Water-related research projects in agriculture undertaken in South Africa

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WATER RESEARCH COMMISSION

TT 503/11

Water-related research projects in agriculture undertaken in South Africa

Report to the
Water Research Commission

by

Frost and Sullivan International

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The publication of this report emanates from a short-term project entitled: Project to develop a database of all water-related research in agriculture currently undertaken in South Africa (Project No K8/951//4)

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1 Introduction

The Water Research Commission (hereafter referred to as WRC) is a statutory organisation established in 1971 by an Act of Parliament. The organisation represents a dynamic hub for water-centred knowledge, innovation and intellectual capital. The WRC provides leadership for water-related research and development through the support of knowledge creation, transfer and application.

The mandate of the WRC consists of the following:

- Promoting co-ordination, communication and co-operation in the area of water research and development;
- Establishing water research needs and priorities;
- Stimulating and funding water research according to priority;
- Promoting the effective transfer of information and technology;
- Enhancing knowledge and capacity building within the water sector.

One of the WRC's recent initiatives has been to identify and quantify all water research projects that relate to agriculture in South Africa. This initiative was aligned with the Key Strategic Area (KSA): Water Utilisation in Agriculture, which concentrates on increasing the efficient use of water for production of food, fibre, fuel and forage; ensuring sustainable water resource use; reducing poverty and increasing the wealth of people dependent on water-based agriculture.

The WRC Director: Water Utilisation in Agriculture, initiated this project to develop a database of all water-related research in agriculture undertaken in South Africa during the year 2010. A key driver behind this project was the fact that little of this information is publicly accessible. Initiatives of this nature are important because they promote coordination, improve collaboration between research organisations, encourage greater transparency, particularly with regards to research funding and dissemination of information.

The WRC required an independent study and hence it commissioned international research and consulting company Frost & Sullivan to gather the project data and collate this short report of the key project findings.

1.1 Aim and Objectives

The aim of this project was to develop a database of all water-related research projects in agriculture being undertaken in South Africa during 2010.

In the context of the above aim, the project objectives are outlined in the figure below:

Figure 1: Project objectives

1.2 Project Scope

This project analysed water-related research studies conducted by various organisations that fall within the KSA research project portfolio. Sub-sectors that fall within the scope of the project include:

- Irrigated agriculture
- Rain-fed (dry-land) agriculture
- Woodlands and forestry
- Grasslands and livestock watering
- Freshwater aquaculture and inland fisheries

The **primary objective** of research on Water Utilisation in Agriculture is to increase household food security and to improve the livelihoods of people on a farming,

community and regional level through efficient and sustainable utilisation and development of water resources in agriculture.

The **secondary objectives** are to:

- Increase biological, technical and economic efficiency of water use
- Reduce poverty through water-based agricultural activities
- Increase profitability of water-based farming systems
- Ensure sustainable water resource use through protection and reclamation practices

Water users in all the above-mentioned subsectors as well as organisations such as Water User Associations, co-operatives, agri-businesses and government departments serving water users, are the clients or target groups of the research output. The point of departure of applied research is therefore the real-life problems experienced primarily by water users and related organisations, for irrigated and rain-fed crop production, fuel-wood and timber production as well as livestock and fish production. The problems which may be experienced in practice for any aspect of water use on the farm, irrigation scheme or river catchment vary from non-existence of knowledge, doubt regarding the applicability of existing knowledge, deviation of empirical observations from some relevant theoretical optimum, to an unclear outcome of possible alternative decisions and actions.

Research as a dynamic problem-solving and creative process to exploit opportunities, must provide information, technologies and models, which can be applied by present and future generations of water users. The overall objectives are to utilise scarce water resources efficiently, beneficially and sustainably to increase household food security and farming profitability, and thereby increase economic and social welfare, i.e. efficient growth and equitable distribution of wealth on a farming, local community and regional level. These objectives must be achieved through the creation of knowledge by means of research and dissemination of knowledge, technology transfer, training and extension. Traditionally contributions are made by scientists in applied disciplines or focus areas of soils, crops, engineering, climatology, economics and sociology. Increasingly, however, the complexity of the information needs of water users requires a multidisciplinary or interdisciplinary research effort. In all instances the priorities are enhancement of management abilities in order to improve the efficiency of water utilisation for food production in the agricultural value chain (Water Research Commission, 2011).

The geographic scope of the project is limited to South Africa. All projects analysed were active in 2010. This includes projects that started prior to 2010 and projects that have completion dates beyond 2010.

1.3 Project Methodology

The project was carried out using primary research (distributing questionnaires under a covering letter by e-mail, followed-up by telephone or face-to-face interviews) as the principal method of data gathering. The focus of the interviews predominantly included the respondent types outlined in the figure below.

Primary Participants	Other Respondent Groups
Interviews with primary participants involved: ▪ Universities ▪ Science councils ▪ Government departments ▪ Private organisations (for example Growers Associations or Consulting Firms)	Interviews with other participants involved: ▪ Academics ▪ Researchers ▪ Heads of Department ▪ Individuals

Figure 2: Project methodology

All respondents listed in Appendix III were initially contacted via an emailed letter contained in Appendix I. This email was then followed up with a telephone call. Based on this call, it was determined whether the organisation had any water-related research projects, or if a contact person was available to provide details of any water-related research. Certain organisations were unable to provide contact persons who had knowledge of relevant projects, while other organisations were unavailable for further discussions. Contact persons that indicated they were willing and available to provide project information were sent the questionnaire detailed in Appendix II. Contact was made with Deans of Faculties of Agriculture; Research Institute Managers of Science Councils; Heads of Provincial Government Departments and Heads of

Private Research Organisations. Two to three follow-up calls were then made to all respondents emailed. Some contacts responded with project information while some did not respond despite frequent phone calls.

Total respondents contacted via phone *	145
Total respondents emailed who were willing and able to participate	91
Total respondents contacted who did not respond	42
Total respondents contacted who did not have any water related research	12

Figure 3: Summary of interviews conducted

*** Most respondents were contacted on more than one occasion to verify specific data.**

Challenges Faced During Primary Interviews

Certain challenges were experienced during the primary data gathering phase of the project. The information being sought was generally difficult to find in the public domain. There was a complex communication chain within organisations, while a standardised database of water-related research projects per organisation was absent. Furthermore, it was problematic obtaining the information from certain organisations. These organisations either were not able to prioritise the task of gathering the project data or the data was not easily accessible.

2 Research Overview

2.1 Background to the KSA – Water Utilisation in Agriculture

In the Key Strategic Area (KSA) on Water Utilisation in Agriculture, research focuses on challenges that relate to water utilisation in agriculture through applied research and knowledge dissemination. The key focus of this KSA is to increase the efficient use of water for the production of food, fibre, fuel and forage crops, ensuring sustainable water resource use, poverty reduction and increasing the wealth of people dependant on water based agriculture.

Research thrusts and programmes that meet these broad goals can thus be placed into four key groupings:

- Thrust 1 – Water utilisation for food, forage and fibre production
- Thrust 2 – Water utilisation for fuelwood and timber production
- Thrust 3 – Water utilisation for poverty reduction and wealth creation in agriculture
- Thrust 4 – Water resource protection, restoration and reclamation in agriculture

Research programmes and projects placed within these groupings attempt to address the challenges of water utilisation in agriculture. Specific programmes that further define these thrusts include the following:

THRUST 1: WATER UTILISATION FOR FOOD, FORAGE AND FIBRE PRODUCTION

Scope: The direction and driving force for research activities and outputs are determined by the strategic focus to improve the knowledge of the processes of production of field, horticultural and industrial crops.

Water productivity can be increased by producing more with the same use of water or by producing the same with less use of water. This requires understanding of water dynamics in the soil-water-plant-atmosphere continuum, the equipment which is used and the method of production which is followed. Research on all these aspects can contribute to higher water use efficiency in agriculture.

Various processes and factors, which are site-specific, have an influence on the quality of water for crop, livestock and fish production. Significant shortcomings exist in the assessment of the fitness-for-use of water sources and identifying water related production problems. The emphasis in this programme is on the efficient use of water and management of water quality for irrigation of crops, livestock watering and aquaculture in rivers, ponds and dams.

