## Program – Day One

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<td>9.00-9.10</td>
<td><strong>Professor Robert Saint</strong></td>
<td>Conference Opening and Welcome</td>
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<td></td>
<td>Deputy Vice-Chancellor (Research) Flinders University</td>
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<tr>
<td>9.10-9.15</td>
<td><strong>Professor Adrian Werner</strong></td>
<td>Housekeeping</td>
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<td>Conference Chair</td>
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<td>9.15-9.45</td>
<td><strong>Dr. Harriet Whiley</strong></td>
<td><strong>Life after a PhD - from PhD student to early career researcher</strong></td>
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<td>Lecturer, School of the Environment Flinders University</td>
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<tr>
<td>9.45-10.00</td>
<td>Lei Mai</td>
<td>Application of high rate nitrifying trickling filters to remove emerging contaminants from wastewater</td>
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<tr>
<td>10.00-10.15</td>
<td>Amy Hawley</td>
<td>Pathogen removal in high rate algal ponds with inclined plane addition</td>
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<td>10.15-10.30</td>
<td>Prasert Makkaew</td>
<td>The impact of leaf morphology and microbial wastewater quality on estimating the health risk from consumption of wastewater irrigated salad crops</td>
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<td>10.30-10.45</td>
<td>Ngai Ning Cheng</td>
<td>Current Australian pig industry manure treatment practice and innovative integration with algal biomass production for energy</td>
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<td><strong>Morning Tea</strong> - 10.45-11.15</td>
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<td><strong>Dr. Leanne Morgan</strong></td>
<td><strong>Seawater intrusion overshoot - possible occurrence and cause</strong></td>
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<td></td>
<td>Post-Doctoral Fellow School of the Environment Flinders University</td>
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<tr>
<td>11.45-12.00</td>
<td>Paul Young</td>
<td>Microbiology of high rate algal ponds</td>
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<td>12.00-12.15</td>
<td>Salini Sasidharan</td>
<td>Antagonistic effects of biochar amendment on transport of <em>escherichia coli</em> and bacteriophages in saturated sand porous media</td>
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<td>Olanrewaju Abiodun</td>
<td>Streamflow modelling in contiguous sub-catchments in a semi-arid environment using SWAT</td>
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<td>Robert Andrew</td>
<td>Temporal decomposition of GRACE data for the estimation of water storage components across Australia</td>
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<td>12.45-13.00</td>
<td>Nyda Chhinh</td>
<td>Drought and rice production in Cambodia</td>
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<td><strong>Lunch and Poster Session - 13.00-14.30</strong></td>
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<td>14.30-15.00</td>
<td>Rob Tucker</td>
<td>Life after PhD – An industry perspective</td>
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<td><strong>Keynote Address</strong></td>
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<td>15.00-15.15</td>
<td>Suranga Wadduwage</td>
<td>Evaluation of agricultural land dynamics at urban fringes</td>
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<td>15.15-15.30</td>
<td>Thi Thanh Trang Pham</td>
<td>The performance of water user association on irrigation performance in Vietnam</td>
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<td>15.30-15.45</td>
<td>Darrell House</td>
<td>The impacts of large-scale land acquisitions on land systems</td>
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### Program – Day Two

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<td>Professor Adrian Werner</td>
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<td>9.15-9.45</td>
<td><strong>Dr Doug Weatherill</strong></td>
<td><strong>Keynote Address</strong> Senior Groundwater Modeller Jacobs A broad horizon: consulting with a PhD</td>
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<td>9.45-10.00</td>
<td>Megan Hawley</td>
<td>Aerobic treatment of pig slurry to achieve ammonia oxidation in a laboratory scaled wastewater treatment system</td>
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<td>10.00-10.15</td>
<td>Yu Lian</td>
<td>A comparison of <em>E. coli</em> inactivation rates under environmentally relevant UVB dose rates, different temperatures and water resources</td>
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<td>10.15-10.30</td>
<td>Nachalida Yukalang</td>
<td>Development of an environmental health model for municipal solid waste management in rapidly urbanizing area of northeast Thailand</td>
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<td>10.30-10.45</td>
<td>Tara Garrard</td>
<td>Nematophagous fungi and <em>Strongyloides</em></td>
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<td><strong>Morning Tea - 10.45-11.15</strong></td>
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<td>11.15-11.30</td>
<td>Jackie Wright</td>
<td>Characterisation of Environmental Methamphetamine Exposure through Hair Analysis</td>
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<td>11.45-12.00</td>
<td>Darryl Harvey</td>
<td>Impacts of plantation forestry on groundwater resources in the lower South East of South Australia</td>
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12.00-12.15 Teguh Sugiyarto  
Maternal health inequality in West Java Province, Indonesia

12.15-12.30 Emmanuel C. Chubaka  
Toxicological and microbiological study of rainwater used for drinking

**Lunch and Poster Session - 12.30-14.00**

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<td>12.30</td>
<td>Marpaleni</td>
<td>Understanding Environmentally Friendly Behaviour (EFB) in Indonesia: A Case of South Sumatera Province</td>
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<td>14.00</td>
<td>Safa Karimi Molan</td>
<td>How to strengthen public support for climate mitigation policies</td>
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<td>14.30</td>
<td>Professor Craig Simmons</td>
<td>Reflections and Prospections on a Career in Academia</td>
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<td>15.00</td>
<td>Professor Adrian Werner</td>
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**Closing Reception and Drinks - 15.30-16.30**

