IRT and IFPRI funded project

Theme B

Project 1: An analysis of food safety on fresh produce wholesale markets in South Africa: Towards insights for dual standards development

The project assessed food safety concerns and regulatory control mechanisms on wholesale markets in South Africa and addresses the question whether dual standards can be developed which will ensure both adequate food safety and better market access for small scale farmers.

The research seeks to address a number of key questions:

- What are the particular food safety concerns on fresh produce wholesale markets?
- Are there particular challenges related to the enforcement of food safety at wholesale level?
- Does the ownership structure of wholesale markets affect the development, implementation and enforcement of food safety standards?
- How do food safety requirements impact on the organisation and governance of the supply chain?
- Are there already different risk management systems being applied at the different wholesale markets and inside them depending on the customers?
- How does consumer perception of food safety differ in retail versus wholesale markets and is there a link to actual purchasing behaviour?

To date, the research indicates that while the South African regulatory framework for food safety is sufficient, the main concern is with the enforcement of these regulations. Lack of inspections and fragmented mandates lead to significant food safety gaps on fresh produce wholesale markets. The study also indicates how concerns about liability and competitive forces between markets are driving food safety initiatives.

The project will contribute to a deeper understanding of the South African food control system, an area which has received little attention from academic researchers to date.

Project leaders:

Prof Johann Kirsten is Professor and head of the Department of Agricultural Economics, Extension and Rural Development at the University of Pretoria. He completed his MSc Agric (cum laude) at UP and then spent two years in London as South Africa's agricultural attaché.

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He returned to South Africa in 1992 when he joined the University as lecturer, completed his PhD and was appointed to his current position as Head of the Department in 1996.

Prof Kirsten served as a council member of the National Agricultural Marketing Council in South Africa and as the Vice-President of the International Association of Agricultural Economists.

He has published 112 articles in peer reviewed journals as author and co-author and also co-edited four books. A total of 51 master's students and 20 PhD students completed their studies under his supervision.

His main research interests relate to the commercialization of farming in poor communities, land reform, and agricultural policy. In recent years his focus areas also include aspects related to price transmission and the role of market power in supply chains and the economics of origin based foods.

Email: johan.kirsten@up.ac.za

Ms Cerkia Bramley is a qualified attorney and agricultural economist. She is an agricultural and food law specialist with a particular interest in the role of law in food system governance. Ms Bramley is currently a researcher at the Institute for Food, Nutrition and Wellbeing (IFNUW) at the University of Pretoria.

She completed a master's degree in Agricultural Economics at the University of Pretoria. Her thesis explored the relevance of geographical indications in the South African Agricultural sector.

She has participated in various projects related to the economics and legal dimensions of food quality. Her research interests include intellectual property rights and food law, with particular emphasis on the role of the State in supporting participation in the global food system through appropriate regulatory frameworks.

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Team members:

- Dr Gerrie du Rand – Department of Consumer Science (UP Faculty of Natural and Agricultural Sciences);
- Prof Lise Korsten – Department of Microbiology and Plant Pathology (UP Faculty of Natural and Agricultural Sciences)
- Dr Estelle Bienabe (CIRAD, Agricultural Research for Development, France)

Students

- Mr Thomas Mutengwa
- Ms Brigitte van Dyk
- Ms D Ferreira

Mr Mbulaheni Thomas Matengwe, Mrs Annancietar Gomba, Ms Brigitte van Dyk, Prof Lise Korsten, Dr. Johan Kirsten and Ms Cerkia Bramley

Project 2: Host-pathogen infection models in plant, animal and human systems.

The increase in foodborne disease outbreaks over the past 20 years has resulted in a compromised public health system and placed more pressure on the food supply system requiring compliance with good agricultural and food safety systems. This has resulted in new studies to determine why foodborne pathogens which ultimately affect human health and well-being are increasingly using plants as vehicles.