This thrust includes two programmes:

- Water-efficient production methods in relation to soils, crops and technology in rain-fed and irrigated agriculture
- Fitness-for-use of water for crop production, livestock watering and aquaculture

THRUST 2: WATER UTILISATION FOR FUELWOOD AND TIMBER PRODUCTION

Scope: The direction and driving force for research activities and outputs are determined by the strategic focus to improve the knowledge of the processes of production of trees in woodlands, plantation forestry and trees planted in combination with food and forage crops.

In catchment areas where trees are a prominent feature of land use, runoff and deep percolation of water can be reduced. Management of these so-called streamflow reduction activities necessitates an understanding of the water use by trees and the competitive or complementary relationship of water use by trees and water use by staple food and forage crops. Due to research specialisation, separate attention is given in this programme to increase the efficiency of water use by trees in woodlands and plantations for fuel-wood and timber production.

This thrust includes one programme:

- Water-efficient production methods and systems in agro-forestry, woodlands and forestry plantations

THRUST 3: WATER UTILISATION FOR POVERTY REDUCTION AND WEALTH CREATION IN AGRICULTURE

Scope: The direction and driving force for research activities and outputs are determined by the strategic focus to improve the knowledge of the management processes undertaken by people who are using water.

Poverty, hunger and malnutrition amongst rural people are widely recognised as major problems. These members of rural communities, consisting mainly of women, children and the elderly, are also disadvantaged or marginalised for various social, economic and political reasons. A wide-ranging programme is required to support the sustainable development of rangeland livestock, rain-fed and irrigated crop production. Efficient use of water through a combination of agricultural activities can contribute to improving living conditions. Empowerment of rural people can be promoted further through participatory action research which improves knowledge, farming skills and leadership capabilities.

Commercial farming is a major user of water resources and faces a particular challenge to ensure that this share of water is used effectively and efficiently. There is invariably a close link between efficient use and allocation of water and whole-farming profitability. Water management on farms is also time-dependent and based on incomplete knowledge of changes in the weather, prices and technology. Under these circumstances modelling is a powerful tool to provide decision-support and management advice. The focus in this programme is therefore on developing procedures, methods and models to provide advice to farmers on best management practices and the optimal combination of crop and livestock enterprises within the constraints of water, land and capital resources.

This thrust includes two programmes:

- Sustainable water-based agricultural activities in rural communities
- Integrated water management for profitable farming systems

THRUST 4: WATER RESOURCE PROTECTION, RESTRORATION AND RECLAMATION IN AGRICULTURE

Scope: The direction and driving force for research activities and outputs are determined by the strategic focus to improve the knowledge of the natural processes and people-induced impacts of resource use.

With cultivation and irrigation, larger quantities of salts present in the soil and lower strata could be mobilised. Increasing salinity levels and higher water tables threaten the sustainable use of soil and water. Knowledge and tools to manage the quantity and quality of water resources for agricultural production are therefore required. The focus of research is on developing methods and models to manage water distribution and prevent water resource degradation.

Agricultural decisions to use land and to conserve rainfall or to abstract water from rivers, dams and boreholes, has wide-ranging impacts on the natural environment. Intensification of crop and livestock production processes can potentially contribute to higher levels of chemical residues of fertilisers, pesticides and herbicides in surface and groundwater. Precautions must be taken as part of the agricultural production process to protect the terrestrial and aquatic ecosystems. This requires an understanding of

the negative impacts of agriculture and guidelines for an assessment and mitigation of those impacts.

This thrust includes two programmes:

- Sustainable water resource use on irrigation schemes and within river catchments
- Impact assessment and environmental management of agricultural production (Water Research Commission, 2011)

3 Research Findings

3.1 Introduction

The focus of the analysis was to identify and quantify all water research projects that relate to agriculture in South Africa during the year 2010. This includes projects that commenced prior to 2010 and projects that have completion dates beyond 2010. Project data was obtained from various organisations conducting water research in agriculture across South Africa. Key data points collected included:

- Research organisation and division
- Project title
- Project leader and their contact details
- Project objectives and deliverables
- Project timelines
- Agriculture sub-sector
- Value of project funding
- Funding sources

The collated data was captured within an Excel spreadsheet and analysed according to the following categories:

- Funding source
- Research organisation
- Agriculture sub-sector

The data was researched as a complete dataset as well as within each research thrust area, as defined by the WRC. The results of this analysis are contained herein this report.

The full dataset collected during this project is included in the CD on the back cover of this report and the questionnaire is in Appendix II.

3.2 Total Project Database Analysis

Agriculture Sub-sector Analysis

A total of 65 projects were identified with research funding totalling R208 498 584.15. The majority of the projects identified, both in terms of project number (60%) and funding value (47%), fell within the research sub-sector of irrigated agriculture. A large portion of the funding value (28%) for a small number of projects (9%) falls under the woodlands and forestry sub-sector. This is because of the DWEA Working for Water project that had a high project funding value (R44 662 959.00), which skews the results.

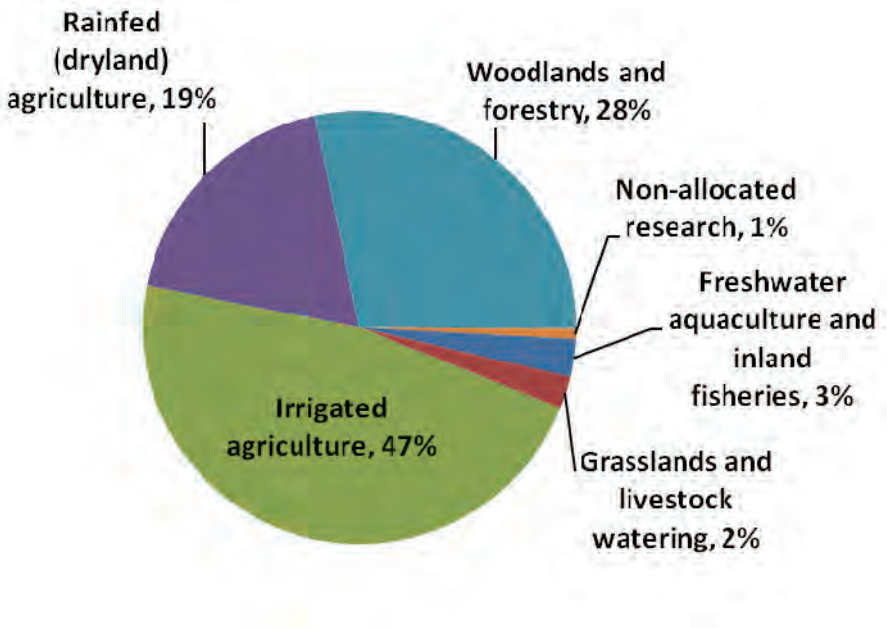

Figure 4: Total research funding segmented by agriculture sub-sector

Table 1: Total project number and funding value by agriculture sub-sector

Agriculture Sub-sector	Number of projects (%)	Funding Value
Irrigated agriculture	39 (60%)	R98 057 626.48
Rainfed (Dryland) agriculture	15 (23%)	R38 689 206.67
Woodlands and forestry	6 (9%)	R59 262 059.00
Grasslands and livestock watering	1 (1.5%)	R5 000 000.00
Freshwater aquaculture and inland fisheries	3 (5%)	R5 930 000.00
Non-allocated research	1 (1,5%)	R1 559 692.00
Total	**65 (100%)**	**R208 498 584.15**

Research Thrust Analysis

Of the total number of projects identified, 26 projects (40%) fall within Thrust 1, while this only represents 25% of all projects in terms of funding value. Thrust 2 represents the smallest share, both in terms of the number of projects and the total project funding value at 6% and 5% respectively. Thrust 3 includes 31% of projects and 26% of funding value. Thrust 4 represents the largest share of projects by funding value (44%), but only represents 15 projects (23%) in total. This is again caused by the high project funding value of the DWEA Working for Water project.