**Poster Session - Both Days**

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<td>Dicky Muharawan</td>
<td>Evaluation of the potential for the implementation of a 3D Cadastre in urban areas in Indonesia</td>
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<td>Sugiarito Badaruddin</td>
<td>Characteristics of active seawater intrusion</td>
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<td>Suratman</td>
<td>The effectiveness of an educational intervention to improve knowledge and perceptions for reducing organophosphate pesticides (OPs) exposure among Indonesian farmworkers</td>
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<td>Darren Cox</td>
<td>Turbulent velocities: moving beyond the concept of eddy diffusivity</td>
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<td>Van Vuong Le</td>
<td>Spatial distribution of epiphytic lichens in South Australia</td>
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<td>R. Ganda P. Sihombing</td>
<td>Dealing with data scarcity: mass appraisal practice in the National Land Agency of Indonesia</td>
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<td>Rahmi Yudianti</td>
<td>The Role of Land Reform in Minimizing the Probability and Resolution of Rural Land Disputes in Indonesia</td>
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<td>Ingrid Tejada</td>
<td>Globalisation or changing demand: Uruguay’s contribution to the global soybean trade</td>
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<tr>
<td>Manh Hai Vu</td>
<td>Groundwater-surface water interaction in sandy soil provinces of southern central coastal Vietnam</td>
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<tr>
<td>Mirahmad Chabok</td>
<td>Visibility through the smoke in airborne remote sensing</td>
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*Conference Chair: Professor Adrian Werner*
*Conference enquiries: Renee Spinks*
*Email: renee.spinks@flinders.edu.au*
*Phone: 0430 507 526*
KEYNOTE SPEAKERS

Dr Harriet Whiley

Lecturer

School of the Environment

Flinders University

Harriet Whiley's areas of expertise are Public Health, Risk Assessment and Environmental Microbiology. She undertook a PhD with Flinders University in collaboration with The South Australian Water Corporation investigating the presence of *Legionella* and Mycobacterium avium complex in South Australian potable and reuse water distribution pipelines.

Dr Leanne Morgan

Postdoctoral Research Fellow

School of the Environment – Flinders University

Leanne is currently a post-doctoral research fellow at Flinders University. In this role, she is developing a regional-scale groundwater flow model for the South East of South Australia, as part of the Goyder South East Regional Water Balance Project. Leanne is also exploring the use of sampled land surface variability to parameterise evapotranspiration and water table depth relationships, to address concerns about upscaling groundwater evapotranspiration within regional-scale models. Additionally, Leanne is carrying out research that will improve the understanding of sub-sea freshwater reserves in the region. Leanne graduated with a PhD from Flinders University in 2014 in the area of coastal hydrogeology. During her PhD, Leanne worked as principal groundwater modeller on the National Assessment of Seawater Intrusion Vulnerability for Australia project; a collaboration between Geosciences Australia and the National Centre for Groundwater Research and Training. Leanne developed, applied and critically evaluated new methods for assessing seawater intrusion vulnerability for 28 case study sites around Australia. Leanne also initiated international research projects to explore the so-called 'seawater intrusion overshoot' effect. Leanne has previously worked as a groundwater modeller for the South Australian Government, focusing on River Murray salinity issues.

Rob Tucker

Senior Engineer

River Murray Operations and Major Projects,

Department of Environment Water and Natural Resources, South Australia

Rob Tucker’s area of expertise is in Project management, Contract management, Coastal Management and Civil Engineering. He is currently a Senior Engineer with the Department of Environment Water and Natural Resources. He is currently involved with project management and contract management of civil engineering projects in Australia and internationally, including water and waste water treatment, sewerage, storm water and ground water pollution investigations. He has prior experience in Coastal management in the South Australian Public Service for 24 years, focusing on coastal protection and conservation issues, including state representative on national integrated coastal zone management programs since 1993.
Dr Doug Weatherill

Senior Groundwater Modeller
Jacobs Group Australia

Doug is a hydrogeologist with 13 years’ research and consulting experience. He has specialist skills in groundwater flow and solute transport modelling, applied tracer testing and fractured rock hydrogeology. In his role as a Senior Groundwater Modeller with consulting firm Jacobs, he works with clients representing a range of industries and backgrounds across Australia and overseas. He was a member of the project team that developed the Australian Groundwater Modelling Guidelines and has developed and reviewed groundwater models for a spectrum of applications including mine dewatering, water supply, contaminant migration, aquifer storage and recovery, sustainable yield assessment, water allocation planning, in-situ leaching and river floodplain watering and salinity management.