Water sources contaminated with enteric human pathogens have been identified as the primary cause of contamination in food production systems. This leads to increased risks in the 'water-plant' to 'food-human' continuum, and highlights critical questions that require interdisciplinary research teams to resolve.

Food safety compliance in the "farm to the fork" supply chain is the main focus of the research programme together with the development of a strong national food safety research and diagnostic framework. It addresses various facets of food safety including microbiological and agricultural chemical aspects in the supply chain.

Through this project, which brings together researchers from a number of complementary fields, the Institute will contribute to more effective food control measures.

Interactive research

The primary aim of the project is to establish an interactive research and disease diagnostic platform within the Institute for Food Nutrition and Well-being. This will ensure that scientists from various disciplines can integrate research activities within a common theme of water, plant, food, animal and human health, addressing

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food safety and biosecurity challenges in South Africa.

The research question is to determine the potential of *Eschericia coli* to internalise plants and pose a food safety risk for the consumer. An interactive research platform is being established to share knowledge, techniques and equipment of importance in food safety research. This will be supported by a data bank of facilities, equipment, test methods and culture collections.

By centralising bacterial cultures and sharing isolates the various research groups will be strengthened and it will allow for a greater integration of research activities.

Contribute to food safety

The outcomes of the research will contribute to food safety and the rights of communities to have access to safe, nutritious and adequate food supplies.

The duration of this project is three years, with an initial period devoted to literature review and the development of test methods, collection of isolates and the establishment of a central databank of expertise, methods used and a cultural collection of critical isolates.

Project leader:

- Prof Lise Korsten **(see profile on page 35)**

Team members:

- Prof Elna Buys – Department of Food Science (UP Faculty of Natural and Agricultural Sciences)
- Dr Juan Vorster – Department of Plant Production and Soil Science (UP Faculty of Natural and Agricultural Sciences)
- Prof Riana Bornman – Department of Public Health (UP Faculty of Health Sciences)
- Mr Alan Hall, Central Microscopy Unit (UP Faculty of Natural and Agricultural Sciences).

Student supported by the project:

- Ms Willeke de Bruin (PhD Plant Pathology)

From left to right: Ms Willeke de Bruin, Prof Elna Buys and Prof Lise Korsten

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BASF/DAFF-funded project

Project 3: Green Chemistry

'Green chemistry' is the study and research of chemical processes and methods that limit the use of hazardous substances emitted into the environment. The objective is to design molecules, materials and chemical processes that are sustainable and safer for human health and the environment.

The University of Pretoria has established a relationship with the Department of Agriculture, Forestry and Fisheries (DAFF) and a contractual agreement with BASF (previously Becker Underwood) for scholarships and supportive research programmes.

This initiative will train and develop emerging scientists in the field of eco- and mammalian toxicology with a special emphasis on risk assessments. It also focuses on pesticide regulatory science in fields of plant pathology, entomology, weed science, agronomy and soil science.

The DAFF will fund eight master's bursaries which will include internship and special skills development programmes, while BASF, will fund the supportive research programmes in biological and chemical technologies, agricultural product research and development.

The future growth of 'Green Chemistry' is central to the national innovation and skills development and this project will contribute to efforts to promote sustainable scientific practices in South Africa.

Talented young people

The aim of the partnership is to develop talented young people who will have a positive impact on the country and continent and to build awareness and expertise in the utilisation of sustainable biological technologies in agriculture.

Through a strategic alliance with industry partner, BASF, the IFNuW will develop capacity and train students in agricultural green chemistry science and technology for crop protection and animal health.

In support of this project the DAFF recently established a capacity-building programme within the regulatory science field. This will contribute to the development of scientists in the field of eco- and mammalian toxicology with special emphasis on risk assessments.

BASF provided funding for the promotion of agricultural studies at the University of Pretoria. Financial support will be provided to eight Master of Science students linked to research programmes funded by the company BASF.A Green Chemistry workshop was hosted by the UP in September 2013 with funding from the Department of Science and Technology and the Fresh Fruit Exporters Forum: Post-harvest Innovation Fund.