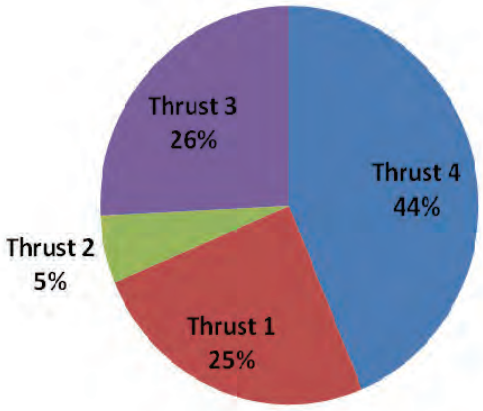

Figure 5: Total research funding segmented by research thrust

Table 2: Total project number and funding value by research thrust

Thrust No	Thrust description	Number of projects (%)	Funding Value
1	Water utilisation for food, forage and fibre production	26 (40%)	R52 055 647.67
2	Water utilisation for fuelwood & timber production	4 (6%)	R11 495 351.00
3	Water utilisation for poverty reduction & wealth creation in agriculture	20 (31%)	R53 778 288.00
4	Water resource protection, restoration and reclamation in agriculture	15 (23%)	R91 169 297.48
Total		**65 (100%)**	**R208 498 584.15**

Research Project Funding Range Analysis

The majority of the projects analysed (13) have funding values of less than 0.49 million. The total value of these projects is R2.8 million. Projects with funding of between R1-1.99 million constitute the second largest number of projects (11) with a total value of R19.6 million. The DWEA Working for Water Programme is the only project with funding of over R10 Million with a value of R44 million.

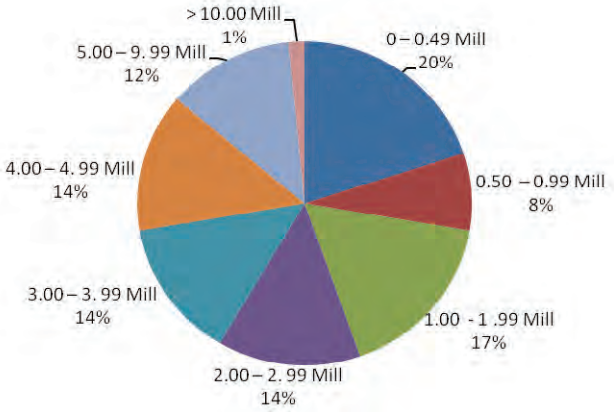

Figure 6: Total research funding range analysis

Table 3: Research projects by funding value range

Funding Range (ZAR Million)	Number of Projects
0-0.49	13
0.50-0.99	5
1.00-1.99	11
2.00-2.99	9
3.00-3.99	9
4.00-4.99	9
5.00-9.99	8
>10.00	1
Total	**65**

Research Organisation Activity Analysis

In terms of project funding value, the Agricultural Research Council (ARC) completed research totalling the highest value (R76 088 351.48). The majority of the funding for ARC projects can be attributed to the WRC (approximately R20 million) and the Working for Water project funded by DWEA (approximately R44 million in total). Amongst universities, the University of KwaZulu-Natal conducts the most funded research (approximately R31 million), followed by the Universities of Pretoria and the Free State respectively, who both conduct research funded at approximately R10 million each. Overall, universities and science council research institutes constitute the bulk of organisations conducting research.

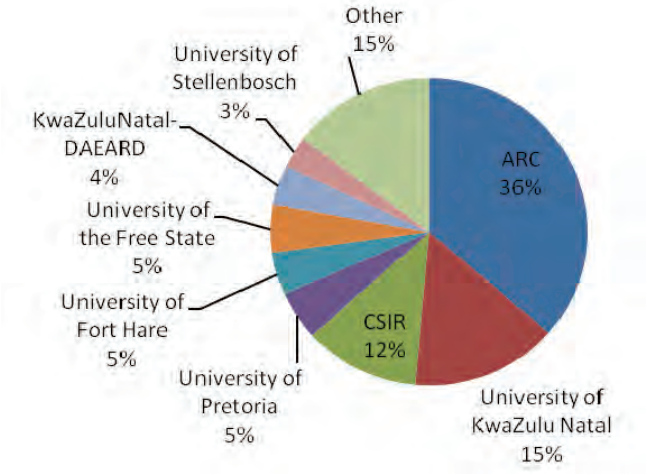

Figure 7: Total research funding segmented by organisations conducting the research

Others include: organisations that have only one ongoing project, these include- North West University, Rhodes University, University of Cape Town, Tshwane University of Technology, University of Venda, AquaGreen consulting, CPH Water and Aurecon.

Table 4: Total project number and funding value by research organisation

Organisation	Number of Projects (%)	Funding Value
ARC	13 (20%)	R76 088 351.48
University of KwaZulu-Natal	12 (18%)	R31 114 529.00
CSIR	8 (12%)	R24 540 276.00
University of Pretoria	4 (6%)	R10 639 200.00
University of the Free State	3 (5%)	R10 490 000.00
University of Fort Hare	2 (3%)	R9 500 000.00
KwaZulu-Natal – DAEARD	3 (5%)	R8 700 000.00
University of Stellenbosch	2 (3%)	R6 912 500.00
Other	18 (28%)	R30 513 727.67
Total	**65 (100%)**	**R208 498 584.15**

Research Funding Analysis

Sixty two percent of the total project funding identified can be attributed to the WRC with research funds of approximately R129.8 million for 43 projects. The Department of Water Affairs represents the second largest source of research funding at approximately R35.7 million for the Working for Water project. The balance of this project's funding was provided by the ARC. The ARC is the third largest funding source with funds totalling approximately R11.1 million. The "other" category constitutes 18 organisations that have total funding of less than R1.5 million per funding source and R9.3 million in total.

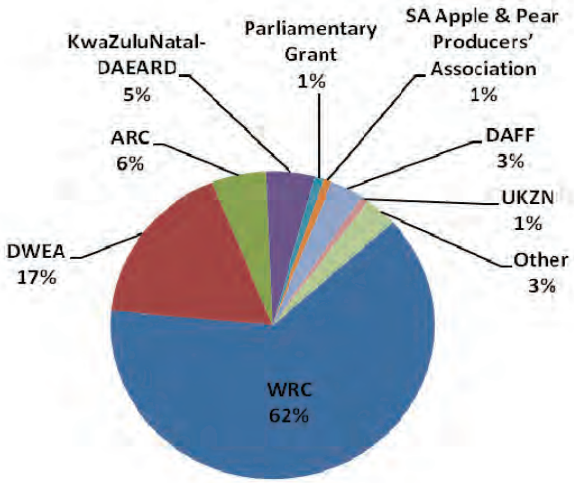

Figure 8: Total research funding segmented by organizations funding the research

Table 5: Total research funding by funding organisation

Funding Organisation	Funding Value
WRC	R129 809 582.00
DWEA	R35 730 367.20
ARC	R11 166 124.62
KwaZulu-Natal – DAEARD	R9 947 753.60
DAFF	R6 800 000.00
UKZN	R2 066 666.67
Parliamentary Grant	R1 856 395.92
SA Apple & Pear Producers' Association	R1 783 596.08
Other*	R9 338 098.07
Total	**R208 498 584.15**

*** "Other" refers to projects that represent less than 4% of total project funding. Funding sources for these projects include: UFS, TUT, Winetech, Citrus Research International, SUBTROP (SA Litchi Growers Association) , Unilever UK , DFPT , ESKOM, Eastern Cape – Department of Agricultural and Rural Development, SASRI, Western Cape Department of Agriculture, Stockholm Environment Institute, SA Litchi Growers' Association, NRF and CUT.**

3.3 Thrust 1 Projects Analysis

Thrust 1 focuses on water utilisation for food and fibre production. One of the key aims of research in this thrust is to promote the efficient use of water and management of water quantity and quality (in particular nutrients and microbial organisms) for irrigation of crops, livestock watering and aquaculture in rivers, ponds and dams.

Research Funding Analysis

The WRC currently funds 67% of the research within this thrust. This represents a total project funding value of just over R34 million. The KwaZulu-Natal Department of Agriculture, Environmental Affairs and Rural Development is the second largest funding source with funds of R6 million. The remaining organisations are much smaller funding sources with total project funding of less than R4 million per organisation.