Professor Craig Simmons

Inaugural Schultz Chair in the Environment
Matthew Flinders Distinguished Professor of Hydrogeology
Director, National Centre for Groundwater Research and Training

Professor Craig Simmons is a leading groundwater scientist, recognised for major national and international contributions to groundwater science, education and policy reform. Director of the National Centre for Groundwater Research and Training, he is one of Australia’s foremost groundwater academics and has been a significant contributor to global advances in the science of hydrogeology for many years. He is a member of the Statutory Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC). Professor Simmons is Matthew Flinders Distinguished Professor of Hydrogeology and Schultz Chair in the Environment at Flinders University. He is a Fellow of the Australian Academy of Technological Sciences and Engineering. Professor Simmons’ work has been recognised by numerous national and international research and teaching awards including the Anton Hales Medal for outstanding contributions to research in the Earth Sciences by the Australian Academy of Science. He was recently named the 2015 South Australian Scientist of the Year. Professor Simmons has served as an Editor and Associate Editor for numerous major international journals including Water Resources Research, Journal of Hydrology, Hydrogeology Journal, Groundwater, Environmental Modeling and Assessment and Vadose Zone Journal.
RHD ABSTRACTS
ORAL PRESENTATIONS

Application of high rate nitrifying trickling filters to remove emerging contaminants from wastewater

Lei Mai
Supervisors: Professor Howard Fallowfield and Professor Nancy Cromar

The nitrifying trickling filter (NTF) is a treatment process used to remove ammonia to reduce the cost and better manage chlorine disinfection in wastewater treatment plants. In this study, the possibility of removal of eight emerging contaminants, namely caffeine (stimulant), bisphenol A (plasticiser), benzotriazole (detergent additive), trimethoprim (antibiotic), acetaminophen (analgesic agent), atrazine (herbicide), 17\(\alpha\) ethynylestradiol (hormone), DEET (insect repellent), were conducted on a laboratory scale NTF. The results revealed the following order of effectiveness of NTF in removal of these contaminants in 12 hours: caffeine (>95%) > acetaminophen (58.6%) > DEET (58.6%) > atrazine (48.7%) > 17\(\alpha\) ethynylestradiol (48.3%) > benzotriazole (42.8%) > bisphenol A (26.2%) > trimethoprim (17.9%). With NTF, the removal of caffeine was the most effective and that of trimethoprim the least. The results also showed that biodegradation was the dominant process. Furthermore, we also found that some of the emerging contaminants might negatively affect nitrification process in the NTFs.

Pathogen Removal in High Rate Algal Ponds with Inclined Plane Addition

Amy Hawley
Supervisors: Professor Howard Fallowfield and Professor Nancy Cromar

Pathogens are everywhere in wastewater. Removal is thus essential but not always adequately achieved. The occurrence of pathogens post treatment is frequent and must be addressed. High rate algal ponds are effective at microbial reduction using the germicidal properties of sunlight for disinfection. Sunlight exposure is increased with the inclusion of a paddlewheel for continual water circulation. Sufficient exposure however is still limited due to attenuation and poor light penetration restricting availability to pathogens. Strategies to improve exposure and thus pathogen reduction in these ponds are required.

Inclined planes are investigated in this research to address this issue. The inclined plane on the pond wall allows for water to run over a larger surface area and increase the time it is exposed to solar irradiation, elevating pathogen reduction. The impacts of attenuation will be reduced with water exposed over a larger area in a thin film. Model and large scaled high rate algal ponds are used to investigate the impacts of the inclined plane with the MS2 bacteriophage used to evaluate microbial die-off in the systems. Results will provide additional insight into both pond performance and pathogen behaviour and can assist in the development of improved water treatment ponds.

The impact of leaf morphology and microbial wastewater quality on estimating the health risk from consumption of wastewater irrigated salad crops

Prasert Makkaew
Supervisors: Professor Nancy Cromar and Professor Howard Fallowfield

Quantitative Microbial Risk Assessment (QMRA) is a tool to estimate the health risk associated with the exposure to pathogens. The challenge of using QMRA is the lack of data or quality of data available to be used to estimate the risk. This study aims to improve the QMRA associated with the consumption of wastewater irrigated crops by determining the factors that may impact the risk assessment by determining wastewater retention volumes for 3 different types of lettuce (Iceberg, Cos and Oak leaf), quantifying *Escherichia coli* (*E. coli*) concentration after irrigation of the 3 different types and parts of lettuce (outer leaves, inner leaves and composite sample), and comparing the numbers of *E. coli* between the direct enumeration method (enumerate the microbial concentration directly on the lettuce leaves after irrigating with wastewater) and the indirect method (estimate based on wastewater retention on the lettuce leaf surfaces). The results showed that the
different types of lettuce have different wastewater retention capabilities. There was no difference in *E. coli* concentration in different parts of lettuces, and the *E. coli* concentration was the same whether determined by the direct or indirect method.

**Current Australian pig industry manure treatment practice and innovative integration with algal biomass production for energy**

*Ngai Ning (Ryan) Cheng  
Supervisor: Professor Howard Fallowfield and Dr Richard Bentham*

Manure comprises both urine and faeces. It consists of water (90% of manure), complex of carbohydrate and nutrients. These eventually are broken down into simpler compounds such as carbon dioxide and water during effluent treatment. Pig manure also contains large quantities of nitrogen, phosphorus and potassium, as well as minor nutrients, trace elements and salts. A range of pathogen is also contained in pig manure. The main objective of piggery waste treatment systems is to sustainably treat or dispose of large quantities of these organic matter, nutrients and salts. In this presentation, various effluent treatment options will be described and their chose reasons would depend on verities of climatic conditions, local environmental issues, economic factors and practical issues. Innovative integration of pig slurry and algal biomass for biogas production and effluent treatment would also be discussed which is a part of my PhD research aims to provide an understanding of optimum conditions for co-digestion of wastewater grown algal biomass with pig slurry, this will include determination of the effect feed ratios and digester residence time on the quantity and quality of biogas produced and suspended solid/COD removal.