Sustainable platform

Through this project a sustainable green chemistry platform has been created at the University of Pretoria bringing together the multi-disciplinary skills and knowledge of researchers from animal sciences, veterinary sciences, plant pathology, weed science and entomology.

Access to this large pool of scientists will contribute to the training and development of young professionals in the fields of agricultural chemical product research, development, registration and regulation.

The research conducted will provide valuable inputs into the broader concept of pesticide regulatory control. Participants in the project will contribute to technical input into issues relating to governance, regulatory control and the development of green technologies.

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The 'green chemistry' platform represents an open-ended source of technical experts that can advise regulators on issues pertaining to the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act no. 36 of 1947) and provide linkages and mentorship programmes for post-graduate students working in the field of regulatory science and agriculture.

Project leader:

- Prof Lise Korsten **(see profile on page 35)**

Team members:

- Prof Francien Botha – Department of Paraclinical Sciences (UP Faculty of Veterinary Science);
- Prof Kobus Eloff – Department of Paraclinical Sciences (UP Faculty of Veterinary Science);
- Prof Nico Labuschagne - Department of Microbiology and Plant Pathology (UP Faculty of Natural and Agricultural Sciences);
- Prof Zeno Apostolides – Department of Biochemistry (UP Faculty of Natural and Agricultural Sciences);
- Prof Kerstin Kruger – Department of Zoology and Entomology (UP Faculty of Agricultural and Natural Sciences);
- Dr Lyndy McGaw – Department of Animal Health (UP Faculty of Veterinary Science);
- Prof Tiaan de Jager – Department of Public Health (UP Faculty of Health Sciences);
- Prof Egmont Rohwer – Department of Chemistry (UP Faculty of Natural and Agricultural Sciences);
- Dr Natalie Aneck-Hahn – Department of Urology (UP Faculty of Health Sciences);
- Prof Anita Michel – Department of Animal Health (UP Faculty of Veterinary Science).

Students supported by the project*:*

- Ms Pheladi Makgolane (MSc Plant Pathology);
- Ms Stella Nembudane (MSc Agronomy);
- Ms Andille Mahlangu (MSc Veterinary Sciences);
- Ms Millicent Motileng (MSc Entomology);
- Ms Roleen La Grange (MSc Entomology);
- Mr Thomas Mutengwa (PhD Plant Pathology).

Project partners:

- The Department of Agriculture, Forestry and Fisheries;
- BASF

Front left to right: Ms Mari-Roleen la Grange, Ms Magalane Makgolane, Ms Zandile Mahlangu, Dr Lyndy McGaw and Ms Millicent Motileng
Back left to right: Prof Nico Labushcagne, Ms Tshiwela Nembudane, Prof Kerstin Kruger, Mr Pieter Louw, Prof Francien Botha, Prof Lise Korsten and Mr Thomas Mutengwe

Project 4: Laboratories at tertiary institutions: "Improving the quality of results"

To ensure greater global participation and more effective trade flows South Africa needs technical infrastructure and a knowledge chain to support the national Standards, Quality, Accreditation and Metrology (SQAM) framework.

Once this technical framework has been established it requires equivalence in measurement systems and in standards to support industrialisation and export trade, provide proof of compliance with technical regulations, product specifications and standards.

There is, thus, a strong need for a national accreditation body, a standardisation body, a metrology system and a technical regulatory framework. For each of these critical domains certain internationally accepted practices are required to ensure mutual recognition and universal acceptance.

South Africa has a national accreditation body, the South African National Accreditation System (SANAS), mandated to accredit conformity assessment bodies namely certification bodies, testing laboratories and inspection services in terms of the Accreditation for Conformity, Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006). Although the SA accreditation system is well-developed and internationally recognised, it is still necessary to raise awareness about accreditation and the role of SANAS. Furthermore it is important to expand the human capacity and expertise required in accreditation as the needs are continuously growing. A specific need exists to establish an awareness programme within academic institutions to foster their knowledge and skills in the technical infrastructure for the country.

