuous output. In: *Modern statistical and mathematical methods in reliability*, edited by A. Wilson, N. Limnios, S. Keller-McNulty & Y. Armijo. Singapore: World Scientific. pp. 169-176.

Finkelstein, M.S. & Esaulova, V. 2006. Failure rates in heterogeneous populations. In: *Handbook of Engineering Statistics*, edited by H. Pham. Germany: Springer. pp. 369-386.

Reports

- Bekker, K.N. 2005. *Estimation of parameters and quantiles of the Wakeby distribution: A compromise*. Report no. 347 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Bekker, K.N. 2005. *Parameter estimation for the Wakeby distribution: A simulation study*. Report no. 348 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Bekker, K.N. & Van der Merwe, A.J. 2005. *Credibility theory in actuarial science: A full Bayesian approach*. Report no. 341 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Brüssow, M.E. & Van der Merwe, A.J. 2005. *A Bayesian analysis of the linear calibration problem*. Report no. 343 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Clark, J. & Steyn, P.W. 2005. *Coverage probabilities and the nominal confidence level*. Report no. 342 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J. 2005. *Predictive density derived from the Dirichlet process on goodness of fit of extreme modeling*. Report no. 352 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J. & Beirlant, J. 2005. *Choice of the threshold through the entropy of the Dirichlet process when applying pot*. Report no. 351 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Beirlant, J. & Dierckx, G. 2006. *Bayes estimate of the Weibull tail index*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Beirlant, J. & Dierckx, G. 2006. *Predicting high quantiles through the dirichlet process on extreme modeling*. Report no. 362 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Ngesi, K. & Nel, A. 2005. *Predicting inflow into the Gariiep dam using a linear time series model*. Report no. 346 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- De Waal, D.J., Van Gelder, P.H.A.J.M. & Nel, A. 2005. *Estimating joint tail probabilities on rhine discharges through the logistic copula*. Report no. 355 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Erasmus, R.A. & Groenewald, P.C.N. 2005. *Bayesian disease mapping: A study of the relative risks of various diseases in the Republic of Botswana*. Report no. 349 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

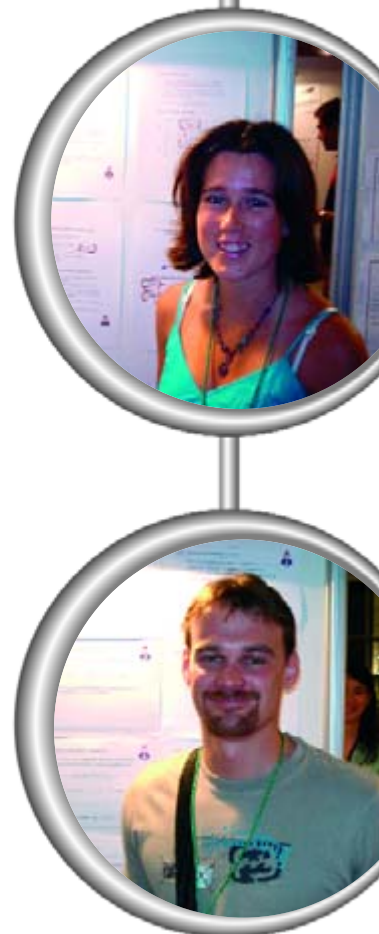
Finkelstein, M.S. 2005. *Aging: Damage accumulation versus increasing mortality rate*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2005-018.

Finkelstein, M.S. 2005. *On some approaches to defining virtual age of degrading systems*. Report no. 354 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Finkelstein, M.S. 2006. *On engineering reliability concepts and biological aging*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2006-021.

Finkelstein, M.S. 2006. *Shocks: Damage and degradation models*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Finkelstein, M.S. & Esaulova, V. 2005. *Asymptotic behaviour of mixture failure rates*.



- Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2005-023.
- Finkelstein, M.S. & Esaulova, V.** 2005. *On mixture failure rate ordering*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany.
- Finkelstein, M.S. & Esaulova, V.** 2006. *On asymptotic failure rates in bivariate frailty competing risks models*. Report to Max Planck Institute for Demographic Research (MPIDR), Rostock, Germany. WP-2006-023.
- Finkelstein, M.S. & Esaulova, V.** 2005. *Failure rates in heterogeneous populations*. Report no. 353 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Garisch, I. & Groenewald, P.C.N.** 2006. *Calculating the probability of consensus decision-making using expert information*. Report no. 367 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Groenewald, P.C.N.** 2006. *Change-points in linear regression*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Hugo, J. & Van der Merwe, A.J.** 2005. *Bayesian tolerance intervals for the balanced one-way random effects model with non-normal measurement errors*. Report no. 356 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Kruger, A. & Van der Merwe, A.J.** 2006. *Bayes prediction in regression analysis with normal and T-errors*. Report no. 368 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Liebenberg, C-M., Van der Merwe A.J., Van Rooyen, L.C. & Bekker, K.N.** 2006. *The Skew Distributions with applications to Bayesian Linear Models*. Report no. 359 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A. & De Waal, D.J.** 2005. *Probabilities of an overflow in the Gariep Dam*. Report no. 350 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., Bekker, K.N. & De Waal, D.J.** 2005. *Fitting the Wakeby distribution to the 20-day block maximum inflows into the Gariiep dam*. Report no. 345 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., De Waal, D.J. & Van Gelder, P.H.A.J.M.** 2006. *Estimating joint tail probabilities through the Logistic Copula*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., Pretorius A.L. & De Waal, D.J.** 2005. *The Egarch model applied to Eskom data*. Report no. 344 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Nel, A., Pretorius, A.L. & De Waal, D.J.** 2005. *Models of Eskom pricing data*. Report no. 340 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ngesi, K. & De Waal, D.J.** 2006. *Predicting inflow into the Gariep Dam using time series models*. Report no. 361 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ngesi, K. & De Waal, D.J.** 2006. *Predicting inflow to the Gariep Dam*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ntja, M.E. & De Waal, D.J.** 2006. *Relationship between the tail above the threshold and the mean of certain distributions with applications*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Ntja, M.E., De Waal, D.J. & Nel, A.** 2006. *Selecting the threshold for peaks over threshold methods in extreme value analysis*. Report no. 360 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Schall, R.** 2006. *The empirical coverage of confidence intervals: Point estimates and confidence intervals for confidence levels*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Steyn, P.W. & Rabele, T.E.** 2006. *Mantel – Haenszel tests and related topics*. Report no. 364 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Thupeng, W.M. & De Waal, D.J.** 2006. *Posterior predictive assessment of fit for Dirichlet Process Based Generalized Pareto Model*. Report no. 366 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Merwe, A.J. & Delpont, D.** 2006. *Credibility intervals for the ratio of means of two populations which contains Zero and Log-normally distributed observations*. Report no. 363 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Merwe, A.J., Liebenberg, C. & Venter, J.** 2006. *Skew distributions with applications to Bayesian Regression Models*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Merwe, S., Garisch, I. & Van der Merwe, C.** 2006. *Data mining: A comparative summary*. Report no. 358 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Van der Rijst, M., Hugo, J. & Van der Merwe, A.J.** 2005. *Performance of confidence intervals in one-factor random models for balanced and unbalanced data*. Report no. 357 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.
- Veraverbeke, N.** 2006. *Nonparametric estimation problems under dependent censoring*. Report no. 365 to the Department Mathematical Statistics, University of the Free State, Bloemfontein, South Africa.

Conference contributions

- Bekker, K.N. & De Waal, D.J.** 2006. *Estimating extreme quantiles for the 20-day maximum inflows into Gariiep Dam: An approach based on two distributions in DA [Fréchet]*. Poster presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.