**Microbiology of high rate algal ponds**

*Paul Young  
Supervisors: Professor Howard Fallowfield and Professor Nancy Cromar*

High rate algal ponds provide many advantages of conventional wastewater treatment ponds. These include: decrease in treatment time and land use, increase in effluent for reuse and algae biomass for a range uses. Despite these apparent advantages, there has been a lack of research into these systems in comparison with more established treatment systems. A particular area in need of further investigation is their disinfection capabilities. The typical organisms – *Escheria coli*, faecal and total coliforms, have been investigated extensively but other organisms particularly viruses and protozoa have been largely ignored. As these two groups of organisms are significant contributors to water-borne illness throughout the world, the understanding of their behaviour in high rate algal ponds is crucial. Additionally, examples of these organisms are recommended for the assessment of natural pond systems in the wastewater reuse guidelines by the World Health Organization and the Australian Natural Resource Management Ministerial Council – adenovirus, norovirus and Cryptosporidium spp.. The bacteria *Campylobacter* spp. is also recommended by both guidelines and has yet to be investigated in high rate algal ponds. The objective of this research was to investigate how the ability of high rate algal ponds to disinfect the previously listed organisms.

**Antagonistic Effects of Biochar Amendment on Transport of *Escherichia coli* and bacteriophages in saturated sand porous media**

*Salini Sasidharan  
Supervisors: Professor Peter Cook and Dr Saeed Torkzaban*

Biochar is a stable form of carbon which is produced by pyrolysis of biomass. There are some potential positive indications that biochar application to natural porous media (e.g. sand) may enhance pathogen retention. However, our current understanding of the governing processes that control the transport and retention of various microbes such as bacteria and viruses in porous media - amended with biochar is still limited. Our study aims to investigate the underlying mechanism involves in the transport and retention of bacteria and virus in biochar-amended sand. To achieve this, we have used various biochars and ultra-pure quartz, as porous media; and *Escherichia coli* and bacteriophages as microbes. At first stage, batch studies with biochar or sand were conducted at various chemical conditions. This was the key experiment to differentiate the attachment and straining processes of microbes to biochar and sand surfaces. At next step, packed column transport
experiments using various fractions and particle size of biochar-amended sand were conducted to understand the combined retention mechanism (attachment and straining) of microbes. Comparative studies between batch and column experiment show enhanced transport of bacteriophages through biochar amended sand. Enhanced retention of bacteria in packed column was the result of straining by fine biochar particles. Our study provides an important breakthrough knowledge regarding the potential negative impact of biochar in land application.

**Streamflow modelling in contiguous sub-catchments in a semi-arid environment using SWAT**

*Lanre Abiodun*

*Supervisors: Dr Vincent Post and Professor Okke Batelaan*

Monthly stream flows in 67 sub-catchments (59 ungauged and 8 gauged) contiguous sub-catchments in the semi-arid environment of the Western Mount Lofty Ranges (WMLR) in South Australia over the periods of 1998 – 2005 were modelled and calibrated in the Soil and Water Assessment Tool (SWAT) and the Sequential Uncertainty Fitting Ver. 2 (SUFI-2) of the SWAT Calibration and Uncertainty Programs (SWAT – CUP) respectively. Observation data from 1 of the gauged sub-catchments was used to calibrate streamflow for the other 66 sub-catchments while using the 7 other gauged sub-catchments to evaluate the results of the calibration. Climate, geology, soil and land cover data were ancillary data in the modelling of the streamflow while 16 parameters representing the surface, sub-surface and sub-catchment responses were calibrated. The results of the calibration of the 7 modelled and calibrated sub-catchments were compared to their respective observed gauge data using the Nash-Sutcliffe efficiency (NSE) and the coefficient of determination (R²), with the results ranging from 0.68 - 0.90 and 0.75 - 0.90 respectively. The modelling of streamflow in ungauged contiguous sub-catchments became necessary as Integrated Water Management (IWM) seeks effective water resources management from the sub-catchment scale through to the Continental scale.

**Temporal Decomposition of GRACE Data for the Estimation of Water Storage Components Across Australia**

*Robert Andrew*

*Supervisors: Dr Huade Guan and Professor Okke Batelaan*

The Gravity Recovery and Climate Experiment (GRACE) has been in operation since 2002. GRACE provides total water storage estimates globally for pixels sized roughly 100km x 100km. This is achieved by satellites measuring the gravitational pull across these pixels and converting it to mass, with the assumption that any mass change is from water storage. We use a wavelet filter to deconstruct the GRACE data and partition it into various water storage components including soil water and groundwater. Comparisons to the Australian Water Resources Assessment (AWRA) model show promising results with high correlations between the model and filtered GRACE data across Australia.