In addition, inadequate human capacity and expertise in accreditation hamper future growth in trade. There is a need to establish an awareness programme within academic institutions to foster knowledge, build human capacity and skills in the technical infrastructure of the country's accreditation system.

Knowledge platform

The "Laboratories at Tertiary Institutions: Improving the quality of results" programme was therefore established to create a knowledge platform and partnership with academic institutions such as Pretoria University to build their capacity and understanding of laboratory accreditation to contribute to improve research results as well as laboratory results of their commercial laboratories.

The purpose of this agreement is to engage academia to train junior lecturers and students in laboratory accreditation, create accreditation awareness in research and train technical assessors for the country.

A Memorandum of Understanding was established between SANAS and UP and four bursaries were awarded to undergraduate students:

- Ms F. Abdool-Khader
- Ms Carien Du Toit
- Ms Khrystyne Hill
- Mr Olivam Monakali

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SANAS-funded project

An important impact of the project will be to strengthen the technical competence and human competence in the diagnostic laboratory capacity within the agriculture and food environment. The partnership with SANAS will support the objectives of excellence in research within the IRT.

This project will stimulate awareness within academic institutions to foster knowledge, build human capacity and skills in the technical infrastructure of the country. A revitalised national accreditation system will provide a crucial framework for the growth of a knowledge-based economy in South Africa.

Project leader

Prof Lise Korsten **(see profile on page 35)**

Team members:

- Ms Anette Durand - Quality Assurance Officer Paraclinical Science (UP Faculty of Veterinary Science)
- Dr Mapitsi Thantsha – Department of Microbiology and Plant Pathology (UP Faculty of Natural and Agricultural Sciences)
- Dr Francien Botha – Department of Animal and Wildlife Sciences (UP Faculty of Veterinary Science)
- Dr Akinbowale Jenkins – Department of Veterinary Tropical Diseases (UP Faculty of Veterinary Science)
- Prof Elna Buys – Department of Food Science; (UP Faculty of Natural and Agricultural Sciences);
- Prof Egmont Rohwer - Department of Chemistry (UP Faculty of Natural and Agricultural Sciences);
- Dr Yvette Naudé - Department of Chemistry (UP Faculty of Natural and Agricultural Sciences);
- Prof Zeno Apostolides – Department of Biochemistry (UP Faculty of Natural and Agricultural Sciences).

Front left to right: Ms Carien du Toit (SANAS bursary holder), Dr Lyndy McGaw, Ms Khrystyne Hill (SANAS bursary holder), Prof Lise Korsten and Prof Zeno Apostolides

Back left to right: Dr Francien Botha, Mr Olwam Monakali (SANAS bursary holder) and Ms Anette Durand

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Project 5: The evaluation of the risks associated with the use of rainwater, harvested from rooftops for domestic use and homestead food gardens; and groundwater for domestic use and livestock watering.

(Water Research Commission: Project 2012 KSA 4)

The harvesting of rainwater from rooftops for domestic consumption is widely regarded as an ecologically friendly approach to address the country's critical water shortages.

Water collected in this manner can be used for domestic purposes, human consumption and to irrigate food gardens. Food gardens are increasingly being promoted as sustainable projects to promote food security among urban and rural communities, create jobs and provide access for emerging producers into the broader market supply chain.

However, there are certain important safety concerns that must be investigated and addressed before the use of such water is promoted.

It is essential to determine the potential level of microbiological risks associated with water collection systems. Harvested rainwater is commonly stored in large plastic containers. The ability of micro-organisms to proliferate in such water storage containers is well documented but the quality of such harvested and stored water is not well known.

