PLANT, SOIL AND ENVIRONMENT SYSTEMS THEME RESEARCH REPORT

2015

University of New England

School of Environmental and Rural Science




Five Stars – Just in Time for World Soils Day

The Excellence in Research for Australia (ERA) 2015 results were released just prior to World Soils Day and UNE's overall research standing has increased significantly since the last assessment in 2012. Our research seeks excellence in delivering innovative solutions to challenges facing society and industry, and the ERA outcome demonstrates this commitment. These latest results indicate that UNE has achieved the highest rating of 5 stars ('well above world standard') in nine fields, which included Soil Sciences, Ecology and Agriculture, and Land and Farm Management, all areas in which researchers in the Plant, Soil and Environment Systems (PSES) theme in the School of Environmental and Rural Science are making a significant contribution.

Without healthy green plants we would neither breathe nor eat. Of all the food the world requires each year, most comes from plants, which synthesise it out of air, sunlight, water and soil. The remainder comes from animal products, which in turn are derived from plants. The researchers working within the PSES theme in the School of Environmental and Rural Science at UNE are finding ways to retain and improve the health and productivity of these plant, soil and environment systems for our current and future needs. They do so within the three sub-themes described on the following pages.

Professor Brian Sindel - Theme Leader

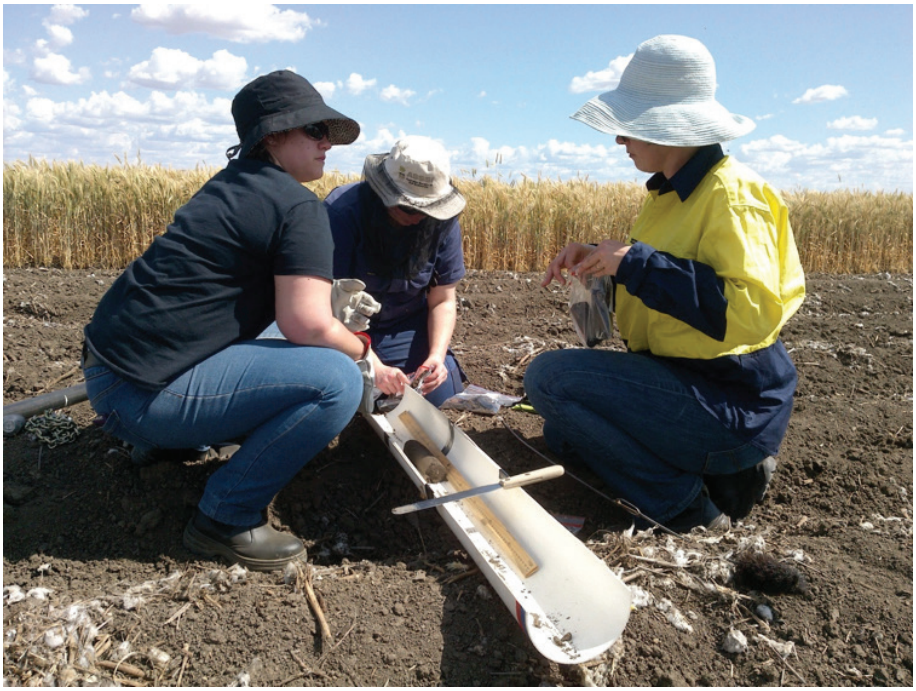
Australian Government
Australian Research Council
ERA 2015 Excellence in Research for Australia

ROOT ZONE PROCESSES

How can soil root zone processes be optimised to enhance resource condition and use?

The rhizosphere surrounding plant roots sustains all terrestrial life. This is a complex and hidden system that requires multi-disciplinary research strategies to uncover its secrets. Within this research sub-theme, we study the relationships between root architecture, water uptake, nutrient and carbon distribution, and key physical, chemical and biological processes in the root zone and their optimization for enhanced plant productivity, resource condition and use.

The advanced techniques we bring to bear on these challenges include real time 3D tomography of root architecture, soil structure and changes in biological communities; isotope tracking of carbon and other important plant nutrients; and soil biophysical measurements of root distribution and growth.



ENVIRONMENTAL STRESSORS

How can critical stressors affecting plant, soil and water conditions be managed to achieve environmental balance?

Our environment is faced with a myriad of stresses that threaten the ecosystem services on which all human and natural systems depend. Managing the consequences of these stresses costs billions of dollars worldwide each year. Some of the issues we are grappling with that cause system degradation are pollution, fire, surface and groundwater water depletion, salinity, acidification and erosion.

Scientists in our multi-disciplinary team are using world-class laboratory and field facilities available at UNE to understand the critical processes driving these system degradation changes. They identify effective management and mitigation strategies that then inform effective policies and ensure the long-term protection and productivity of the environment and, ultimately, human health.

PLANT PRODUCTION SYSTEMS

How can growth in Australian and world food and fibre production be sustained under increasing system constraints?

Maintaining the strong role of agriculture in Australia's economy and addressing global concerns about food security are key challenges for our nation. Changing socio-economic drivers, and environmental constraints, such as increasing temperatures and drought, along with threats from weeds, pests and disease, create a need to develop resilient farming systems that employ innovative technologies and diverse approaches to plant production. Understanding how plants function and respond to environmental as well as management factors in our extensive cropping, irrigated, horticultural and pastoral enterprises is central to ensuring that crops and pastures remain productive. At the same time, a thorough knowledge of whole farm systems is needed for effective and efficient use of finite resources by agricultural producers and other land managers.

Our team of researchers, uniquely placed in rural Australia with access to modern farms, advanced precision technology, information resources, genomic facilities and international partnerships, is conducting innovative research to tackle these local and global issues.

OUR PEOPLE

Dr Richard Flavel

- crop agronomy and plant nutrition
- root system architecture
- soil-plant interactions (physics and chemistry)
- x-ray computed tomography, x-ray fluorescence

Richard has worked as a Research Fellow in plant-soil interactions for the Cooperative Research Centre for Polymers on non-wetting soils and the interactions between the wheat root systems, the soil physical structure and 'functionalized polymers' capable of moderating the soil moisture dynamics. In his current role as Crop Lecturer his research interest is in the soil physico-chemical interactions that occur at the root interface and the implications that mechanisms at this locus have for crop and plant productivity.

A/Professor Chris Guppy

- plant-soil interactions in the rhizosphere
- role of organic matter in nutrient cycling
- soil solution chemistry and plant nutrition
- whole farm systems research

Current active research projects also include K and S nutrition in soils, and N and C cycling in soil. Recent research has also focussed on novel P, S, N, and Si fertiliser sources and assessing short-term and long term nutrient use efficiency. The interaction of nutrient supply and root response is currently investigated using state-of-the-art micro-CT tomography.

Dr Nellie Hobley

- soil chemistry
- soil carbon dynamics
- environmental and site influences on storage and stability of organic matter in soils

Dr Yui Osanai will be commencing in July 2016, replacing Dr Nellie Hobley who left the project and UNE in December 2015.