**Drought and Rice Production in Cambodia**

*Nyda Chhinh*

*Supervisors: Professor Andrew Millington, Dr Simon Benger and Professor Okke Batelaan*

Drought disasters have been destroyed paddy productions in Cambodia severely after flood within 1996-2000 as shown by the Ministry of Environment. While drought onset and cessation events have been monitored around the world including neighbouring countries of Cambodia, Cambodia has no drought monitoring system yet. This study investigates a drought monitoring tool, known as the Standardized Precipitation Index (SPI) in the context of paddy rice production in Cambodia. The SPI has been used officially by many countries such as the United States for its versatilities in major climate systems. Also, the study links the SPI with drought impacts on paddy rice damages; then with global climate events such as the El Niño Southern Oscillation (ENSO). We find that drought occurrences defined by the SPI are closely associated with paddy rice damages in Kampong Speu Province. Also, the SPI was satisfactory corrected with the ENSO indices. Then, the SPI is recommended for drought monitoring in Cambodia.
**Evaluation of Agricultural Land Dynamics at Urban Fringes**

*Suranga Wadduwage*

*Supervisors: Professor Andrew Millington, Dr Harpinda Sandhu and Dr Neville Crossman*

As a result of accelerated urbanization, agricultural lands are transformed into urban form mainly at the urban fringes. Land-use intensification and land fragmentation are the significant features associated with these anticipated land transitions. Although these non-linear transitions fluctuate due to various physical and socio-economic factors, the land agents’ decisions significantly impact the rate, scale and location of changes. These agricultural land dynamic processes have not been extensively studied due to the complex nature of this land system. This research investigates agricultural land transition processes at the city fringes of Adelaide over time and space. Agent-based model (ABM) simulations are used to analyse the said land transitions in a virtual environment. Initially, this research investigates the spatial dimensions of these land transitions along urban to rural (UR) transects. Then, it analyses the agricultural agents’ internal and external effects on land-use decisions for parameterising their behaviours in ABM. Finally, it evaluates the agricultural land transitions at the Adelaide city fringes, using the developed ABM simulations. Preliminary results display heterogeneous land-use change and land fragmentation patterns along the examined UR transects. Anticipated ABM simulations will be utilized to underpin the agricultural land transition processes in this complex land system.

**The Performance of Water User Association on Irrigation Performance in Vietnam**

*Thi Thanh Trang Pham*

*Supervisors: Associate Professor Beverley Clarke, Dr Simon Benger and Professor Andrew Millington*

The Vietnamese Government in the early 1990s devolved its responsibilities for the operation and management of irrigation systems to grass roots Water User Associations (WUAs). Since the inception of WUAs in Vietnam very little research has been undertaken about the effectiveness of them. This research is filling the gap by asking people directly affected by the Associations, farmers, about their experiences. The research is based on 15 in depth-interviews, four focus groups, and 200 farmer’s questionnaires. Fieldwork was conducted in Vietnam in 2013 across four different irrigation systems and WUAs models. The initial findings suggest several benefits for farmers operating under the WUAs including increased agricultural productivity, increased household income, and ability to diversify household income. The functioning of irrigation systems has also been shown to have benefitted under WUAs with reduced volumes of rubbish disposed of in canals and a more reliable delivery of water. There are also reported social benefits of increased community cohesion and less conflict between farmers. However, this study has found that there are still problems to be addressed including a shortage of funding for WUAs, lack of technical and management training programs for members of WUAs, lack of co-operation between WUAs and other water management entities, and lack of participation of farmers in operating and managing the irrigation systems.

**The Impacts of Large-scale Land Acquisitions on Land Systems**

*Darrell House*

*Supervisors: Professor Andrew Millington and Dr Simon Benger*

Foreign investment has been a significant factor in Australian agriculture since British settlement and the introduction of European farming practices. However, in the wake of the 2007-08 global food price crisis; the foreign ownership of Australian farmland has become a highly politicised issue surrounded by a great deal of speculation and public anxiety. Much of this opposition appears to stem from concerns around food, water and job security and the environmental ramifications of the foreign ownership of Australian farmland. These concerns are compounded by what has been dubbed the “information vacuum” which surrounds foreign investment, as to date there are definitive data as to levels of overseas ownership. The aim of my project is to examine the issues of foreign ownership of Australian farmland, and through the use of a combination of remote sensing, ecosystem service and statistical analysis techniques, investigate whether some of these concerns are legitimate or unfounded. My presentation for this seminar series will be based on my current train of thought, which is an exploration into whether changes in farmland tenure can be detected through resultant alterations to the lands phenological cycle.
Aerobic treatment of pig slurry to achieve ammonia oxidation in a laboratory scaled wastewater treatment system

Megan Hawley
Supervisors: Professor Howard Fallowfield and Professor Nancy Cromar

Where there are pigs there is pig waste, a potential sustainable resource goldmine. Strategies to extract maximum usage of pig slurry whilst reducing greenhouse gas emissions and natural resource dependence is required. Effluent treatment has attracted attention as a potential strategy to help achieve this goal and boost the industry’s environmental position. Integration of wastewater treatment systems as a means of deriving alternate water and energy sources from pig slurry is one route under investigation. Water from anaerobic ponds, an effective technique is often reused in Australian piggeries for on-farm and irrigational purposes. Unfortunately, this water retains adverse ammonia and suspended solid loads. If not dealt with could have detrimental impacts on environmental and pig health, a concern for reuse. Further treatment is crucial. The addition of aerobic treatment to anaerobic pre-treated pig slurry in an integrated wastewater treatment system is being assessed throughout this research project. The intent to oxidise ammonia to its non-toxic form whilst, providing quality reuse water. Optimal conditions for nitrification via this technology will be analysed first on a laboratory scale prior to an on-farm construction. Success would not only revolutionise the industry’s approach to slurry but also help lower environmental impacts and natural resource reliance associated with pork production by providing alternative resources.