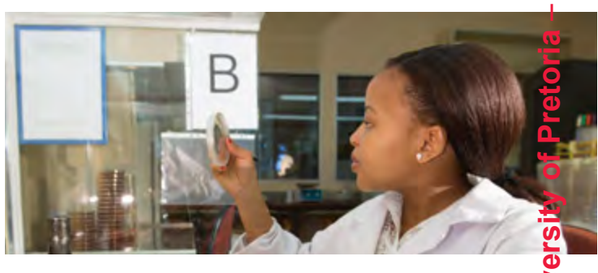
Quite often dust, bird droppings, chemical leachates from the roof material, adhesives, and coatings and other contaminated material are washed down from the roofs after heavy rain storms. This water that is collected in containers poses a potential serious risk for consumers.

The water quality is, thus compromised by the method used for collection.

Water quality

In addition, biofilms may develop in the storage unit and further deteriorate the water quality. This is of particular importance since it is known that waterborne pathogens may survive, proliferate and shed into the waterways thereby contributing to the contamination risk.

The risks posed by inorganic water quality constituents (WQC) to livestock have been studied in various scenarios in South Africa since 1990 with the focus on groundwater. The results showed that there is the potential for high risks to livestock and rural communities.



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However, the risks attributed to naturally occurring WQC in groundwater are not generic, but are associated with the type of livestock, the livestock production system (LPS), the geographic location, the physiological condition of the livestock and the inorganic constituent being ingested.

An assessment of the risks led to the publication of Guidelines for LPS as an easy, handy reference document. Further research went into the development of a software system as a useful tool to assess risk by coupling the biological attributes of livestock, the physical attributes of the environment and the ingestion rate of the WQC. This resulted in the development of a constituent ingestion rate risk assessment (CIRRA).

The recent research has progressed to the point where the Guidelines need to be updated and republished. This project should eventually also lead to a revision of the CIRRA software programme.

The project is being approached in a multi-disciplinary context with the main focus on the microbiology of rain harvested from roof tops commonly used in food gardens. The project will also focus on the quality of surface water mixed with rain harvested water and used in livestock production for small scale farmers and human user groups.

The project has two components:

- Microbiological water quality of rain-harvested water used in food gardens led by Prof Lise Korsten.
- Water quality constituents (WQC) regarding livestock production systems (LPS) and human user-groups led by Prof Norman Casey.

Project leaders

- Prof Lise Korsten **(see profile on page 35)**

Prof Norman H Casey attained the BSc (Agric) and MSc (Agric) degrees at the University of Natal and the DSc (Agric) at the University of Pretoria. In 1979, he accepted an academic appointment at the University of Pretoria in animal production physiology.

As professor, he was the Head of the Department of Animal and Wildlife Sciences, from 1992 to 2005. He is chairperson of the Ethics Committee of the Faculty of Natural and Agricultural Sciences and sits on the Senate Committee on Research Ethics and Integrity. He is Honorary President and a former President of the South African Society of Animal Science and is a Ministerial appointee on the Council for Natural Scientific Professions.

Prof Casey is a former President of the Congress of the World Association of Animal Production, was Vice-president of the International Goat Association and chaired the 8th International Conference on Goats and 9th International Symposium on Ruminant Physiology.

He has received awards for research and academic excellence and for services to the Animal Science profession. He serves on the editorial boards of *Livestock Science, Small Ruminant Research* and the *SA Journal of Animal Science*. He has 69 scientific peer reviewed publications, 80 conference proceedings and presentations, 22 books and reference manuals, 38 contracted scientific reports and has supervised 62 MSc and PhD candidates.