OUR PEOPLE

Dr Oliver Knox

- plant/microbial interactions
- nematology
- GM plants
- bulky organic fertilisers
- phosphorus and soil science

Oliver's research interests are largely in the area of soil systems and their associated biology. His focus is primarily on cotton where he brings his microbial, nutrition and agronomic knowledge into focus in undertaking work for the Australian cotton industry whilst supporting several postgraduate students. Over the past couple of years Oliver has continued to develop our understanding of nematodes in cotton production systems, worked closely with the Regional Development Officers, CottonInfo and CRDC to promote improved fertiliser use and co-ordinated the Cotton Hub at UNE.

Dr Lisa Lobry de Bruyn

- plant, soil and environment systems

Lisa's teaching is with units on land assessment and sustainability for environmental and agricultural degrees. Her research activities focus on building a better and clearer understanding of issues involved in the development of sustainable agricultural systems, as well as farmers' understanding of soil health and how to monitor land condition, and increasingly how to evaluate the success of education and training programs in NRM. She also works with community groups.

Dr Sheikh Mohammad Fazle Rabbi

- plant root architecture
- nutrient uptake by plants
- x-ray microtomography

Rabbi is interested in studying organic matter dynamics in soil under different land uses and soil management regimes. His research also focuses on the mechanisms of organic carbon stabilization in soil. He believes studying soil organic matter dynamics is essential for improving the productive capacity of soil and also for a better understanding of the link between soil and climate change.

OUR PEOPLE

Dr Matthew Tighe

- soil chemistry - the fate and behaviour of nutrients and trace elements
- soil health and landscape ecology
- probability based environmental modelling

Matt is a Senior Lecturer in Ecosystem Modelling. His research focuses on combining novel data analysis and rapid data collection approaches to understand thresholds in environmental and production systems. He believes that we need new and novel ways to examine data, as well as revisiting past data, to address our future environmental and production constraints. His research interests include hidden soil fertility, ancient pollution as a proxy for future management issues, and rangeland soil function.

A/Professor Brian Wilson

- plant:soil interactions
- soil carbon/soil organic matter distribution and cycling
- management effects on soil carbon and soil condition
- measurement and estimation of soil carbon
- soil organic matter dynamics in native and restored systems
- organic amendments and soil condition

Dr Susan Wilson

- fate, behaviour and availability of pollutants in soil systems
- soil-pollutant interactions
- food chain contaminant transfers
- ecotoxicity and impacts of contaminants
- exposure and risk assessment
- remediation and rehabilitation of polluted systems
- environmental chemistry, analysis and monitoring

Sue is a Senior Lecturer in Environmental Pollution and has established the Pollution Science Research Group in the School of Environmental and Rural Science. Her research focuses on pollutants in soils: their processing and cycling, interactions, their effects, managing risks and remediation.

OUR PEOPLE

Professor Iain Young

- soil biophysics
- soil-plant-microbe interactions

Dr David Backhouse

- plant diseases
- fungi
- epidemiology of soilborne plant diseases
- plant-pathogen interactions
- biological control of plant diseases

Mr Craig Birchall

- crop agronomy
- grains production
- international development

Dr Alice Del Socorro

- entomology
- semiochemicals (plant volatiles and sex pheromones) as pest management tools
- development of plant-based attractants for *Helicoverpa* moths and diamondback moths for use in an attract-and-kill approach

OUR PEOPLE

Mr Brendan Griffiths

- crop agronomy
- cotton production

Brendan's current research interests are in soil science and cotton soil and plant interactions. His first research project since taking on the role of Lecturer in Cotton Production was 'Phosphorus availability in rain-grown cotton'. In his current project 'Spatio-temporal visualisation of cotton root development' he is looking to investigate the extent to which subsoil constraints are limiting cotton root development across the eastern Australian cotton industry.

A/Professor Paul Kristiansen

- horticulture
- weed ecology and management
- supply chain analysis
- rural sociology
- organic (& alternative) farming systems
- farming systems in SE Asia
- experimental design and analysis

A/Professor Priti Krishna

- plant stress biology
- hormone biology
- root biology

Priti's research interests lie in understanding molecular mechanisms underlying plant stress responses. Her research group was among the first to establish the role of brassinosteroid, a relatively new plant hormone, in plant stress tolerance. Brassinosteroid controls many important agronomic traits such growth, yield, plant architecture, xylem differentiation, seed germination and others. BR-related genes therefore offer a unique possibility of increasing crop yields through changing plant architecture, metabolism and protecting plants from environmental stresses. While continuing to unravel the mechanisms, using genetic, genomic and molecular biology approaches, by which brassinosteroid confers broad range stress tolerance, Priti is now focusing on BR's role in root development. This research has considerable potential for optimising root growth for different soil types for better use of soil nutrients and water, and increased resistance to pathogens.

OUR PEOPLE

Professor Brian Sindel

- weed ecology and management
- weed seed banks
- weed surveys
- crop competition and herbicide tolerance

Brian is a weed specialist with a particular interest in pasture weeds and a current project on Macquarie Island in the sub-Antarctic. He has, with his students, led Australian research into the ecology and management of weeds such as fireweed (*Senecio madagascariensis*), serrated tussock (*Nassella trichotoma*), Chilean needle grass (*Nassella neesiana*), saffron thistle (*Carthamus lanatus*), feathertop wiregrass (*Aristida latifolia*), and lippia (*Phyla canescens*).

Dr Mark Trotter

- precision agriculture
- pasture science
- autonomous animal monitoring
- landscape productivity monitoring
- precision livestock management

Dr Nigel Warwick

- plant ecophysiology
- soil-plant water dynamics of natural, forestry and agricultural systems
- nutrient dynamics in arid, semi-arid and humid plant communities

Technical and Administrative Staff

- *Ms Roz Mortimer*
- *Mrs Leanne Lisle*
- *Mr Greg Chamberlain*
- *Mr Gary Cluley*
- *Mr Michael Faint*
- *Mr George Henderson*

RESEARCH HIGHLIGHTS

Oliver Knox

One of Oliver's highlights from 2015/2016 was being asked to chair the CottonInfo/CRDC cotton nutritional tour. The tour took place in February of 2016 and involved nine scientists, CRDC staff and industry representatives travelling to five cotton growing regions to present the latest information on nutrition in cotton and why action is required on farm to ensure the industry's environmental footprint is as low as possible. As part of the tour Oliver was interviewed by the ABC and also filmed by CottonInfo for their YouTube channel. Other highlights for the year included running a soil pit at that National Cotton Day at Mungindi with Brendan Griffiths, continuing to work closely with the RDO network on their trials, which resulted in a couple of published articles in Spotlight and a chapter update in the 2015/16 Cotton Production manual.