A comparison of E. coli inactivation rates under environmentally relevant UVB dose rates, different temperatures and water resources

Yu Lian
Supervisors: Professor Nancy Cromar and Professor Howard Fallowfield

Disinfection of this wastewater is necessary to reduce the risk of exposure of the public to pathogenic microorganisms in situations where wastewater is reused. There have been few studies on the mechanisms of disinfection occurring in natural wastewater treatment systems such as waste stabilization ponds (WPSs) and high rate algal ponds (HRAPs)(Bolton, 2011; Buchanan et al., 2011; Mayo, 1995). Several factors besides light dependent disinfection mechanisms may contribute to the inactivation rate of pathogenic microorganisms, e.g. temperature, hydraulic residence time (HRT), starvation and ingestion by antagonistic biota. In this paper, UVB was investigated since it is the primary germicidal component of natural sunlight. More specific, compare the E.coli removal efficacy under different environmentally relevant regimes of UVB irradiance in buffered distilled water is investigated in this study. A UV cabinet was designed for this study to receive appropriate UVB dose and dose rate. The results showed that at both temperatures the E.coli inactivation rate increased with the increasing environmentally relevant UVB dose rates from 0 to 4.5 W/m². Temperature was shown statistically to influence E.coli inactivation rates in wastewater when incubated in the dark as well.

Development of an environmental health model for municipal solid waste management in a rapidly urbanizing area of northeast Thailand

Nachalida Yukalang
Supervisors: Dr Kirstin Ross and Associate Professor Beverley Clarke

Land surrounding Mahasarakham University in Mahasarakham province Northeast Thailand is quickly being converted from rural farm land to urban dwellings mainly in the form of student accommodation facilities. This coupled with an increase in commercial activity has led to the area producing over 300 tonnes of municipal solid waste every month. Solid waste is collected daily and transported to landfill sites where uncontrolled burning is the current waste management approach. There is little segregation of waste into streams for recycling. A major barrier around solid waste management is community attitude and behavior. Many waste management projects have been abandoned due to lack of community support. Additionally, there are few mechanisms to provide and distribute information that could improve community participation. The aim of this research is to alter community behavior and engagement in regard to municipal solid waste management; with the overall goal of improving solid waste management through better waste segregation. The research has two components. Firstly, waste management issues in Tha Khon Yang sub-district Mahasarakham province will be reviewed. Secondly, factors that are preventing better waste management practices will be determined and addressed.
Nematophagous fungi and *Strongyloides*

**Tara Garrard**

*Supervisors: Dr Kirstin Ross, Associate Professor John Edwards and Dr Michael Taylor*

Nematophagous fungi are fungi which trap and digest nematodes. There are multiple types affecting different parts of a nematode’s lifecycle. Nematophagous fungi have been used successfully in biological control for pest nematodes in agriculture. *Strongyloides stercoralis* is a human parasitic nematode. The initial source of infection is usually from soil contaminated with *S. stercoralis* larvae. Nematophagous fungi potentially could be used to inhibit *S. stercoralis* before they have contact with a host. The aims of this project are to isolate nematophagous fungi from soils in the Northern Territory, representative of areas where *Strongyloides* occurs. To determine the efficacy of various nematophagous fungi on *Strongyloides ratti*. To test the toxicity of various nematotoxic compounds extracted from nematophagous fungi on *S. ratti*. Soil samples were collected from the Northern Territory, they were then analysed in the lab for the presence of nematodes and nematophagous fungi. Nematophagous fungi were then isolated from the samples. Assays were then developed using *Caenorhabditis elegans* in vitro using nematophagous fungi. The assays were testing the efficacy of the nematophagous fungi, the toxicity of fungi and nematicotoxins as well as other conditions such as pH, temperature and salinity. These assays will then be performed on *S. ratti*.

Characterisation of Environmental Methamphetamine Exposure through Hair Analysis

**Jackie Wright**

*Supervisors: Dr Stewart Walker and Associate Professor John Edwards*

The analysis for drugs in hair has been undertaken to provide information on environmental exposures to methamphetamine by police involved in assessing and evaluating drug laboratories, as well as a family who have been unknowingly living in a home for 2 years that was formerly used as a methamphetamine drug laboratory. Analysis involved extraction using methanol and analysis using liquid chromatography with tandem mass spectrometry (LC-MS/MS) using an electrospray ionisation (ESI) source. For police officers, with a range of experience in up to 120 drug laboratories, there were no detections of methamphetamine or amphetamine. This data enable confirmation that existing procedures for entering methamphetamine laboratories and the level of personal protective equipment (PPE) worn provide adequate protection. For the family of two parents and three children aged 7-12, the hair analysis results showed detections of methamphetamine and amphetamine at levels that correlated with information provided by the family on the potential for exposure within the home (i.e. exposure behaviours). The most elevated levels were reported in the hair of the youngest children where the levels were consistent with the lower end of the range of concentrations reported in the analysis of hair from children removed from active methamphetamine drug laboratories and chronic adult drug users. These exposures were also found to be associated with health effects in the youngest child.