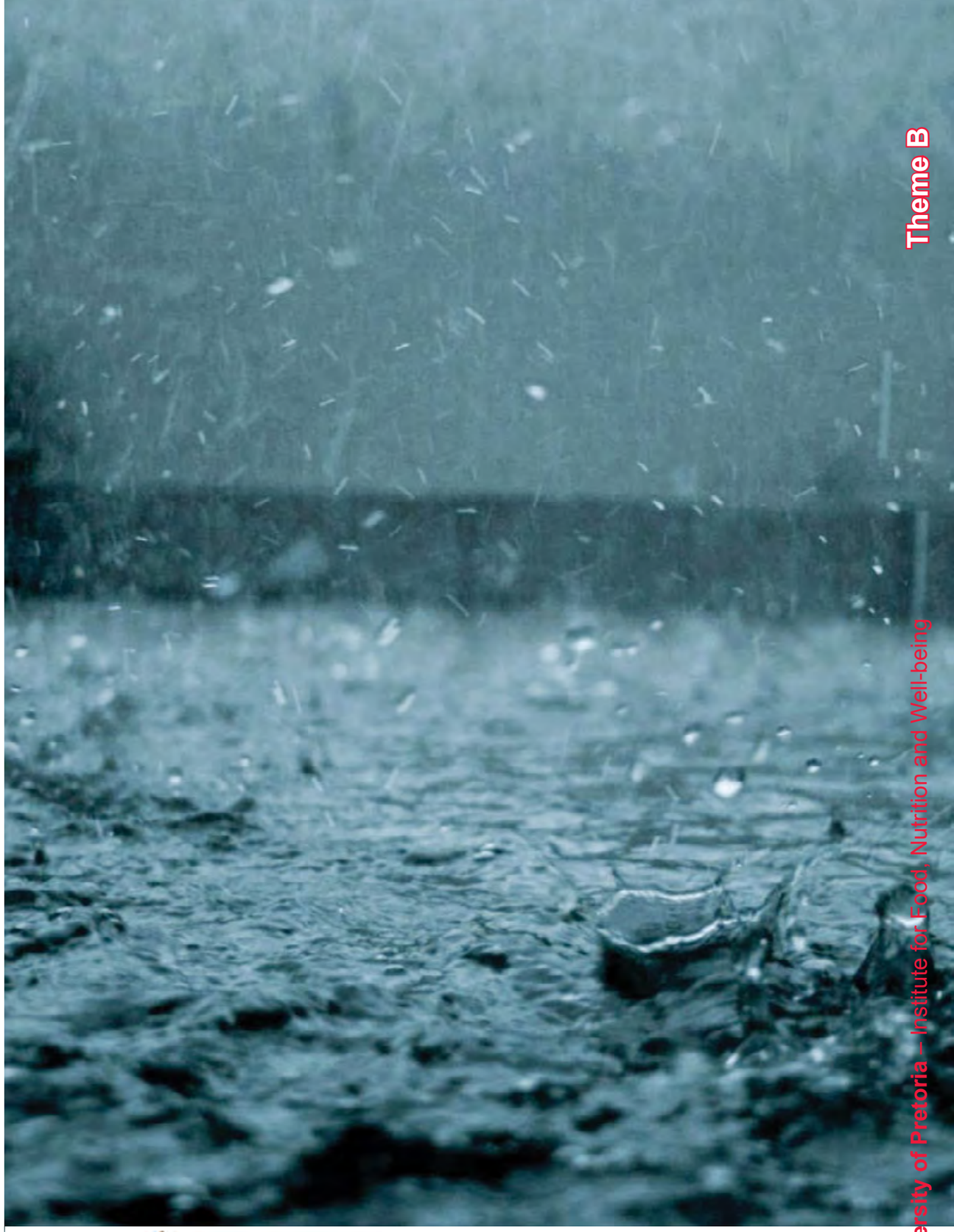
Prof Casey has more than 20 years of experience in livestock science and water quality. He has done extensive research on water quality and its effect on animal health and has written guidelines and easy to use hand reference documents.

Team members:

- Dr Jan Myburgh – Department of Paraclinical Sciences (UP Faculty of Veterinary Science);
- Prof Elna Buys – Department of Food Science (UP Faculty of Natural and Agricultural Sciences);
- Prof Ronel Ferreira – Department of Education Psychology and Human Nutrition (UP Faculty of Education).

Partner:

- South African Water Research Commission



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