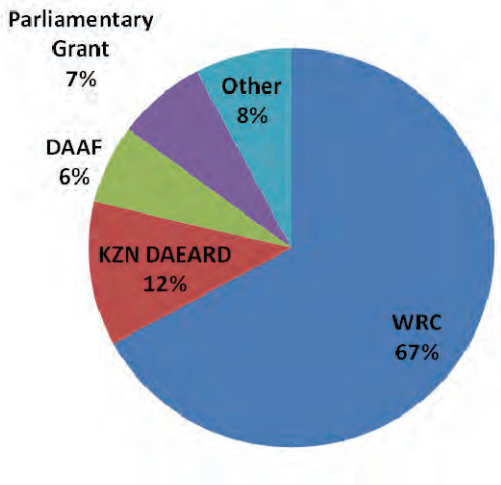

Figure 9: Funding sources for projects in Thrust I

Others include : Citrus Research International, SUBTROP (SA Litchi Growers Association), Unilever UK, Eastern Cape Department of Agricultural and Rural Development, SASRI, Stockholm Environment Institute, SA Litchi Growers' Association, NRF.

Organisational Activity Analysis

The majority of organisations conducting research in Thrust 1 are universities. Science Councils, etc. have the second largest representation with a total of 3 organisations conducting research in this thrust. Growers associations have the smallest representation with only one organisation conducting research within this thrust.

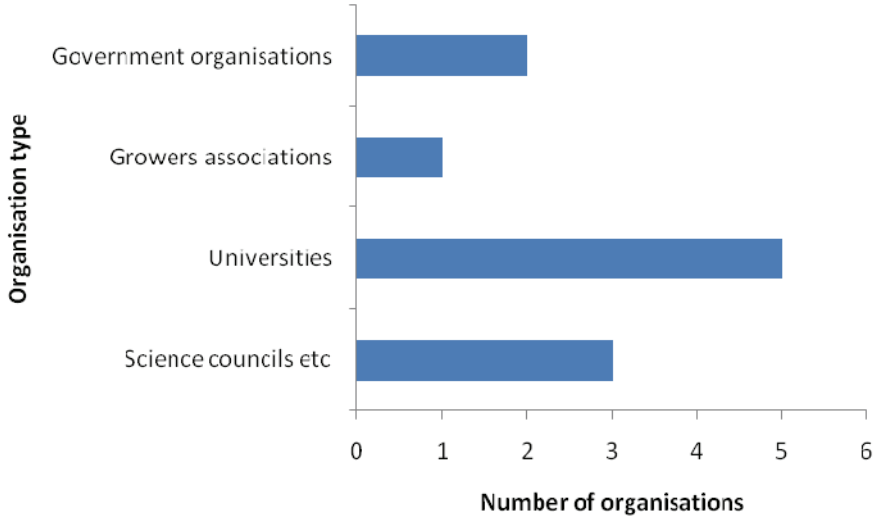

Figure 10: Analysis of organisations conducting research in Thrust 1 based on the number of projects per organisation

Table 6: Organisations conducting research in Thrust 1

Thrust 1	Number of organisations	Types of organisations
Science councils, etc.	3	ARC, Citrus Research International, CSIR
Universities	5	University of KwaZulu-Natal, University of Venda, University of Pretoria, University of Stellenbosch, North West university,
Growers associations	1	South African Sugar Association
Government organisations	2	Eastern Cape-Department of Agricultural and Rural Development, KwaZulu-Natal-Department of Agriculture, Environmental Affairs and Rural Development

Agriculture Sub-sector Analysis

Projects within Thrust 1 fall into 3 sub-sectors: Irrigated agriculture, rain-fed (dryland agriculture) and freshwater aquaculture and inland fisheries. A total of 18 projects fall within the category of irrigated agriculture. This constitutes 72% of all projects in

Thrust 1 based on total project funding value. Rain-fed (dry-land) agriculture represents 25% of the total project funding value with R12.8 million. Organisations conducting research within these 3 sub-sectors include: ARC, CSIR, UKZN, University of Pretoria and other research organisations and universities.

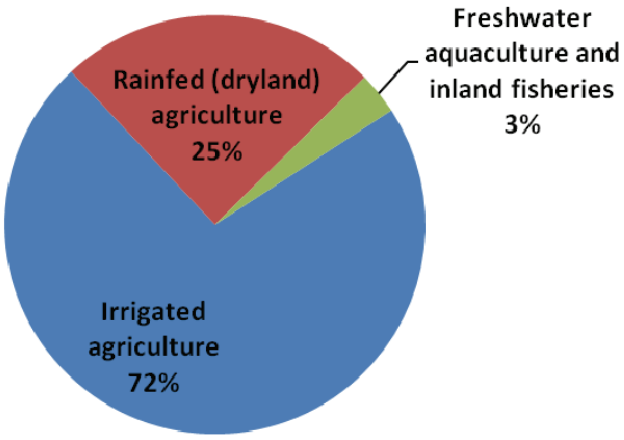

Figure 11: Analysis of agriculture sub-sectors based on the project funding value

Table 7: Thrust 1 total project number and funding by agriculture sub-sector

Thrust I	Number of projects	Project Funding
Irrigated agriculture	18	R37 568 981.00
Rainfed (dryland) agriculture	7	R12 806 666.67
Freshwater aquaculture and inland fisheries	1	R1 680 000.00
Total	**26**	**R52 055 647.67**

3.4 Thrust 2 Projects Analysis

Thrust 2 focuses on water utilisation for fuel and fibre production. One of the key aims of research in this thrust is to increase the efficiency of water use by trees in woodlands and plantations for fuel-wood and timber production.

Organisational Activity Analysis

Thrust 2 has the smallest number of research projects and the lowest total project funding value compared to the other 3 thrusts. Four projects were identified within this

thrust. The WRC funded three of these projects and the Western Cape Department of Agriculture funded the fourth. The CSIR and ASSET Research are the organisations conducting the research. Based on total project funding value the CSIR projects constitute the bulk of projects in Thrust 2.

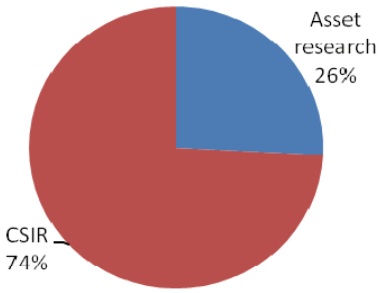

Figure 12: Analysis of organisations conducting research in Thrust 2 based on total project funding value per organisation

Agriculture Sub-sector Analysis

Woodlands and forestry projects constitute 98% of the research projects, with a total value of just over R11 million.

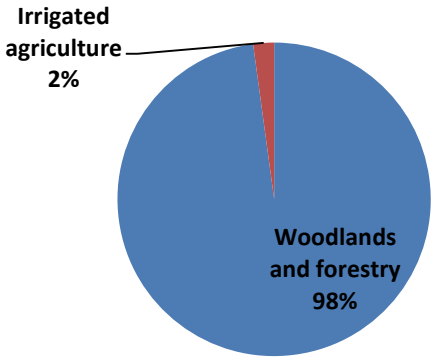

Figure 13: Analysis of sub-sectors based on total project funding value for Thrust 2

Table 8: Thrust 2 total project number and funding by agriculture sub-sector

Thrust 2	Number of projects	Project Funding
Woodlands & forestry	3	R11 249 100.00
Irrigated agriculture	1	R246 251.00
Total	**4**	**R11 495 351.00**

3.5 Thrust 3 Projects Analysis

Thrust 3 focuses on water utilisation for poverty reduction and wealth creation in agriculture. The primary aim of research projects within this thrust is the empowerment of people in rural areas, supporting sustainable farming activities and improving livelihoods. This is achieved by developing procedures, methods and models to provide advice to farmers on the best management practices and the optimal combination of crop and livestock enterprises within the constraints of water, land and capital resources.

Research Funding Analysis

There are a total of 20 research projects within Thrust 3. Eighty-eight percent of total project funding can be attributed to the WRC with a total value of just over R47.1 million. Following the WRC, the KZN Department of Agriculture, Environmental Affairs and Rural Development is the second largest funding source with funds totalling R2.7 million. The ARC is the smallest funding source with total funds of less than R1 million.