**Ankit Kavi**

*Supervisors: Associate Professor Jochen Kaempf and Dr Erick Bestland*

Two dedicated satellite missions (SMOS and Aquarius) were launched in 2009 and in 2011 respectively, to routinely measure, for the first time, sea surface salinity (SSS) fields from the space at global and regional scales. The SMOS mission was launched in November 2009 by the European Space Agency (ESA). The Aquarius/SAC-D mission was launched in June 2011 by NASA and CONE, the Argentina’s space agency [Lagerloef et al., 2008; Lagerloef, 2012; Lagerloef et al., 2012]. Both satellites differ in their technologies. As a result they have different spatial resolution, revisiting time, and accuracy [e.g. Kerr et al., 2010; Le Vine et al., 2010]. Several studies have already been completed during the first three years of operations of the Aquarius satellite. These studies demonstrate the potential of the Aquarius SSS measurements to enhance the understanding of variety of oceanic processes. Most of these studies concentrated on the Atlantic Ocean and very few were dedicated to the Indian Ocean. In my study I will concentrate on the analysis of the latest Aquarius sea surface salinity data for the Indian Ocean comparison with in-situ salinity data sets. In particular, I will undertake a detail error analysis of the one selected year (2012) of salinity observations in comparison with RAMA moorings data and ARGO data. This approach ill address the important research questions: How reliable are Aquarius data?, How accurately do Aquarius data capture the temporal and spatial variability of salinity distribution in the Indian Ocean?, Can the quality of Aquarius data be improved?, What are the main sources of errors (spatially and temporally) in Aquarius data?
Impacts of plantation forestry on groundwater resources in the lower South East of South Australia

Darryl Harvey
Supervisors: Professor Craig Simmons and Dr Huade Guan

Plantation forests are an extensive land use in the lower South East of South Australia, covering about 16% of the available landscape. They reduce groundwater recharge and extract groundwater where the water table is shallow. Therefore it is important there is a water accounting system that incorporates these hydrological impacts on the regional water balance. Under the recently adopted water allocation plan, plantation forests are required to account for their hydrological impacts. The existing 160,000ha forest estate accounts for an impact of 300GL, about 30% of all licensed groundwater allocations. It is impractical to measure forest hydrological impacts at a commercial scale, whether in terms of impacts on groundwater recharge, or extraction from shallow water tables. Based on biophysical principles, models with outputs expressed in annualised values have been developed. These estimate hydrological impacts based on a characterisation of plantation forests of the same type in the same groundwater management area. The deemed values ‘smooth’ the hydrologic impacts over the full forest life. This presentation discusses the principles on which the adopted forest water models are established and the research to validate the accounting models.

Maternal health Inequity in West Java Province, Indonesia

Teguh Sugiyarto
Supervisors: Associate Professor Gour Dasvarma and Dr Lillian Mwanri

There has been a slow progress in the reduction of maternal mortality ratio (MMR) in Indonesia. If its current trend continues, then it would not be possible for Indonesia to meet its goal of a three-quarters reduction in the MMR by 2015, as stipulated in the United Nations Millennium Development Goal 5 (MDG5). There are also evidences that there are large inequalities in maternal mortality between and within the provinces of Indonesia. This is also not conducive for the achievement of MDG 5 by Indonesia. The present study addresses the inequalities in maternal mortality with a focus on the province of West Java, where the inequalities in maternal mortality are among the largest in the country. The study has three main objectives, namely (1) To examine the extent of inequality in maternal mortality at both the macro and micro levels within West Java Province; (2) To identify the determinants of maternal mortality and (3) To recommend policies to reduce maternal mortality and improve maternal health. The study is based on analyses of available secondary data on maternal mortality and additional primary data collected through a field work in West Java during 2013-14. The large inequality in maternal mortality in West Java, measured by the Gini Ratio and the Concentration Index is apparent at both the macro and micro levels. The determinants of maternal mortality identified in the study include characteristics of the household head, women’s empowerment and the availability of resources and facilities. Improving maternal health requires improvements in not only health care provision but in several other aspects affecting health seeking behaviour of women.

Toxicological and microbiological study of rainwater used for drinking - Metropolitan Adelaide – South Australia

Emmanual C. Chubaka
Supervisors: Dr Kirstin Ross and Associate Professor John Edwards

Bushfires result in airborne contaminants that can be deposited on roofs as noted by Buynder et al (2006). These contaminants can include bushfire ash, fire retardants, debris, and copper, chromium and arsenate from CCA treated timber (Buynder et al, 2006). This research is a toxicological and microbiological study of rainwater being used for drinking. We will be taking samples from rainwater tanks from areas affected by bushfires, for comparison with industrial areas in metropolitan Adelaide, and the Adelaide Hills region. Inclusion of industrial areas is important as a comprehensive survey of rainwater quality in industrial areas in Adelaide has not been undertaken for decades, despite changes in building regulations that require rainwater tanks to be installed in new or extended dwelling and other buildings. Parameters being investigated include the detection of trace metals and pathogens. In addition, this study will test the efficacy of current rainwater filtration systems. Sampling will be once a month or after significant rainfall events, for a period extending to two winters. Although it is hard to predict the study outcomes before experiments, however, we are expecting to find metals such as chromium, lead, cadmium, etc., and E. coli during experiments; in line with previous studies on rainwater conducted around Australia and in South Australia by Buynder et al (2006), Chapman et al (2008), Gleeson and Gray (1996), Kwaadsteniet et al

inspiring achievement
(2013) and Toze (2014). This study will allow clear advice to be given to residents in areas reliant on rainwater tanks post bushfires.