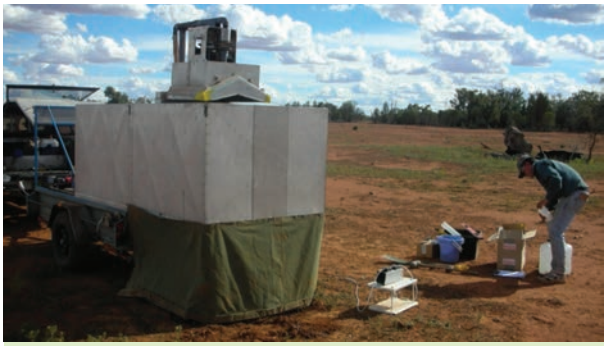
Brendan Griffiths

Excellent results have been gleaned from the 2015 'P nutrition in rain-grown cotton project'. Many previous projects have shown inconsistent or often very little plant uptake response to fertiliser P in the year it is applied. The 2015 rain grown P experiment was able to utilize a long term nutrition experimental site where the plots had been enriched with P over time, such that a gradient of background soil test values had been achieved. This was then planted to rain grown cotton and allowed the researchers to monitor nutrient uptake and tissue concentration against the range of soil test values, gaining extremely useful information with respect to both soil and plant tissue critical values for commercial soil test and plant nutrient analysis.

RESEARCH HIGHLIGHTS

Matt Tighe

Soil has been heralded as a potentially important future storage zone for carbon via land use change. However, results vary significantly across studies. In 2015 we revisited data on soil carbon collected with previous federal funding across eastern Australia. By using novel data mining approaches, we determined that there were distinct combinations of soil and climate that resulted in significant increases in soil carbon with shifts between land uses. However, we also identified zones that showed little change in soil carbon regardless of land use change, due to the overriding influence of climate and soil type. This research is currently informing policy debate and economic analysis of carbon storage, and was published in the high profile journal Scientific Reports in late 2015.



Matt Tighe assessing erosion in western NSW using a rainfall simulator

Lisa Lobry de Bruyn

Lisa was on study leave in the first part of 2015 and had a 5 week trip to the United States, mainly in the mid-West States of Nebraska and North Dakota. There she had the opportunity over time to converse with many US and Australian colleagues and famers on the subject of soil information and soil monitoring and management. Her presentations were well received in America where they have just embarked on a new Soil Health Division in the USDA, so they were interested to see how this development would be viewed by farmers. Another very valuable experience was writing collaboratively with new colleagues, and this occurred on all publications and grant proposals in 2015, with good possibilities for further collaborations in the future. Lisa submitted two full funding proposals to Environmental Trust (NSW) (category 1 funding) of which only 32, including hers, were selected from 176 applications for full submission.

Over the second half of 2015 Lisa was involved in Collaboration Counts Project with Northern Tableland Local Land Services (NTLLS), which is examining community action planning around natural resource management issues in a partnership between Landcare, NTLLS and community groups.

Discussing with a farmer the use of soil testing data he has collected on soil health in North Dakota, USA.

Observing a clod of soil in situ and realising soil testing ignores the three-dimensional aspect of soil

RESEARCH HIGHLIGHTS

Paul Kristiansen

Paul's research is focussed on two main areas, (a) weed science in agricultural and natural landscapes and (b) rural development in SE Asia as well as contributing to a range of horticultural R&D projects at UNE. His weed science work has included an on-going project funded by the Australian Antarctic Division (AAD) on the ecology and management of the invasive plant *Poa annua* on Macquarie Island; a new AAD project on *Stellaria media*, another invasive plant on Macquarie Island; and a national scoping study of weed management in the vegetable industry. The latter study provided a summary of research and extension needs for the industry, and a recent funding call used the recommendations from that report.

In SE Asia, Paul has been carrying out a project in Central Sulawesi, Indonesia, on the use of seaweed by-products as biofertilisers in potting mixes and field cultivation. This is a collaborative project with UNE Alumni, Dr Ramal Yusuf, Lecturer in Horticulture, Tadulako University, funded by the Indonesian government. His on-going project on nutrient management in rice production in Myanmar was finished, with the PhD thesis submitted and passed. Paul has been especially active in Vietnam, maintaining a number of collaborative projects in Thai Nguyen, Central Highlands, Hue and Ho Chi Minh City, representing UNE in the Regional University Network missions to Vietnam (April and November 2015) to develop linkages of direct relevance to ERS and UNE Business School. A number of R&D grant applications have since been prepared and more are under discussion.

A visit with Mr Ha Huu Hong, Director, Center for Sustainable Production & Consumption, Hue, Vietnam (Endeavour Executive Fellow, July-Oct 2015), was a follow up to Paul's UNE Seed Grant research on the value chain of essential oils in central Vietnam in 2014.

RESEARCH HIGHLIGHTS

Susan Wilson - Pollution science research

The Pollution Science Research Group has been engaged in a range of targeted projects, working with local to national collaborators. We have significantly progressed our research in understanding antimony in the environment, work that underpins the development of well-founded guidelines for human and the environment protection. For 2015 we received a UNE Seed Grant to quantify threats to Australian ecosystems from antimony contamination as highlighted on ABC Radio in April.

We have collaborated with regional groups to inform the remediation of antimony and arsenic contaminated mine tailings material at a Urunga processing plant and success with the NSW TechVouchers Scheme enabled us to progress research on understanding processes that hinder the effective bioremediation of gasworks contaminated soils. We also successfully completed our work for NSWEPA to inform policy for managing risks with applying municipal waste derived compost onto our NSW soils.

During the year we teamed up with the Aquatic Ecology Research Group UNE and University of Canberra to sample the Macleay River Catchment and progress a combination of ecotoxicity experiments on native fish to quantify the effects of the mining derived antimony and arsenic in the catchment. This work was presented at the 4th International Antimony Workshop in Leipzig, Germany, in October, and will be used by catchment managers to inform implementation of risk mitigation measures.

RESEARCH HIGHLIGHTS

The Cotton Hub

The Cotton Hub here at UNE has come about as the result of discussion between UNE and the Cotton Research and Development Corporation (CRDC).

The Cotton Hub at UNE will deliver cross disciplinary work on the issues affecting production of sustainable cotton now and over the coming decades. It will also facilitate the deployment of required expertise in response to situations that may arise and require immediate attention within the cotton industry.

UNE has expertise that is well regarded by the cotton industry. The Cotton Hub will act as a focus, where this expertise will come together to develop responses to both open and tender based calls from the CRDC. The outcome will be to improve the cross disciplinary responses to the challenges of cotton production over the coming decades.

Verticillium symptoms in a cotton stem and root

The Cotton Hub, led by Dr Oliver Knox, draws on expertise from researchers in agricultural law, agronomy and soil science; agricultural, business and resource economics; ecosystem management, and science and technology.