- De Waal, D.J.** 2006. *Using the Dirichlet process to select the threshold in extreme modeling*. Paper presented at the Astro Workshop, Statistical and Applied Mathematical Sciences Institute (SAMSI), Duke University, USA.
- De Waal, D.J. & Nel, A.** 2006. *Estimating joint tail probabilities through the logistic copula*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Finkelstein, M.S.** 2005. *Biological aging*. Paper presented at the Mathematical and Statistical Methods Conference, University of California at Berkeley, USA. (Invited speaker).
- Finkelstein, M.S.** 2005. *Models of imperfect repair*. Paper presented at the European Safety and Reliability Conference (ESREL 2005), Gdansk, Poland. (Invited speaker).
- Finkelstein, M.S.** 2005. *Statistical modeling and inference in life sciences*. Paper presented at the Lifetime Data Analysis Conference, Potsdam, Germany. (Invited speaker).
- Finkelstein, M.S.** 2005. *Stochastic modeling of a human life span*. Paper presented at the Stochastic Models in Reliability, Safety, Security and Logistics Conference, Beer Sheva, Israel.
- Finkelstein, M.S.** 2006. *On virtual age modelling*. Paper presented at the Accelerated Life Time Congress, Anger, France.
- Finkelstein, M.S.** 2006. *Reliability approaches to biological aging*. Paper presented at the European Safety Reliability Conference, Estoril, Portugal.
- Finkelstein, M.S.** 2006. *Shock models*. Paper presented at the Workshop on Aging, Max Planck Institute, Rockstock, Germany.
- Finkelstein, M.S.** 2006. *Stochastic models of aging*. Paper presented at the Statistical Methods for Biomedical and Technical (BIOSTAT) 2006 Conference, Limassol, Cyprus.
- Finkelstein, M.S. & Esaulova, V.** 2006. *Bivariate mixture failure rate models*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Hugo, J. & Van der Merwe, A.J.** 2006. *Bayesian tolerance intervals for the balanced one-way random effects model with student-t distributed measurement errors*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Nel, A. & De Waal, D.J.** 2006. *Multivariate extreme values*. Poster presented at the Valencia / ISBA 8th World Meeting on Bayesian Statistics, Gran Hotel Bali, Benidorm, Spain.
- Thupeng, W. & De Waal, D.J.** 2006. *Goodness of fit measures using a Bayesian approach*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Van der Merwe, S.** 2006. *The Dodgy finder*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.
- Von Maltitz, M.J.** 2006. *Relative risk in currencies: Comparing the South African Rand with the Brazilian Real, the Japanese Yen and the Euro*. Paper presented at the 49th Conference of the South African Statistical Association, University of Stellenbosch, Stellenbosch, South Africa.