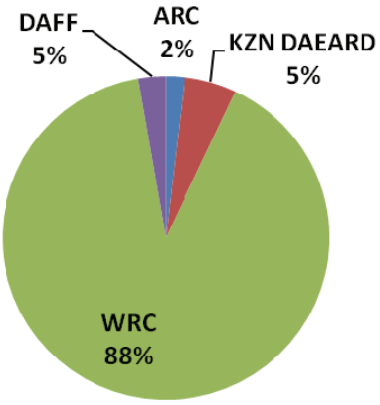

Figure 14: Funding sources for projects in Thrust 3

Organisational Activity Analysis

The organisational activity analysis for Thrust 3 was carried out based on the number of organisations conducting research within this thrust. The majority of the organisations conducting research within this thrust are universities totalling 7 organisations. Science Councils, etc. have the second largest representation totalling 2

organisations (CSIR and the ARC). Other organisations conducting research in this thrust include CPH Water and WSM Leshika (Pty) Ltd. Projects being conducted by these organisations are predominantly WRC funded.

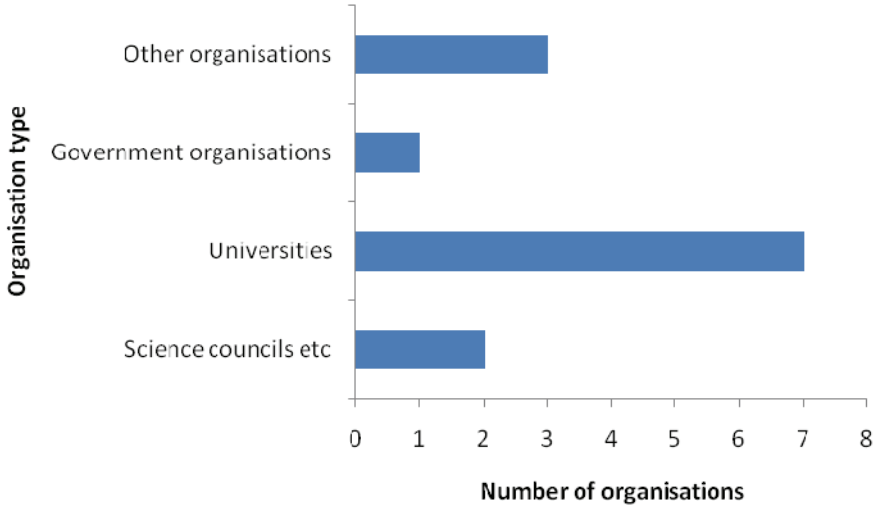

Figure 15: Analysis of organisations conducting research in Thrust 3 based on the number of projects per organisation

Table 9: Organisations conducting research in thrust 3

Thrust 3	Number of organisations	Types of organisations
Science councils, etc.	2	ARC, CSIR
Universities	7	Rhodes University, Tshwane University Of Technology, University Of Fort Hare, University Of KwaZulu-Natal, University Of Free State, Zakhe Agricultural College, University of Pretoria
Government organisations	1	KwaZulu-Natal-Department of Agriculture, Environmental Affairs and Rural Development,
Other organisations	3	CPH Water, Umhlaba Consulting Group, WSM Leshika (Pty) Ltd

Agriculture Sub-sector Analysis

Unlike Thrust 1 and 2, within Thrust 3 there is a good representation of project activity across a range of sub-sectors. The bulk of the research in this thrust is focused on irrigated agriculture. It has a total of 11 projects with a total project funding value of

R27.6 million (51%). The second largest sub-sector is rain-fed (dryland) agriculture with 6 projects with a total value of approximately R20 million (38%).

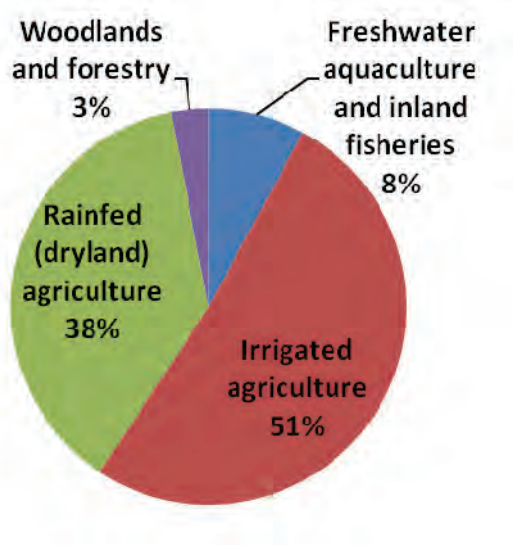

Figure 16: Analysis of agriculture sub-sectors based on total project funding value for Thrust 3

Table 10: Thrust 3 total project number and funding by agriculture sub-sector

Thrust 3	Number of projects	Project funding values
Irrigated agriculture	11	R27 652 288.00
Rainfed (dryland) agriculture	6	R20 226 000.00
Freshwater aquaculture and inland fisheries	2	R4 250 000.00
Woodlands and forestry	1	R1 650 000.00
Total	**20**	**R53 778 288.00**

3.6 Thrust 4 Projects Analysis

Thrust 4 focuses on water resource protection, restoration and reclamation in agriculture. The aim of research in this thrust is to provide an understanding of the detrimental impacts of different sources of pollution (salinisation, sedimentation, nutrient loading, agricultural chemicals), climate change and other agricultural practises. It also includes guidelines for an assessment, adaptation, and mitigation of those impacts.

Research Funding Analysis

The DWEA currently contributes the most funding in Thrust 4 through the Working for Water programme with approximately 52.1% of the funding in Thrust 4. The programme currently runs research projects in all nine of South Africa's provinces focusing on invasive alien plants. The programme also works with government departments including the Departments of Environmental Affairs and Tourism, Agriculture, and Trade and Industry, provincial departments of agriculture, conservation and environment, research foundations and private companies. The WRC contributes the second largest amount with 43% of the total project funding.

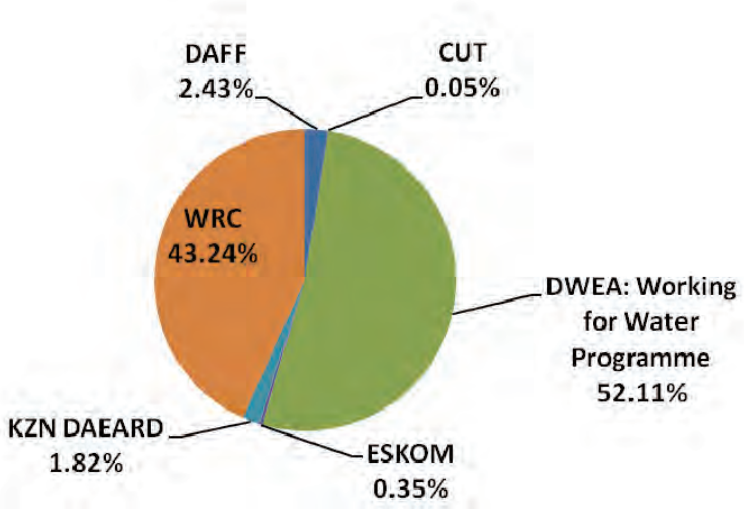

Figure 17: Funding sources for projects in Thrust 4

Organisational Research Activity Analysis

Similar to Thrust 1, 2 and 3, universities constitute the majority of the organisations conducting research in Thrust 4, followed by the research organisations ARC and CSIR. Other organisations conducting research in this thrust include: Aurecon and AquaGreen Consulting.