Cotton Hub researchers

Dr Oliver Knox
Dr David Backhouse
Professor Oscar Cacho
Adjunct Professor Peter Gregg
Mr Brendan Griffiths
A/Professor Chris Guppy
Dr Nellie (Eleanor) Hobley
A/Professor Bernice Kotey
A/Professor Priti Krishna
Professor David Lamb
A/Professor Graham Marshall
Professor Paul Martin
A/Professor Lily Pereg
Professor Nick Reid
A/Professor Darren Ryder
Dr Mark Shepheard
Professor Brian Sindel
Dr Adam Smith
Dr Rhiannon Smith
A/Professor Brian Wilson

PhD student Katherine Polain getting a better look at the cotton crop

RESEARCH HIGHLIGHTS

Sub-antarctic weed ecology and management

From left to right, PhD student Laura Williams with supervisors Brian Sindel and Sue Wilson enjoying lunch while walking the plateau between sites, Macquarie Island

The research station on the isthmus at the northern tip of Macquarie Island looking south to the plateau

Since 2012 we have been leading research in the sub-Antarctic funded by the Australian Antarctic Division in the ecology and management of invasive weeds, with particular focus on Australia's Macquarie Island. The first project which has continued through 2015 is on the ecology and management of invasive *Poa annua* (winter grass). The second project which began in 2015 examines changes in the ecology and control of introduced non-native plants following pest herbivore eradication in the sub-Antarctic, with a particular focus on *Stellaria media* (chickweed). The PhD students working on these two projects are Laura Williams and Jane Gosden.

The PSES researchers leading the two projects are Paul Kristiansen, Justine Shaw (Australian Antarctic Division), Brian Sindel and Susan Wilson.

Macquarie Island is about 1500 km south of Hobart (54°30'S, 158°57'E) in the Southern Ocean and has a cold, cloudy, wet, windy climate which can make the logistics of getting to Macquarie Island and conducting research there very difficult. The island is about 35 km long from north to south and about

RESEARCH HIGHLIGHTS

5 km wide and is home to several million penguins, several hundred thousand seals as well as albatross and other sea bird species. This elongated undulating plateau of oceanic origin is now a world heritage area under the control of the Tasmanian Government but has also gained notoriety for the recent eradication of rabbits, rats and mice from the island through an extended program of baiting and hunting. Now that these damaging herbivores are gone, invasive plants pose the most serious environmental threat to the island as well as to the broader sub-Antarctic region, with the risk of invasion increasing with increased tourist traffic to the islands and changing climate patterns.

There are only three alien plant species on Macquarie Island currently, with *Poa annua* being the most widespread and common. It and *Stellaria media* seem to be well adapted to disturbance caused by human activity, wildlife and landslips. What will happen to these palatable weeds following the removal of rabbits is part of the subject of our investigations. Moreover, we aim to investigate the ecology of these weeds, including their seedbanks, longevity and relationships to environmental factors as well as the effectiveness of various management practices including herbicides and their environmental fate.

PhD student Jane Gosden monitoring Stellaria media *plots on the steep east coast slopes of Macquarie Island*

Stellaria media *(chickweed) on Macquarie Island seems to be growing lush and rampant following the eradication of rabbits*

OUTREACH ACTIVITIES

Public engagement

Several of our people in PSES are highly sought after as speakers in industry forums such as field days and workshops where they deliver the latest research findings related to the industry. Oliver Knox and Brendan Griffiths spend a fair bit of time liaising with the cotton industry and growers. The highlights of these activities, as well as other staff associated with the Cotton Hub at UNE, are reported as a blog on the cotton hub web site. The Cotton Hub blog can be accessed via **http://blog.une.edu.au/cottonhub/**

Dr Oliver Knox being put on the spot by ABC rural radio

International activities

Several of our staff are engaged in collaborative research projects in Asia, particularly in Myanmar and Vietnam. As in the photo below, they are working with local agriculturalists and farmers to help them better grow crops with often limited resources.

Many of our researchers present their research at international workshops and conferences to communicate their own research findings to the scientific community but also to develop collaborative associations for international research endeavours. For example, Sue Wilson and Matt Tighe attended and presented at the 3rd International Workshop on Antimony in the Environment, held in Leipzig, Germany, October 2015. Sue and Matt presented on analytical work and environmental issues related to the largest environmental antimony dispersion issue known in the world, centred in the Macleay Catchment of NSW. The workshop was well attended by scientists from many countries, with the issues of antimony pollution examined and further avenues for research dissemination decided upon.

Matt Tighe accepted an invitation to teach a 2 day workshop on Soil Analysis at the University of Santa Clara in California in January 2015. The workshop was attended by a range of humanities and environmental science academics and included field work and data analysis activities emphasising the importance of incorporating hands on experience into university course work.

POSTGRADUATE RESEARCH

Honours

Tony Dickson
Digital image analysis for quantification of tropical grass germination and emergence. *Supervisors Mark Trotter and Carol Harris*.

Steven Doherty
Evaluating the effectiveness of amendments at reducing As and Sb mobility in co-contaminated soils. *Supervisors Sue Wilson and Matt Tighe*.

Stephanie Martin
Mixed Waste Organic Output (MWOO) application to NSW soils: effects on metals, metalloids and chemical constituents in runoff and leachate. *Supervisors Sue Wilson, Matt Tighe and Brian Wilson*.

Jack Mooney
Factors influencing successful grafting of glasshouse tomato plants. *Supervisors Nigel Warwick and Kerri Clarke*.

Lucas Morgan
Digital image analysis for quantification of tropical legume germination. *Supervisors Mark Trotter and Carol Harris*.

Evelyn Osborne
Evaluating the use of M-44 ejectors for wild canid control in the New England Region of New South Wales. *Supervisor Chris Guppy*.

Georgia Rogan
Rapid determination of contamination legacies from Central Thailand bronze-age copper smelting. *Supervisors Matt Tighe and Sue Wilson*.

Masters

Allauddin
Evaluation of Australian government and industry web sites for extension information on broadacre cropping. *Supervisors Brian Sindel and Paul Kristiansen*.

Mustafa Al-Haideri
Effect of potassium on salinity tolerance in wheat. *Supervisors David Backhouse and Richard Flavel*.

Dhahi Al-Shammari
Early detection of Barley Yellow Dwarf Virus in cereal crops using remote sensing technology. *Supervisor Craig Birchall*.

POSTGRADUATE RESEARCH

Haider Al-Shuwaili
Glycine betaine impacts on cotton morphology under water stress. *Supervisor Oliver Knox*.

Isaac Arah
Effect of post-harvest calcium chloride treatment on post-harvest qualities of glasshouse tomatoes (*Solanum lycopersicum* L.). *Supervisors Paul Kristiansen, Nigel Warwick and Kerri Clarke*.

Linda Bailey
Pasture cropping in the northern grains region. *Supervisor Chris Guppy*.

Mieke Bourne
Assessing the performance of agricultural advisory models for scaling-out conservation agriculture with trees in East Africa. *Co-supervisor Lisa Lobry de Bruyn*.

Shyama Chakma
Plant hormone effects on cotton seed germination and seedling growth under salinity and drought stress conditions. *Supervisor Priti Krishna*.