Statistical data of the faculty



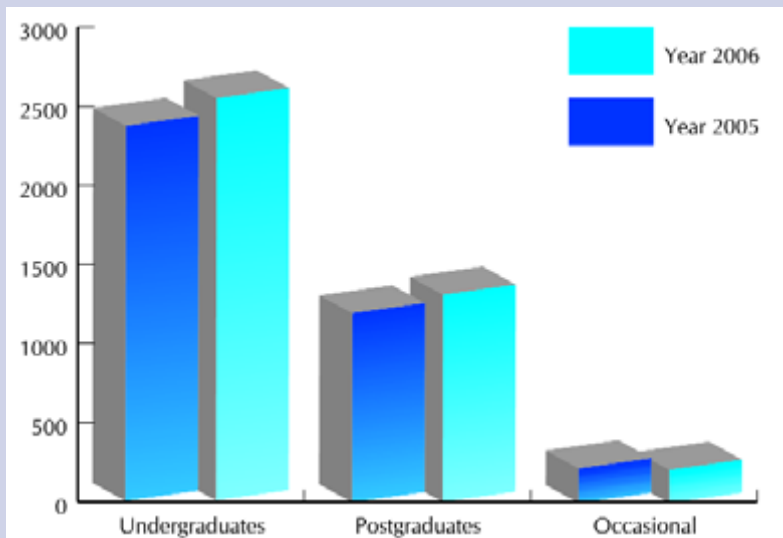
Student figures

Faculty of Natural and Agricultural Sciences, 2005/06

| Male | | | | | |
|-------------------|-------------|-----------|-----------|-------------|-------------|
| 2005 | | | | | |
| Description | African | Coloured | Indian | White | Total |
| Undergraduate | 676 | 31 | 26 | 724 | 1457 |
| Postgraduate | 351 | 22 | 15 | 400 | 788 |
| Occasional | 84 | 3 | 4 | 17 | 108 |
| Total 2005 | 1111 | 56 | 45 | 1141 | 2353 |
| 2006 | | | | | |
| Description | African | Coloured | Indian | White | Total |
| Undergraduate | 729 | 28 | 21 | 768 | 1546 |
| Postgraduate | 385 | 21 | 16 | 431 | 853 |
| Occasional | 68 | 2 | 2 | 23 | 95 |
| Total 2006 | 1182 | 51 | 39 | 1222 | 2494 |

| Female | | | | | |
|-------------------|------------|-----------|-----------|------------|-------------|
| 2005 | | | | | |
| Description | African | Coloured | Indian | White | Total |
| Undergraduate | 563 | 41 | 11 | 394 | 1009 |
| Postgraduate | 206 | 16 | 11 | 221 | 454 |
| Occasional | 101 | 5 | 2 | 11 | 119 |
| Total 2005 | 870 | 62 | 24 | 626 | 1582 |
| 2006 | | | | | |
| Description | African | Coloured | Indian | White | Total |
| Undergraduate | 641 | 39 | 17 | 401 | 1098 |
| Postgraduate | 243 | 15 | 17 | 234 | 509 |
| Occasional | 103 | 2 | 2 | 16 | 123 |
| Total 2006 | 987 | 56 | 36 | 651 | 1730 |

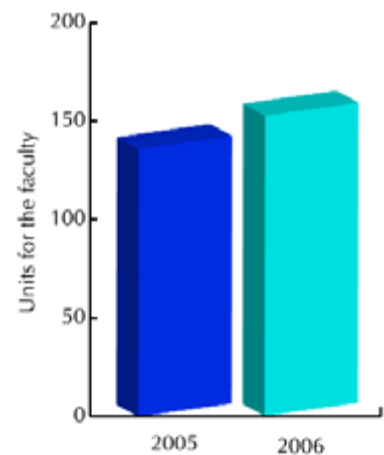
| Total | | | | | |
|-------------------|-------------|------------|-----------|-------------|-------------|
| 2005 | | | | | |
| Description | African | Coloured | Indian | White | Total |
| Undergraduate | 1239 | 72 | 37 | 1118 | 2466 |
| Postgraduate | 557 | 38 | 26 | 621 | 1242 |
| Occasional | 185 | 8 | 6 | 28 | 227 |
| Total 2005 | 1981 | 118 | 69 | 1767 | 3935 |
| 2006 | | | | | |
| Description | African | Coloured | Indian | White | Total |
| Undergraduate | 1370 | 67 | 38 | 1169 | 2644 |
| Postgraduate | 628 | 36 | 33 | 665 | 1362 |
| Occasional | 171 | 4 | 4 | 39 | 218 |
| Total 2006 | 2169 | 107 | 75 | 1873 | 4224 |



Student figures

| Student nationality | | |
|---------------------|-------------|-------------|
| Nationality | 2005 | 2006 |
| Angola | 1 | |
| Asian countries | 21 | 18 |
| Botswana | 20 | 20 |
| European countries | 6 | 6 |
| Lesotho | 142 | 142 |
| Malawi | 2 | 1 |
| Mauritius | | 2 |
| Mozambique | 8 | 7 |
| Namibia | 40 | 42 |
| No information | 1 | |
| North America | 4 | 4 |
| Other Africa | 45 | 48 |
| South Africa | 3610 | 3893 |
| South America | | 1 |
| Swaziland | 13 | 13 |
| Zambia | 4 | 6 |
| Zimbabwe | 18 | 21 |
| Total | 3935 | 4224 |