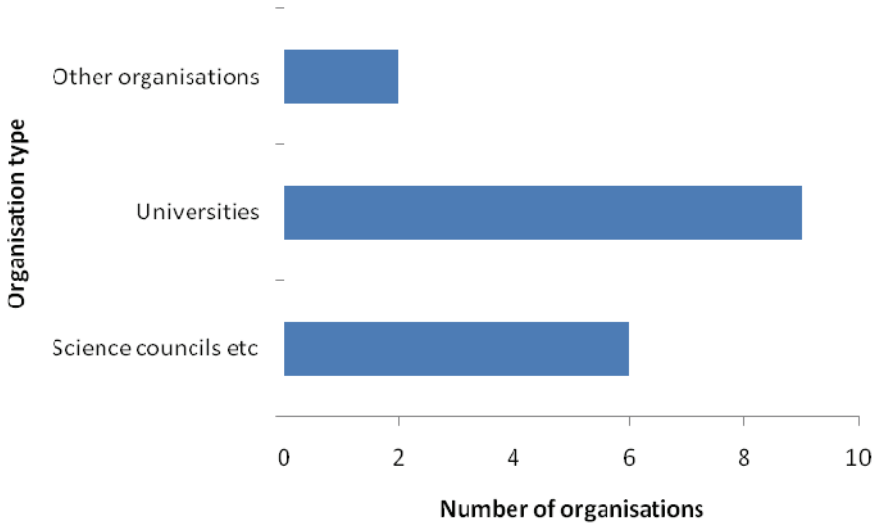

Figure 18: Analysis of organisations conducting research in Thrust 4 based on the number of projects per organisation

Table 11: Organisations conducting research in thrust 4

Thrust 4	Number of projects	Types of organisations
Science councils, etc.	6	ARC, CSIR
Universities	9	University of the Western Cape, University of the Free State, University of KwaZulu-Natal, University of Fort Hare, University of Cape Town, Central University of Technology, University of the Free State, University of Pretoria,
Other organisations	2	Aurecon, AquaGreen Consulting

Agriculture Sub-sector Analysis

Two projects fall within the woodlands and forestry research area. One of these is the DWEA Working for Water Programme that focuses on invasive alien species. This project is valued at just over R44 million and as a result the woodlands and forestry research area constitutes 51% of total project funding. The second largest amount of research conducted within this thrust focuses on irrigated agriculture. This research area consists of 9 research projects with a total value of approximately R32.5 million, which are predominantly funded by the WRC. All other research focus areas within this thrust constitute a single project and have project funding values of less than R6 million each.

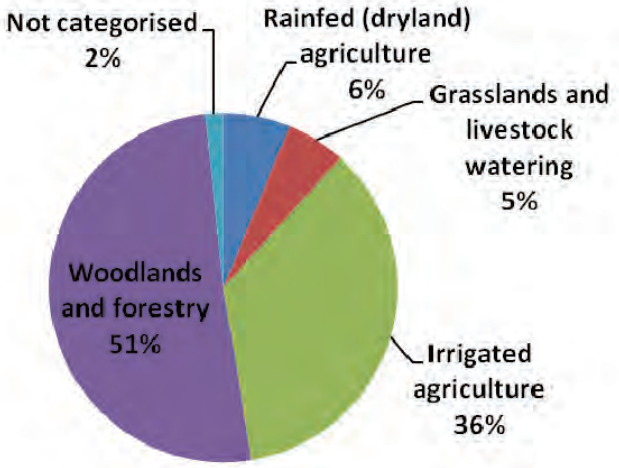

Figure 19: Analysis of agriculture sub-sectors based on total project funding value for Thrust 4

Table 12: Thrust 4 total project number and funding by agriculture sub-sector

Thrust 4	Number of projects	Value of projects
Irrigated Agriculture	9	R32 590 106.48
Woodlands and Forestry	2	R46 362 959.00
Grasslands and Livestock Watering	1	R5 000 000.00
Rainfed (dryland) agriculture	2	R5 656 540.00
Not categorised	1	R1 559 692.00
Total	**15**	**R91 169 297.48**

4 Conclusion

The collection of project data for all water-related research in agriculture was conducted on a country-wide basis. The process followed to collect this information included initial contact with all organisations via email and telephone. Based on this initial contact organisations indicated whether they had any water related research projects and if any contact persons were available for further interview. Some organisations indicated they had no water related research, some were willing and available to provide details on water projects while some were not. Subsequent to this initial contact, a questionnaire was then sent out to all persons that were willing and available to participate in the data collection exercise. At least two follow-up telephone calls were then made to all emailed respondents. Some contacts responded with relevant project information while some did not respond albeit the follow up calls.

Once all the project data was collected, a detailed research funding, research organisation and research thrust analysis was conducted.

The primary objective of this project was to identify and categorise water research related to agriculture in South Africa. The budgeted value of the identified research projects as well as the source of the funds was also of importance.

To this end, a significant number of projects (65) were identified. Projects within the irrigated agriculture sub-sector constituted the highest number of projects (39), followed by rain-fed agriculture with 15 projects while all other sub-sectors (woodlands and forestry, grasslands and livestock, aquaculture and fisheries) constituted 11 projects in total. This result perhaps reflects the nature of the agriculture sector in South Africa, which has a well developed irrigated commercial sector. Big investments have been made and high levels of management are required for use of the largest share of surface water that makes a significant contribution to the country's food production.

These research projects were also mapped across the four WRC Thrusts with the Thrust: Water Utilisation for Food, Forage and Fibre Production having the highest number of projects (26). This is followed by the Thrust: Water Utilisation for Poverty Reduction and Wealth Creation in Agriculture with 20 projects and the Thrust: Water Resource Protection, Restoration and Reclamation in Agriculture with 15 projects. The Thrust: Water Utilisation for Fuelwood and Timber Production in Agriculture has the least number of projects (4).

The total project funding value for all research projects analysed amounted to R208 498 584.00 in 2010. The highest amount of funding was attributed to the Thrust: Water Resource Protection and Reclamation in Agriculture (R91 169 297.00). The second highest funding was for Thrust 3: Water Utilisation for Poverty Reduction and Wealth Creation in Agriculture (R53 778 288.00). The Thrust: Water Utilisation for Food, Forage and Fibre Production is funded just a bit less (R52 055 647.00). The least amount of funding was attributed to the Thrust: Water Utilisation for Fuelwood and Timber Production (R11 495 351.00).

The WRC is the largest contributor of research funds (R129 809 582.00) and it is also financing the highest number of projects (43 in total). Other significant funding

organisations include the KwaZulu-Natal Department of Agriculture, Environmental Affairs and Rural Development and the Department of Water Affairs. The inclusion of the Department of Water Affairs is skewed due to the large funding contribution (R35 730 367.20) towards the Working for Water Programme. Other major funding sources include the ARC (R11 166 124.62); KZN DAEARD (R9 947 753.60); DAFF (R6 800 000.00) and the SA Apple and Pear Association (R1 783 596.08)

The ARC conducted the most research in terms of funding value (R76 088 351.48), and also undertook a significant number of projects (13 in total). The majority of the funding for these projects can be attributed to the WRC and DWEA. The University of KwaZulu-Natal conducted a similar number of projects (13), however the total project funding value was nearly half the value of the ARC projects (R31 114 529.00). Other organisations conducting notable water related research included the CSIR, Universities of Pretoria, Fort Hare, the Free State and Stellenbosch.

Some of the organisations that were contacted during the analysis indicated that they did not have any water related research projects. These included Mangosuthu Technikon, Nelson Mandela Metropolitan University in Port Elizabeth, Durban University of Technology, Vaal University of Technology, Canned Fruit Producers' Association, Citrus Growers' Association of South Africa (CGA) and the ARC Institute for Tropical and Sub-tropical Crops.

A consideration when reviewing these results is the importance attributed to the project funding data. It may appear that a particular research thrust is more important because it attracted a greater amount of funding, but this is perhaps not always the case. Time and effort are important cost drivers with projects of this nature so in the event that a particular project requires more time to complete (difficult data to collect) the overall cost and required funding may be higher. Hence, projects that have more funding should not be seen as strategically more important or valuable than projects with a lower value.

An important conclusion from this project was the amount of effort required to collate the project data. As previously stated, organisations either were not able to prioritise time to collect the information or the data was not easily accessible. Improved reporting and communication, in terms of research projects and funding, within and between organisations would certainly make project data of this nature much easier to collate. More standardised databases are certainly needed amongst research

organisations to provide improved transparency and streamlined access to research project details and funding information. This will contribute to better co-ordination of and co-operation in research activities.

Reference

Water Research Commission (2011), *Knowledge Review 2010/11,* Key Strategic Area: Water Utilisation in Agriculture*,* Pretoria

5 Appendix I

Introductory cover letter sent to all respondents

Dear Sir/Madam,

Water-related Research in Agriculture Assessment

The Water Research Commission (WRC) has commissioned Frost & Sullivan to undertake a study on determining what projects are being conducted within the area of "water-related research in agriculture" in South Africa for the year 2010.