Musenga Chella
Zero energy cool chambers for storing horticultural produce. *Supervisor David Backhouse*.

Stephen Chileshe
Plant hormone effects on cotton seed germination and seedling growth under high temperature conditions. *Supervisor Priti Krishna*.

Simon Court
Combining rehabilitation goals: decontamination and revegetation using Australian native plants. *Supervisor Sue Wilson*.

Syarmila Devi
Poultry waste management in Kabupaten Lima Puluh Kota. *Supervisors Paul Kristiansen and Brian Sindel*.

Kirsten Drew
Optimisation of antimony and arsenic bioaccumulation in Australian natives, *Pteris umbrosa* and *Pteris tremula*. *Supervisor Sue Wilson*.

Harry Dube
Municipal solid waste compost effects on availability and uptake of heavy metals. *Supervisor Sue Wilson*.

Truong Thi Hoang Ha
Effects of compost made from *Casuarina cunninghamiana* and chicken manure inoculated with *Trichoderma harzianum* on soil quality and bok choi. *Supervisors Paul Kristiansen and David Backhouse*.

Huynh Thi Ngan Ha
Evaluation of community participation in co-management through the benefit sharing mechanism in Bach Ma National Park, Vietnam. *Supervisors Lisa Lobry de Bruyn, Julian Prior and Paul Kristiansen*.

POSTGRADUATE RESEARCH

Hannah Hartnett
The effect of heat stress on transgenic expression and physiological seed quality in *Gossypium hirsutum*. *Supervisor Priti Krishna*.

Stefan Hasenohr
An assessment of the eco-toxicity of bio-remediated aged manufactured gas plant soil and the effectiveness of chemical assays at predicting PAH bioaccumulation by earthworms exposed to such soils. *Supervisor Sue Wilson*.

Zain Hashim
Effect of glyphosate applied to soil on subsequent wheat growth. *Supervisors Brian Sindel and Paul Kristiansen*.

Wah Wah Hlaing
Mango supply chains for the export market. *Supervisors Julian Prior, Lisa Lobry de Bruyn and Paul Kristiansen*.

Waleed Iqbal
Reducing weed growth through manipulating crop row orientation. *Supervisors Brian Sindel and Paul Kristiansen*.

Renelle Jeffrey
Can Caring for Our Country deliver ecosystem service outcomes from NSW grazing properties? *Co-supervisor Lisa Lobry de Bruyn*.

Watson Matamwa
Supervisor Isa Yunusa.

Mohammed Nabeel
Characterisation and performance of alternative hydroponic growth media: biochars, perlite and rockwool. *Supervisor Paul Kristiansen*.

Hang Nguyen
Effects of plant hormones on cotton seed germination and seedling growth under low temperature conditions. *Supervisor Priti Krishna*.

Hien Nguyen
Impact assessment of hydroelectric plants and agricultural livelihoods of resettled households. A case study of Duong Hoa commune, Huong Thuy district in Vietnam. *Supervisor Lisa Lobry de Bruyn*.

Thuy Nguyen
Comparison between community perceptions of drinking water quality and actual water quality readings in Hoang Mai District of Hanoi City, Vietnam. *Co-supervisor Lisa Lobry de Bruyn*.

Harish Pantha
Effect of post-harvest calcium chloride ($CaCl_2$) treatment on physiochemical characteristics and shelf-life of tomato (*Solanum lycopersicum* L.) during storage. *Supervisors Nigel Warwick, Kerri Clarke and Paul Kristiansen*.

POSTGRADUATE RESEARCH

Dinh Thi Phuong
Flowering and seed production of *Hyparrhenia hirta* in northern New South Wales, Australia. *Supervisors Paul Kristiansen and Brian Sindel*.

Ngyuen Van Long
The effects of shade tree types on light variation and Robusta coffee production in Vietnam. *Supervisors Paul Kristiansen and Isa Yunusa*.

PhD

Eunice Agyarko-Mintah
Supervisor Annette Cowie.

Anahid Al-Amery
Characterisation of brassinosteroid effects and brassinosteroid-responsive genes in cotton for growth and stress tolerance enhancement. *Supervisor Priti Krishna*.

Karrar Al-Hajiya
Role of native vegetation in enhancing cotton biocontrol. *Co-supervisor Lisa Lobry de Bruyn*.

Hazim Al-Hamadani
Diagnosis, resistance and biological control of Verticillium wilt in cotton. *Supervisor David Backhouse*.

Hayder Ali
Biological control of Fusarium wilt in tomatoes. *Supervisor David Backhouse*.

Rawaa Alshalal
Identification and function of a Na+/H+ anti porter gene in *Citrus sinensis* and native Australian *C. glauca* and *C. australasica*. *Supervisors Nigel Warwick, Kerri Clarke, Heather Nonhebel and Shubaio Wu*.

Sahar Jawad Alshamma
Biological control of stem canker of potato caused by *Rhizoctonia solani*. Mycorrhiza and biochar for remediation and plant production in soils polluted with arsenic. *Supervisors David Backhouse, Sue Wilson and Annette Cowie*.

Usamah Alshimaysawe
Supervisors David Backhouse and Paul Kristiansen.

Karl Andersson
The speciation and mobilization of phosphorus in alkaline vertosols. *Supervisor Matt Tighe*.

Mai Thi Lan Anh
Effect of multi-feedstock biochar on green house gas emissions and paddy rice yields in Thai Nguyen, Vietnam. *Supervisor Paul Kristiansen*.

POSTGRADUATE RESEARCH

Sara Bayat
The impacts of mixed waste organic outputs on NSW soils. *Supervisors Sue Wilson, Brian Wilson and Paul Kristiansen*.

Kim Billingham
Legume persistence in dairy and beef pastures on the mid-north coast of NSW. *Supervisors Paul Kristiansen, Mark Trotter , David Herridge and Bruce McCorkill*.

Sean Bithell
Phytophthora root rot of chickpea; effects of genotype, environment, *Phytophthora medicaginis* variability and alternative hosts. *Supervisor David Backhouse*.

James Botfield
Optical, thermal and satellite sensing for sub-field irrigation management. *Supervisor Oliver Knox*.

Graham Charles
Establishing a weed control threshold for cotton using remote sensing. *Supervisors Brian Sindel, Annette Cowie and Oliver Knox*.

Atefah Esmaeili
The remediation of organic contaminants. *Supervisors Sue Wilson and Oliver Knox*.

Rubeca Fancy
The significance of dissolved organic carbon to deep soil carbon storage. *Supervisors Brian Wilson and Paul Kristiansen*.

Skye Gabb
Growth, adoption and management of forage legume systems for West Timor, Indonesia. *Supervisor Chris Guppy*.

Brendan George
Supervisor Annette Cowie.

Lorraine Gordon
Sustainability of biodynamic and organic cattle production in Northern NSW. *Supervisors Oscar Cacho, Steve Walkden Brown, Lewis Kahn and Paul Kristiansen*.