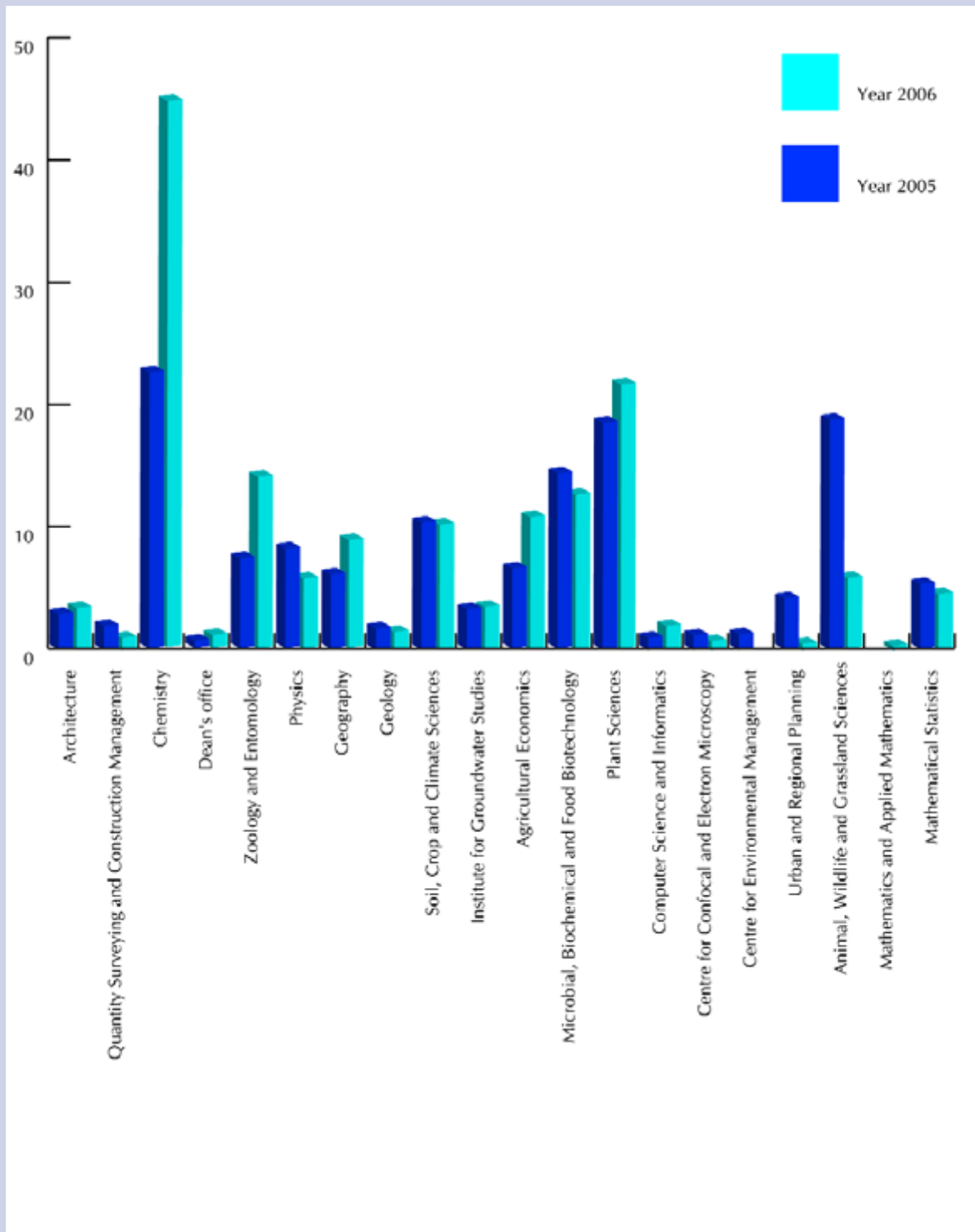
Research outputs for the Faculty of Natural and Agricultural Sciences



Articles published in accredited approved research journals.