The broad aim of this project is to determine what "water-related research in agriculture" projects are running in 2010, how much funding has been allocated to these projects and where this funding has originated from.

As a major contributor and stakeholder in this field of research we ask that your organisation assists us by providing your valuable project information. The results of the research will be publicly available.

If any of your project information is of a sensitive nature we will ensure that this information is not contained in the final research output, but rather aggregated with all research data to provide a consolidated view.

If you have any questions relating to this research project please feel free to contact Dr Gerhard Backeberg (012 330 0340) at the WRC or David Winter (021 680 3275) at Frost & Sullivan.

Kudzanayi Bangure from Frost & Sullivan will be contacting you in the next few weeks to ensure you received this letter and to briefly discuss this project with you.

Yours sincerely,

Dr G.R. Backeberg
Director: Water Utilisation in Agriculture
Water Research Commission

David Winter
Programme Manager
Frost & Sullivan

6 Appendix II

Questionnaire sent out to all respondents

Database of Water Research in Agriculture: WRC

Frost & Sullivan was commissioned by the Water Research Commission (WRC) to develop a database of all water-related research projects in agriculture being undertaken in South Africa during 2010.

The following questions aim to identify what research projects are currently being carried out, the amount of project funding as well as the organisations and individuals involved in the research.

The results from this research will be publicly available. If you do not have any ongoing water-related research in agriculture please indicate clearly in the project title box after filling in all prior questions.

Definitions

RESEARCH SCOPE

Water-related research in agriculture refers to the following research areas:
- Irrigated agriculture
- Rainfed (dryland) agriculture
- Woodlands & forestry
- Grasslands & livestock watering
- Freshwater aquaculture & inland fisheries

The following research directions also fall within the definition of water-related research in agriculture:
- Water Utilisation for Food, Forage and Fibre Production
- Water Utilisation for Fuelwood and Timber Production
- Water Utilisation for Poverty Reduction and Wealth Creation in Agriculture
- Water Resource Protection, Restoration and Reclamation in Agriculture

TIMELINE

This database only focuses on research that is conducted in 2010. This may include ongoing projects and projects that start or finish in 2010.

FUNDING SCOPE

When completing the funding information please specify total funds that have been allocated for research projects active / concluded in 2010.

1. Please complete a separate table as detailed below for each individual project that is running in 2010.

ORGANISATION INFORMATION
Organisation: (e.g. ARC, University or Department, etc.)
Division: (e.g. Institute, Department or Directorate, etc.)

PROJECT 1 **(please complete a new form for each project)**
Project Title :
Project Leader : **Email Address:** **Telephone Number:**
Project Status : (e.g. 40% complete)
Project Duration: Total number of years: Start year: End year:
Project Objectives: (e.g. What are the key project objectives?)
Project Deliverables : (e.g. Report, database, workshop, guideline document, etc.)
Which area does this research project fall within? (Please mark an **X** next to the appropriate category) ▫ Irrigated agriculture ▫ Rainfed (dryland) agriculture ▫ Woodlands & Forestry ▫ Grasslands & livestock watering ▫ Freshwater aquaculture & inland fisheries
Which direction does this research project fall within? (Please mark an **X** next to the appropriate category) ▫ Water Utilisation for Food, Forage and Fibre Production ▫ Water Utilisation for Fuelwood and Timber Production ▫ Water Utilisation for Poverty Reduction and Wealth Creation in Agriculture ▫ Water Resource Protection, Restoration and Reclamation in Agriculture

Funding Details	
Please give the total amount (ZAR) available for this research project: **ZAR……**	
Please break this total amount out between funding contributors	
Funding Contributors	**(%) Breakdown**
Total funds	**100%**

Thank you for your participation.

7 Appendix III

7.1 List of organisations contacted

Organisation	Respondent Title	Contact Number
AgriSA – Natural Resource Services Department	-	012 643 3400
Agricultural Research Council (ARC) – Vegetable and Ornamental Plant Institute	-	012 841 9611/9696
ARC – Plant Protection Research Institute	-	012 356 9820
ARC – Plant Protection Research Institute	-	012 356 9817
ARC – Institute of Soil Climate and Water (ISCW)	-	012 310 2531/082 897 2124
ARC – ISCW	-	012 310 2587
ARC – ISCW	-	012 310 2501
ARC – ISCW	-	012 310 2500
API	-	012 672 9036
ARC – Onderstepoort Veterinary Institute (OVI)	-	012 529 9111
ARC-OVI	-	012 529 9106
ARC, Institute for Agricultural Engineering	-	012 842 4000
ARC, Institute for Agricultural Engineering	-	012 842 4009
ARC, Institute for Agricultural Engineering	-	012 842 4000
Banana Growers' Association of South Africa	-	013 755 2714
Cotton SA	-	012 804 1462
Canned Fruit Producers' Association	-	021 872 1501
Citrus Growers' Association of South Africa (CGA)	-	031 765 2514
Citrus Research International (Pty) Ltd (CRI)	-	013 759 8000
Cooperative Wine cellars' Association (Vinpro)	-	021 807 3324
Central University of Technology	Programme Head for Agriculture & Environmental Sciences	051 507 3134
Central University of Technology	Head of environmental Sciences Dept	051 507 3195
Cape Peninsula University of Technology	Head : Department of Agriculture	021 460 3153
Durban University of Technology	Head : Department of Water Engineering	031 373 2224

Dry Bean Producers' Organisation (DPO)	-	012 325 1850
Deciduous Fruit Producers' Trust (DFPT) Research	-	021 882 8470/1
Deciduous Fruit Producers' Trust (DFPT) Research	-	021 882 8553
Deciduous Fruit Producers' Trust (DFPT)	-	021 882 8470-1
Deciduous Fruit Producers' Trust (DFPT)	-	021 870 2900
Dried Fruit Technical Services	-	021 870 2925
Environmental Chemistry and Water Quality CSIR	-	012 841 4783
Forestry South Africa (FSA)	-	033 330 2330
Grain SA (GSA)	-	056 515 2145
Grains Crop Institute	-	018 299 6100
Department of Agriculture, Land Reform, Environment and Conservation	-	053 838 9102/1
Department of Agriculture, Conservation and Environment	-	011 355 19201973
Department of Agriculture, Conservation and Environment	-	011 355 1445
Department of Agriculture	-	021 808 5005/4
Department of Agriculture	-	021 808 5010
Department of Agriculture	-	033 355 9690/9337
Department of Agriculture	-	015 294 3000
Department of Agriculture	-	015 294 3147
Department of Agriculture	-	015 294 3533
Department of Agriculture	-	051 506 1605
Department of Agriculture	-	040 609 3475/1
Department of Agriculture, Conservation Environmental Affairs	-	018 389 5146
Department of Agriculture, Conservation Environmental Affairs	-	018 389 5723 etx. 4
Department of Agriculture, Rural Development and Land Administration	-	013 766 6031/6020
Department of Agriculture, Rural Development and Land Administration	-	082 802 7161
Hluhluwe Pineapple Marketing Association	-	035 562 0731
HSRC Centre for Poverty, Employment and Growth	-	012 302 2402
HSRC Centre for Poverty, Employment and Growth	-	021 466 7829
Institute for Industrial Crops	-	014 536 3150
Institute for Industrial Crops	-	014 536 3150
Institute for Tropical and Sub-tropical Crops	-	013 753 7000
Infruitec-Nietvoorbij	-	021 809 3105
Infruitec-Nietvoorbij	-	021 809 3070