Jane Gosden
Changes in the ecology and control of introduced non-native plants following pest herbivore eradication in the sub-Antarctic: *Stellaria media*. *Supervisors Brian Sindel, Paul Kristiansen and Justine Shaw*.

Brendan Griffiths
Agronomic control of lodging in irrigated northern wheat production. *Supervisor Chris Guppy*.

Sajanee Gunadasa
Soil contamination with cadmium and arsenic in the dry zone, Sri Lanka. *Supervisors Sue Wilson and Matt Tighe*.

Kyin Htwe
Phosphorus and potassium acquisition strategies of mungbean. *Supervisor Chris Guppy*.

POSTGRADUATE RESEARCH

Husam Khalaf
Relationship between seeding rates and competitive ability of wheat and triticale cultivars to accompanied weeds. *Supervisors Brian Sindel, Paul Kristiansen, Robin Jessop and Craig Birchall*.

Calvin Leech
Optimising the bioremediation of polycyclic aromatic hydrocarbons (PAH) contaminated soil using a composting approach with organic amendments. *Supervisors Sue Wilson and Matt Tighe*.

Karlie McDonald
Integrated modelling of spatial and temporal heterogeneity in trophic shifts: a Bayesian network approach based on empirical data collection. *Co-supervisor Matt Tighe*.

Robert McDougal
Urban agriculture – its productivity and the role of ecosystem services. *Supervisors Romina Rader, Paul Kristiansen and Mark Trotter*.

Gary Marriner
Kings of the world: dynamics of Khmer centralisation 900-1500 CE. *Co-supervisor Matt Tighe*.

Ali Mohammadi
Life cycle assessment of biochar impacts on green house gas emissions and paddy rice yields in Thai Nguyen, Vietnam. *Supervisors Annette Cowie and Paul Kristiansen*.

Stephanie Montgomery
New farming systems for upland cropping in Northwest Cambodia. *Principal Supervisor Matt Tighe*.

Kristian Le Mottee
The ecology of *Helicoverpa punctigera*: adaptations for a changeable climate. *Supervisor Peter Gregg*.

Nukunu Nanedo
A critical analysis of decentralisation and community-based irrigation water resource governance in Ghana. *Supervisors Lisa Lobry de Bruyn and Graham Marshall*.

Samieh Nasrabadi
The impact of sodic soil on mycorrhizal associations with cotton. *Supervisors Chris Guppy and Oliver Knox*.

Maximillian Obiakor
Assessment of the ecotoxic effects of antimony and arsenic in the Macleay River Catchment, NSW. *Supervisors Sue Wilson and Matt Tighe*.

Ivannah Oliver
Influence of root presence on C dynamics. *Supervisors Brian Wilson and Oliver Knox*.

Mortatha Ogee
Resource use by cereals and legumes in mixed cropping. *Supervisors Chris Guppy, Richard Flavel, Graham Blair and Paul Kristiansen*.

POSTGRADUATE RESEARCH

Gavin Peck
Improving the productivity of "rundown" sown grass pastures in the Brigalow Belt bio-region. *Supervisor Chris Guppy*.

Nguyen Thi Thuy Phuong
Contribution of traditional management practices to current forestry management in Vietnam: a case study in Central region. *Supervisors Barbara Rugendyke and Paul Kristiansen*.

Katherine Polain
Microbial C and N cycling within the cotton soil profile. *Supervisors Oliver Knox and Brian Wilson*.

Ali Salman
Effect of neem on charcoal rot of chickpea. *Supervisor David Backhouse*.

Jharna Sarker
Supervisor Annette Cowie.

David Taylor
Evaluation of the role of cropping disturbance in a central west plains grazing land system. *Co-supervisor Matt Tighe*.

Bezaye Tessema
Carbon sequestration potential in different land use ecosystems: The role of vetiver. *Supervisors Brian Wilson and Paul Kristiansen*.

Hla Myo Thwe
Nutrient management in small-holder rice farms in Myanmar. *Supervisors Paul Kristiansen, David Herridge and Barbara Rugendyke*.

Etido Umoren
Impact of environmental pollution in agricultural communities: crude oil contamination of foodchains in the Niger Delta, Nigeria. *Supervisors Sue Wilson and Glen Wilson*.

Arjan Wilkie
High resolution assessment of biomass and soil carbon across diverse landscapes. *Supervisor Brian Wilson*.

Laura Williams
Ecology and control methods: managing the invasive weed *Poa annua* in the Australian sub-Antarctic. *Supervisors Paul Kristiansen, Brian Sindel, Sue Wilson and Justine Shaw*.

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Nguyen VL, Nguyen QN, Nguyen ND, Kristiansen P, Yunusa I and Fyfe C (2015). The effects of shade tree types on light variation and robusta coffee production in Vietnam. *Engineering*, 7, 742-753.

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Smith R, Tongway D, Tighe M and Reid N (2015). When does organic carbon induce aggregate stability in vertosols? *Agriculture, Ecosystems and Environment*, 201, 92-100.

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RESEARCH FUNDING

Table 1. Grants with CI in PSES

Total grant value 2015 = $3.0 million. Running total of grants = $10.7 million.

Lead CI	Research team	Project title	Value for 2015	Total value	Funding body
Mr Craig Birchall	Ms Jenny Gibson A/Prof Meixue Zhou Dr Peter Johnson Dr Guy Westmore Dr Phil Larking Ms Rebecca Fish	Effective control of barley yellow dwarf virus (BYDV) in wheat	*$98,649*	$493,244	University of Tasmania
Prof Annette Cowie	Ms Jharna Rani Sarker	Building resilient and productive grain-based agro-ecosystems through improved knowledge of soil inorganic carbon and their functionality	*$23,671*	$100,000	NSW Department of Primary Industries
A/Prof Christopher Guppy	Dr Michelle Watt Dr Vincent Chochois Mr Priyakant Sinha Dr Matthew Tighe Ms Jane Margaret Carruthers Prof Iain Young Dr Rebecca Haling	Quantifying and understanding root variation in winter cereals	*$466,576*	$1,399,728	Grains Research and Development Corporation
Prof Peter Gregg	Dr Alice Del Socorro Mr Anthony Hawes Dr Greg Baker	Attract-and-kill technology for Diamond Back Moth	*$123,395*	$690,000	Grains Research and Development Corporation
Prof Peter Gregg	Dr Alice Del Socorro	Semiochemical management for occasional pests of cotton and grains	*$40,781*	$193,626	Cotton Research and Development Corporation
Prof Peter Gregg	Dr Alice Del Socorro Mr Anthony Hawes Ms Sophie Gulliver	Substitutes for pupae busting - commercial scale trials of moth busting.	*$215,010*	$754,898	Cotton Research and Development Corporation
Prof Peter Gregg	Mr Anthony Hawes	Development of novel pest management tools for major insect pests.	*$34,557*	$135,000	Australian Research Council - Linkage Round 2
Prof Peter Gregg	Dr Alice Del Socorro	Helicoverpa punctigera in inland Australia - what has changed?	*$107,227*	$321,682	Cotton Research and Development Corporation
Mr Brendan Griffiths	Mr Brendan Griffiths	Phosphorus availability in raingrown cotton	*$31,194*	$51,876	Cotton Research and Development Corporation
Mr Brendan Griffiths	Prof Brian Sindel	Cotton Production Course	*$182,579*	$547,737	Cotton Research and Development Corporation
Mr Brendan Griffiths	Dr Oliver Knox Dr Mark Trotter Mr Tom Dowling Prof David Lamb	Spatio-temporal visualization of irrigated cotton root development in Eastern Australia	*$40,110*	$30,000	CRC for Spatial Information
Mr Brendan Griffiths	Prof Brian Sindel	Cotton Production Course	*$103,056*	$626,354	Cotton Research and Development Corporation
Mr Brendan Griffiths	Prof David Lamb Dr Mark Trotter Mr Tom Dowling Dr Oliver Knox	Spatio-temporal visualisation of irrigated cotton root development in Eastern Australia	*$40,110*	$176,084	Cotton Research and Development Corporation
A/Prof Christopher Guppy	Miss Skye Gabb Dr Lindsay Bell	PhD Scholarship - Optimising tropical forage legume production in Eastern Indonesian farming systems	*$12,487*	$39,000	CSIRO - Postgraduate Studentship
A/Prof Christopher Guppy	Ms Jane Carruthers	Phosphorus reactions and fluxes in pasture soils	*$39,355*	$149,266	Meat & Livestock Australia