Departmental research outputs

Articles published in accredited approved research journals, 2005/06



Glossary



Glossary

A

| | |
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| ACIAR | Australian Centre for International Agricultural Research |
| AEASA | Agricultural Economics Association of South Africa |
| ALPRU | African Large Predator Research Unit |
| ARC | Agricultural Research Council |
| ARMSCOR | Armaments Corporation of South Africa |
| ARS | Agri Risk Specialists |
| ASAQS | Association of South African Quantity Surveyors |
| ASSA | Anatomical Society of South Africa |
| ASTER | Advanced Spaceborne Thermal Emission and Reflection Radiometer |
| AVS | American Vacuum Society |

C

| | |
|-----------|--|
| CANSA | Cancer Association of South Africa |
| CATSA | Catalysis Society of South Africa |
| CBD | Convention of Biological Diversity |
| CCEM | Centre for Confocal and Electron Microscopy |
| CePHMa | Centre for Plant Health Management |
| CfPB | Centre for People and Buildings |
| CIAT | International Centre for Tropical Agriculture |
| CIDB | Construction Industry Development Board |
| CIMMYT | International Maize and Wheat Improvement Centre |
| CIOB | Chartered Institute of Building |
| CIOB-SA | Chartered Institute of Building - South Africa |
| CSACEE | Central South African Council on Economic Education |
| CSIC-INTA | Centro de Astrobiología |
| CSIR | Council for Scientific and Industrial Research |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |

D

| | |
|--------|--|
| DEAT | Department of Environmental Affairs and Tourism |
| DiMTEC | Disaster Management Training and Education Centre for Africa |
| DMISA | Disaster Management Institute of South Africa |
| DST | Department of Science and Technology |

E

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|-------|---|
| EAAP | European Association for Animal Production |
| EASA | Education Association of South Africa |
| ECA | European Crystallographic Association |
| EIGG | Environmental Inorganic Geochemistry Group |
| EPWP | Expanded Public Works Programme |
| ESBES | European Symposium on Biochemical Engineering Science |
| ESREL | European Safety and Reliability |
| ESRP | Economic and Social Rehabilitation Programme |

F

| | |
|-------|--|
| FAO | Food and Agriculture Organisation |
| FEMS | Federation of European Microbiological Societies |
| FMP | Facilities Management Programme |
| FOTIM | Foundation of Tertiary Institutions of the Northern Metropolis |

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|-------|--|
| FSRPO | Free State Red Meat Producers Organisation |
|-------|--|

G

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| GIS | Geographical Information Systems |
| Glen ADI | Glen Agricultural Development Institute |
| GM | Genetically Modified |
| GMBA | Gauteng Master Builders' Association |
| GMO | Genetically Modified Organisms |
| GWK | Griekwaland-Wes Koöperasie |

H

| | |
|-------|---|
| HIV | Human Immunodeficiency Virus |
| HPCSA | Health Professions Council of South Africa |
| HPLC | High Performance Liquid Chromatography |
| HSPCM | Health and Safety Programme for Construction Managers |

I

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|-----------|--|
| IAGOD | International Association on the Genesis of Ore Deposits |
| IAH | International Association of Hydrogeologists |
| ICCC | International Conference on Coordination Chemistry |
| ICEC | International Cost Engineering Council |
| ICID | International Commission on Irrigation and Drainage |
| ICP | Inductively Coupled Plasma |
| ICRBM | International Conference on Rodent Biology and Management |
| ICRISAT | International Crops Research Institute for the Semi-Arid Tropics |
| IDC | Industrial Development Corporation |
| IGS | Institute for Groundwater Studies |
| IITA | International Institute of Tropical Agriculture |
| INCRoP | Insects on New Crops Programme |
| INTSORMIL | International Sorghum and Millet Research Support Programme |

IPMA

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|-------|--|
| IPMA | International Project Management Association |
| IPMP | Intensive Project Management Programme |
| IRDP | Institutional Research and Development Programme |
| IRWH | In-field Rainwater Harvesting |
| IUCr | International Union of Crystallography |
| IUMS | International Union of Microbial Societies |
| IUPAP | International Union of Pure and Applied Physics |

J

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|-----|----------------------------------|
| JFM | Journal of Facilities Management |
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L

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| LExEn | Life in Extreme Environments |
|-------|------------------------------|