Infruitec-Nietvoorbij	-	012 809 3070
Infruitec-Nietvoorbij	-	021 809 3100
Institute for Commercial Forestry	-	033 386 2314
Institute for Commercial Forestry-Information Center	-	033 386 2314
Institute for Commercial Forestry	-	033 386 2314
Institute for Commercial Forestry	-	021 807 3324
South African Sugar Association (SASA)	-	031 508 7461
The South African Mango Growers' Association (SAMGA)	-	015 307 2775
The South African Mango Growers' Association (SAMGA)	-	015 306 6240
The South African Mango Growers' Association (SAMGA)	-	015 307 3676
The South African Pecan Producers Association (SAPPA)	-	012 329 9868
The South African Canegrowers' Association	-	031 508 7200
South African Cotton Producers' Organisation	-	015 533 3017
South African Cotton Producers' Organisation	-	015 533 3016
Milk Producers' Organisation (MPO)	-	012 843 5600
National Emergent Red Meat Producers' Organisation	-	012 361 9127
National Wool Growers' Association	-	041 365 5030
Red Meat Producers' Organisation (RPO)	-	012 348 1933
South African Meat Industry Company (SAMIC	-	012 361 4545
South African Mohair Growers' Association	-	049 836 0140
South African Ostrich Business Chamber	-	044 272 3336
South African Pork Producers' Organisation (SAPPO)	-	012 361 3920
South African Poultry Association (SAPA)	-	012 795 2051
Onion Producers' Organisation	-	049 844 9622
Potatoes South Africa (PSA)	-	012 349 1906
South African Nurserymen's Association (SANA)	-	011 464 1098
South African Subtropical Fruit Growers' Association	-	015 307 3676
Tomato Producers' Organisation (TPO)	-	0153958214
Tomato Producers' Organisation (TPO)	-	015 395 8212

National Department: Agriculture, Forestry and Fisheries	-	012 319 6078
National Department: Agriculture, Forestry and Fisheries	-	012 846 8502
National Department: Agriculture, Forestry and Fisheries	-	012 846 8567
National Department: Agriculture, Forestry and Fisheries	-	012 846 8569
Small Grain Institute	-	058 307 3400
Small Grain Institute	-	058 307 3446
Natural Resources and the Environment CSIR	-	012 841 2983
Natural Resources and the Environment CSIR	-	012 841 3680
Head of Water Resources Department CSIR	-	083 651 8916
Natural Resources and the Environment CSIR	-	012 841 2385
Natural Resources and the Environment CSIR	-	021 888 2491
Natural Resources and the Environment CSIR	-	021 888 2441
Natural Resources and the Environment CSIR	-	021 888 2591
Senior Manager of Department Agriculture	-	040 609 3962
North-West University	Dean: Faculty of Agriculture, Science & Technology	018 389 2050
Mangosuthu Technikon	Head : Faculty of Agriculture	031 907 7671
Mangosuthu Technikon		031 907 7679
University of Zululand	Executive Dean: Faculty of Science and Agriculture	035 902 6649
University of Zululand		035 902 6419
University of KwaZulu-Natal	Dean: Faculty of Science & Agriculture	033 260 5183
University of KwaZulu-Natal	-	033 260 6093
University of KwaZulu-Natal	-	033 260 5490
University of KwaZulu-Natal	-	033 260 6195
University of KwaZulu-Natal	-	031 260 3015/ 031 260 3192
Tshwane University of Technology	Department of Crop Sciences	012 382 5777
University of Stellenbosch	Dean: Agriculture Sciences	021 808 4737
University of Stellenbosch	Head : Dept of Agriculture	021 808 3071
University of Free State (Bloemfontein Office)	Acting Dean: Faculty of Natural -Agricultural Sciences	051 401 9010/058 718 5314
University of Free State (Bloemfontein Office)	-	051 401 2212
University of Venda	Dean: Faculty of Natural and Agricultural Sciences	015 962 8310
University of Venda	Director of Water Irrigation Research	015 962 8324

University of Venda	-	015 962 8568
University of Limpopo	Executive Dean: Faculty of Agriculture	015 268 2203
University of Limpopo	Senior Manager	015 268 2192
University of Limpopo	Senior Manager	015 268 2142
University of Pretoria	Dean: Faculty of Natural and Agricultural Sciences	012 420 2478
University of Pretoria	Director of Water Institution	012 420 2173
University of Pretoria	-	012 420 3226
University of Pretoria	-	012 420 3223
University of Pretoria	-	012 420 3227
University of Pretoria	-	012 420 3880
University of Pretoria	-	012 420 3666
University of Fort Hare	Dean: Faculty of Science & Agriculture	040 602 2232
University of Fort Hare	-	040 602 2364/5
University of Fort Hare	-	040 602 2331
UNISA College of Agriculture and Environmental Sciences	Executive Dean	011 471 3806
University of Cape Town	Head : Urban Water Management	021 650 2589
University of Cape Town	Head : Waste Water Engineering	021 650 2784
University of Cape Town	Head: Hydraulic Engineering	021 650 2588
University of Cape Town	Head: Environmental Science Dept	021 650 2325
Rhodes University	Senior Manager	046 603 7002/8320
University of Western Cape	Senior Manager	021 959 3304
University of Witwatersrand	Head: Ecological & Engineering	011 717 6417/1151
University of Johannesburg	-	011 559 2191
Nelson Mandela Metropolitan University	-	041 504 3202
Vaal University of Technology	Head: Dept of Civil Engineering and Building	016 980 9899
Vaal University of Technology	-	016 950 9792
Wildlife ranching SA	-	012 335 6994
Walter Sisulu University for Technology & Science	-	047 502 2949

7.2 List of persons contacted

Persons contacted		
Nick Opperman	Ms Elmarie Rabie	Prof Odiyo
Dr Sonja Venter	Dr Miriam Altman	Prof NM Mollel
Dr Rami Kfir	Dr Peter Jacobs	Prof A Ströh
Dr Roger Price	Dr Graham Thompson	Prof Hannes Rautenbach
Dr Adam Loock	Nettie Spain	Dr Wayne Truter
Mr Terry Newby	Dr Org van Rensburg	Prof J Annandale
Dr Mphekgo Maila	Mr Reckson Mulidzi	Ms NL Sithole
Dr P Nell	Ms Odette Beukes	Mr Mboweni
Dr Andrew Magadlela	Dr Johan van Zyl	Prof ES du Toit
Prof Tony Musoke	Prof Colin Dyer	Prof JM Steyn
L. Mabena	Desiree Lamoral	Dr N Taylor
Prof Timothy Simalinga	Sally Upfold	Prof J Raats
Felix Reinders	Mr JH Booysen	Prof Okoh
Bertus Britz	Dr Charlie Reinhardt	Dr Nomakhaya Monde
Senior Manager		Dr MJ Linington
Mr Koot Louw	Derek Donkin	Prof Neil Armitage
Senior Manager	Dr Stuart Ferrer	Dr Peter Johnston
Senior Manager	Dr Ben Pieterse	Prof George Ekama
Wilma van der Westhuizen	Mr Piet Dreyer	Prof Kobus van Zyl
Senior Manager	Mr MJ Sebola (Joseph)	Prof Kate Rowntree
Dr P Fourie	Mr AT Van Coller	Ms Leslie Petrik
Mr Sedibe Moosa	Mrs Mary-Jean Gabriel	Dr Isabel M Weiersbye/ Prof Belinda Bozzoli
Prof Fatoki	Dr Cobus Le Roux	Mr Johan Barnard
Mr Bux	Andre Malan	Prof J Modise
Senior Manager	Dr Jimmy Adegoke	Mrs J Dube
Mr H Campbell	Dr Pat Manders	Directed to Nick Opperman
Prof V Hattingh	Dr Deon Nel	Dr Chirwa
Senior Manager	Dr Marius Claassen	
Mr R Hurndall	Dr Keith Kennedy	
Mr D Smit	Dr Paul Oberholster	
Dr James Dabrowski	Mr Jaxa	
Dr John Scotcher	Prof Mashudu Davhana-Maselesele	
Ms Petro Fourie/Mr Pietman Botha	Prof AF Lana	
Dr Hannelien Du Plessis	Dr Buyeye	
Mr WVD Mothibi	Prof RG Ori	
Advocate John Nesidoni	Brian Rawlins	
Andrew Mathabathe	Prof D Jaganyi	
Ms J Isaacs	Mr Lumsden	
Mr Andre Roux	Prof C Everson	
Dr S Mkhize	Prof Nicola Rodda	
Head of department	Prof W van Averbeke	
Head of department	Prof M Karaan	
Prof AE Nesamvuni	Prof E Cloete	
Dr L Moorosi	Prof NJL Heideman	
Mr G Thomas	Prof Chris Du Preez	
Mr P Mogotlhe	Prof REL Ole-Meiludie	
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Research Manager: Dr AJ Sanewe

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