RESEARCH FUNDING

Dr Nellie Hobley	A/Prof Brian Wilson	Contribution of pyrogenic carbon to long-term soil carbon storage	*$9,975*	$9,975	UNE - 2015 University Seed Grants
Dr Nellie Hobley	Dr Geraldine Jacobsen A/Prof Brian Wilson	Contribution of pyrogenic carbon to long-term soil carbon storage	*$10,495*	$10,495	Australian Institute of Nuclear Science and Engineering
Dr Oliver Knox	Dr David Backhouse Prof Iain Young	Soil systems biology position at UNE Armidale	*$83,250*	$499,500	Cotton Research and Development Corporation
Dr Oliver Knox	Dr David Backhouse Prof Iain Young	Soil systems biology position at UNE Armidale	*$68,917*	$413,500	UNE Cash Contribution
Dr Oliver Knox	A/Prof Christopher Guppy Miss Fanny Tisseau des Escotais	Investigation of soil properties that have changed root soil profile exploration in cotton systems	*$5,000*	$5,000	Cotton Research and Development Corporation - Scholarship
A/Prof Priti Krishna	Miss Anahid Al-Amery Dr Heather Nonhebel	Characterisation of brassinosteroid effects and brassinosteroid genes in cotton for growth and stress tolerance enhancement	*$42,933*	$128,800	Cotton Research and Development Corporation - Scholarship
Dr Paul Kristiansen	Dr Justine Shaw Dr Susan Wilson Prof Brian Sindel	Ecology and control methods: Managing the invasive weed Poa annua in the Australian sub-Antarctic	*$170,217*	$1,196,303	Australian Antarctic Division - Australian Antarctic Science Grants
Dr Lisa Lobry de Bruyn	Dr Lisa Lobry de Bruyn	Exploring new technologies to quantify soil macrofauna influences on soil functionality	*$2,906*	$14,693	University of New England - 2013 University Seed Grants
Prof Brian Sindel	Mr Craig Birchall	Graduate Certificate and Diploma in Sustainable Grains Production for industry advisors and growers	*$299,132*	$1,050,248	Grains Research and Development Corporation
Prof Brian Sindel	Prof Brian Sindel Mr Graham Charles	The growth and development of the major weeds of cotton.	*$34,936*	$105,000	Cotton Research and Development Corporation
Prof Brian Sindel	A/Prof Paul Kristiansen Dr Sue Wilson	Changes in the ecology and control of introduced non-native plants following pest herbivore eradication in the sub-Antarctic: Stellaria media	*$477,197*	$1,431,590	Australian Antarctic Division - Australian Antarctic Science Grants
Dr Matthew Tighe	Dr Fiona Robertson Dr Annette Louise Cowie Dr Ram Dalal Dr Warwick Dougherty	Increasing soil carbon in eastern Australian faming systems: linking management, nitrogen and productivity	*$23,394*	$165,000	Department of Agriculture, Fisheries and Forestry - Carbon Farming Futures - Filling the Research Gap
Dr Matthew Tighe	Vincent Pigott Adj/Prof Lisa Kealhofer A/Prof Peter Grave	Rapid soil geochemical signatures to elucidate archaeometallurgical activity	*$12,464*	$19,703	UNE - 2015 University Seed Grants
Dr Matthew Tighe	Prof Iain Young	Eliminating grain defects in chickpea	*$20,000*	$60,000	Grains Research and Development Corporation
Dr Matthew Tighe	Mr Karl Andersson Dr Christopher Guppy	Manipulation of phosphorus sorption in agricultural soils	*$17,557*	$61,642	Grains Research and Development Corporation - Grains Research Scholarship
Dr Mark Trotter	Dr Mitchell Welch Dr Robin Dobos Mr Jamie Barwick Prof David Lamb	Remote autonomous sub-clinical disease detection in sheep - PhD Top-Up scholarship for Jamie Barwick	*$14,595*	$43,824	Australian Sheep Industry CRC
Dr Mark Trotter	Mr Jamie Barwick Dr Rick Llewellyn Dr Mitchell Welch Prof David Lamb Dr Hamish Campbell Mr Zachary Economou Mr Michael Moodle	Sub-Contract Mallee Sustainable Farming Inc. Maintaining ground cover in mixed farming systems	*$70,520*	$70,520	CRC for Spatial Information