M

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|---------|---|
| MIRCHEN | Microbiological Resources Centre |
| MIT | Massachusetts Institute of Technology |
| MRM | Mineral Resource Management |
| MSA | Master's Degree in Sustainable Agriculture |
| MSSA | Microscopy Society of Southern Africa |
| MUCPP | Mangaung University Community Partnership Programme |
| MURP | Master's Degree in Urban and Regional Planning |

N

| | |
|--------|---|
| NaCOF | National Climate Outlook Forum |
| NAFU | National African Farmers Union |
| NAMC | National Agricultural Marketing Council |
| NASA | National Aeronautics and Space Administration |
| NASSP | National Astrophysics and Space Science Programme |
| NCEE | National Council for Economic Education |
| NDA | National Department of Agriculture |
| NECSA | National Energy Commission of South Africa |
| NELSAM | Natural Earthquake Laboratory in South African Mines |
| NERPO | National Emergent Red Meat Producers' Organisation |
| NGO | Non-Governmental Organisation |
| NML | National Metrological Laboratory |
| NMMU | Nelson Mandela Metropolitan University |
| NMR | Nuclear Magnetic Resonance |
| NRF | National Research Foundation |
| NUFU | Norwegian Council of Universities Committee for Development, Research and Education |
| NWGA | National Wool Growers' Association |

O

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| OABS | Optimal Agricultural Business Solutions |
| OECD | Organisation for Economic Co-operation and Development |

P

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|-------|--|
| PARSA | Parasitological Association of Southern Africa |
| PDMIW | Processing and Disposal of Mineral Industry Wastes |
| POT | Peaks over Threshold |
| PPP | Public Private Partnership |
| PRT | Protein Research Trust |

R

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|------|--|
| RICS | Royal Institute of Chartered Surveyors |
| RIEP | Research Institute of Education Planning |
| RNA | Research Niche Area |
| RPO | Red Meat Producers' Organisation |

S

| | |
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| SA | South Africa |
| SAACE | South African Association of Consulting Engineers |
| SAB | The South African Breweries Limited |
| SACI | South African Chemical Institute |
| SACPCMP | South African Council for the Project and Construction Management Profession |
| SACPVP | South African Council for the Property Valuation Profession |
| SACQSP | South African Council for the Quantity Surveying Profession |
| SADC | Southern African Development Community |
| SAFMA | South African Facilities Management Association |
| SAFOI | South African Fryer Oil Initiative |
| SAIP | South African Institute of Physics |
| SAISC | Southern African Institute of Steel Construction |
| SAMSI | Statistical and Applied Mathematical Sciences Institute |

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|----------|---|----------|---|----------|--|
| SANCIAHS | South African National Committee for the International Association of Hydrological Sciences | SEDA | Small Enterprise Development Agency | UNEP | United Nations Environment Programme |
| SANCU | South African National Consumer Union | SMME | Small, Medium and Micro Enterprises | UNESCO | United Nations Educational, Scientific and Cultural Organisation |
| SANPAD | South Africa-Netherlands Research Programme on Alternatives in Development | SRC | Student Representative Council | USA | United States of America |
| SAPOA | South African Property Owners' Association | SRL | Sustainable Rural Livelihood | USAID | United States Agency for International Development |
| SAPS | South African Police Services | SSAG | Society of South African Geographers | UTCHEM | University of Texas Chemical Compositional Simulator |
| SAQA | South African Qualifications Authority | T | | UWC | University of the Western Cape |
| SASAS | South African Society for Animal Science | THRIP | South African National Research Foundation Thrust for Industry-Related Projects | W | |
| SASQUA | Southern African Society for Quaternary Research | TUE | Technical University Eindhoven | WARFSA | Water Research Fund of Southern Africa |
| SAVAH | South African Association of Visual Arts Historians | U | | WATOC | World Association of Theoretically Orientated Chemists |
| SBE | Sustainable Built Environments | UCT | University of Cape Town | WFP | World Food Programme |
| | | UFS | University of the Free State | WITS | University of the Witwatersrand |
| | | UJ | University of Johannesburg | WRC | Water Research Commission |
| | | UK | United Kingdom | WUA | Water Users' Association |
| | | UN | United Nations | | |