RESEARCH FUNDING

Dr Mark Trotter	Prof David Lamb Mr Zachary Economou Dr Rick Llewellyn Mr Michael Moodle Dr Hamish Campbell Dr Mitchell Welch Mr Jamie Barwick	Spatially Enabled Livestock Management: Maintaining ground cover in mixed farming systems	*$30,000*	$30,000	CRC for Spatial Information
Dr Mark Trotter	Prof Kerrie Mengersen Prof David Lamb Dr Dan Tindall	A big data approach for estimating carrying capacity and liveweight gain	*$64,350*	$64,350	CRC for Spatial Information
A/Prof Brian Wilson	Dr Quan Hua	C carbon dynamics and soil development on sub-Antarctic Macquarie Island	*$2,686*	$19,300	UNE - Seed Grants 2014
A/Prof Brian Wilson	A/Prof Lalit Kumar	Multi-criteria analysis of spatial layers for climate change	*$9,335*	$15,000	NSW Government Local Land Services Northern Tablelands
A/Prof Brian Wilson	A/Prof Brian Wilson	Importance of deep soil carbon to long-term carbon storage	*$171,138*	$513,414	Department of Agriculture, Fisheries and Forestry - Carbon Farming Futures - Filling the Research Gap
A/Prof Brian Wilson	Dr Annette Louise Cowie	Ext. Ref. 01203.052 - Environmental Plantings for Soil Carbon Sequestration on Farms	*$17,824*	$130,000	Department of Agriculture, Fisheries and Forestry - Carbon Farming Futures - Filling the Research Gap
A/Prof Brian Wilson	A/Prof Brian Wilson	Identify carbon storage potential for NSW lands to participate in ERF and carbon markets	*$8,582*	$30,000	Office of Environment and Heritage
A/Prof Brian Wilson	Prof David Lamb	Improved high-resolution carbon accounting in diverse landscapes for participation in carbon markets	*$36,000*	$108,000	CRC for Spatial Information
A/Prof Brian Wilson	Dr Oliver Knox Dr Gunasekhar Nachimutha Dr Nellie Hobley A/Prof Lily Pereg Mr Brendan Griffiths Prof Heiko Daniel	Soil Systems Research - physical, chemical and biological processes for plant growth and nutrient cycling down the whole soil profile	*$172,417*	$517,251	Cotton Research and Development Corporation
A/Prof Brian Wilson	Mr Dacre King	Re-visit of Namoi Catchment soil carbon monitoring sites - sub-tropical perennial pastures	*$9,890*	$20,000	NSW Local Land Services North West
A/Prof Brian Wilson	Dr Susan Wilson Dr Paul Kristiansen	Mixed Waste Organic Output (MWOO) application to NSW soils	*$52,786*	$365,100	Office of Environment and Heritage
A/Prof Brian Wilson *Dr Jeff Baldock*	Dr Annette Cowie Dr Isa Yunusa Dr Paul Kristiansen	Quantifying temporal variability of soil carbon	*$65,160*	$562,551	Department of Agriculture, Fisheries and Forestry - Carbon Farming Futures - Filling the Research Gap
Dr Susan Wilson		Bioavailability of PAHs in bioremediated soil	*$2,500*	$2,500	NSW Tech Vouchers
Dr Susan Wilson	A/Prof Lily Pereg Dr Matthew Tighe	Quantifying threats to Australian ecosystems from antimony contamination	*$19,826*	$19,826	UNE - 2015 University Seed Grants
Prof Iain Young	Dr Michelle Watt ProfDavid Mainwaring Prof Daniel Murphy Dr Matthew Tighe Prof Alexander Wissemeier	Polymers for improving soil moisture management and cropping productivity	*$113,236*	$566,181	CRC for Polymers

RESEARCH FUNDING

Table 2. Additional grants without CI in PSES but co-investigators in PSES

Total grant value 2015 = $1.1 million. Running total of grants = $3.9 million

Lead CI	Research team	Project title	Value for 2015	Total value
Dr Hamish Campbell	Dr Mark Trotter A/Prof Paul Kwan Prof David Lamb	Building cyber-infrastructure to enhance national collaborative innovation in agricultural research	*$19,670*	$20,000
Assoc Prof Deli Chen	Dr Tony Weatherley Dr Adriana Downie Dr Annette Cowie	Urban biochar: towards prescriptive biochar use for maximum economic productivity and sustainability benefits in urban environments	*$12,890*	$82,953
Dr Mathew Crowther	A/Prof Clive McAlpine Dr Benjamin Moore A/Prof Clare McArthur A/Prof Mark Bruno Krockenberger Dr Daniel Lunney A/Prof Brian Wilson Mr Mark Howes	Rehabilitating a changing landscape: using the latest advances in koala ecology to direct adaptive management	*$128,284*	$384,853
Mr Zachary Economou	Dr Mark Trotter Prof David Lamb	Determining the potential of virtual fencing for application to grazing livestock	*$5,363*	$19,918
Dr David Herridge	Ms Gabrielle Ray Dr Tin Htut Dr U Kyaw Win Dr U Myint Aung Dr C Gowda Dr Matt Denton Mr Craig Birchall Dr Christopher Guppy	Increasing productivity of legume-based farming systems in the Central Dry Zone of Myanmar	*$414,067*	$2,000,000
Dr David Herridge	Dr David Herridge	National coordination of the nitrogen fixation program	*$60,018*	$135,000
Prof Geoffrey Hinch	Prof Geoffrey Hinch Dr Stephen Wroe Prof Iain Young Prof James Rowe Dr Mark Trotter	Smart data management for Smart livestock production	*$335,725*	$539,000
A/Prof Bernice Kotey	Dr Neil Michael Argent A/Prof Bernice Adei Kotey A/Prof Ruth Nettle A/Prof Anthony David Sorensen Prof Peter Charles Gregg	Skills profile and labour supply structure on cotton farms (formerly called human capacity needs and management on cotton farms)	*$32,898*	$137,000
Prof David Lamb	A/Prof Karl Vernes Prof Geoffrey Hinch Dr Gregory Falzon Dr David Miron Prof Martin Thoms Dr Mark Trotter Prof David Lamb Dr Paul McDonald	SMART farm landscape laboratory	*$7,946*	$30,000

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Prof David Lamb	A/Prof Karl Vernes Prof Geoffrey Hinch Dr Gregory Falzon Dr David Miron Prof Martin Thoms Dr Mark Trotter Prof David Lamb Dr Paul McDonald	SMART Farm Landscape Laboratory	*$52,294*	$198,541
Prof David Lamb	A/Prof Karl Vernes Prof Geoffrey Hinch Dr Gregory Falzon Dr David Miron Prof Martin Thoms Dr Mark Trotter Prof David Lamb Dr Paul McDonald	SMART Farm Landscape Laboratory	*$26,190*	$100,000
Mr Julian Prior	Dr Lisa Iobry de Bruyn, Dr Richard Koech, Dr Michelle Carnegie	Evaluation of the collaborative delivery model between the Landcare Networks and Northern Tablelands Local Land Services	*$25,993*	$77,981
Prof Nick Reid	Prof Nicholas Reid Mr Rodney Campbell Ms Jane Crystal Dr Megan Good Prof Peter Gregg Mr Phil Norman Ms Robyn Walters Mr John Lemon Ms Sally Egan Mr Dennis Boschma	Managing invasive native scrub in the endangered ecological community of Coolibah-Black Box Woodland of the Northern Riverine Plains in the Darling Riverine Plains and Brigalow Belt	*$10,371*	$166,000
Dr Ruy Anaya de la Rosa	Dr Annette Cowie	Biochar for sustainable soils	*$42,526*	$42,526

Additional grants

Seaweed biofertilisers, Ramal Yusuf, UNTAD, Ramal Yusuf, Paul Kristiansen, DIKTI, Indonesia, $16,250

Vietnam agriculture mission, Paul Kristiansen, RUN team (UNE, USQ, CQU, FedU), Comm Dept of Industry & Science, $80,000

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