**Understanding Environmentally Friendly Behaviour (EFB) in Indonesia: A Case of South Sumatera Province**

**Marpaleni**

*Supervisors: Associate Professor Gour Dasvarma and Dr Udoj Saikia*

The Intergovernmental Panel on Climate Change (IPCC) declared in 2007 that global warming and climate change are not just a series of events caused by nature, but rather caused by human behaviour. Thus, to reduce the impact of human activities on climate change it is required to have information about how people respond to the environmental issues and what constraints they face. However, information on these and other phenomena remains largely missing, or not fully integrated within the existing data systems. The proposed study is aimed at filling the gap in this knowledge by focusing on Environmentally Friendly Behaviour (EFB) of the people of Indonesia, by taking the province of South Sumatera as a case of study. EFB is defined as any activity in which people engage to improve the conditions of the natural resources and/or to diminish the impact of their behaviour on the environment. This activity is measured in terms of consumption in five areas at the household level, namely housing, energy, water usage, recycling and transportation. This study has three specific research questions: (i) What is the level of EFB among the people?, (ii) Who are the environmentally friendly people and who are not? and (iii) How have the environmentally friendly people acquired their behaviour?

To answer these questions, an empirical study will be conducted based on primary and secondary data collected in the province under study. The primary data will be collected by interviewing respondents in South Sumatera province who will be selected by using Statistics Indonesia’s socio-economic sampling framework. While the secondary data will be collected from Statistics Indonesia’s Population Census in 2010, Socio-Economic Survey in 2010-2014 and Environmental Care Survey in 2013. By conducting this empirical study, this research expects to find the relation between socio demographic characteristics such as: age, income/social status/occupational prestige, location, education, gender and other statistics; and one’s orientation towards EFB. A model of EFB based on demographic and socio-economic data will also be formulated. The results of this research will be useful to precisely identify what support people require to strengthen their EFB, to help identify specific constraints that different actors and groups face and to uncover a more holistic understanding of EFB in relation to particular demographic and socio-economics contexts. As the empirical data are examined from the national data sample framework, which will continue to be collected, it can be used to forecast and monitor future EFB.

**How to strengthen public support for climate mitigation policies?**

**Safa Karimi Molan**

*Supervisors: Professor Iain Hay and Associate Professor Beverley Clarke*

Climate change is one of the most pressing issues of our planet. There is an urgent requirement for such a global concern to be understood and tackled from a multidisciplinary point of view at both local and global levels. Currently, there are two difference policy approaches to address climate change issues: mitigation and adaptation. Complete understanding of the public perspective about climate policies is one of the important aspect for successful climate policy making and implementation. The aim of this research is to identify effective methods to communicate climate policies with the public in South Australia. This research will investigate whether learning about adaptation strategies influences South Australian’s attitude toward mitigation plans. It will also examine whether public awareness of innovative technologies to reduce the impact of climate change influences their attitude toward mitigation policies. Current research will analyse the data from two important sources in South Australia. First group including climate scientists, policy makers and environmental health professionals will be interviewed while the second group, a representative sample from South Australian residents, will be recruited to fill out questionnaires.
**Evaluation of the potential for the implementation of a 3D Cadastre in urban areas in Indonesia**

Dicky Muharawan  
Supervisors: Professor Andrew Millington and Professor Jorg Hacker

As the developing country, Indonesia especially in urban cities are growing rapidly, there are many infrastructure building developments not only in the land surface but also above and below it. However, at the present time the Indonesian Land Registration System still uses a two dimensional model (map). This present condition should be inadequate for the emerging three dimensional landscapes of towering high rise buildings and the increasingly complex underground infrastructure of modern Indonesian cities. It is also becoming increasingly unmanageable in many ways; for example, problems and conflicts around land rights, registration and responsibilities can be foreseen for Indonesian urban cities. Surveying methods and point cloud data processing are used to explore the 3D cadastre systems. Next step is performing in-depth interviews to the people for evaluating and exploring the potential implementation in Indonesia. This research will provide valuable information regarding present condition of Indonesian land cadastre, explore a full 3D cadastre method, and conduct a critical and comprehensive study and analysis of the issues around the implementation of a 3D cadastre in Indonesia.

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**Characteristics of active seawater intrusion**

Sugiarto Badaruddin  
Supervisors: Professor Adrian Werner and Dr Leanne Morgan

The inland migration of seawater in coastal aquifers, known as seawater intrusion (SWI), can be categorised as passive or active, depending on whether the hydraulic gradient slopes downwards towards the sea or the land, respectively. Previous studies of SWI processes have mainly considered steady-state and/or passive SWI conditions, and active SWI has received considerably less attention, despite evidence of active SWI occurring in many locations. In this study, numerical modelling is used to characterise active SWI in various non-tidal, unconfined coastal aquifer settings, caused by an inland freshwater head decline (FHD). Relationships between the key features of active SWI (e.g. interface location, dispersiveness of the interface and response timescales) and the parameters of the problem (e.g. inland FHD, density, dispersivity, hydraulic conductivity, porosity, and aquifer thickness) are explored. The results show that SWI response timescales are influenced by both the initial and final boundary head differences, extending previous studies of passive SWI that show that only the final boundary head difference controls passive SWI response timescales. Density forces can be neglected in estimating rates of active SWI when the mixed convection ratio (the ratio of forced convection due to hydraulic boundary conditions (advection) to free convection (density) due to density differences) is equal to or below -0.05. Our results highlight that under active SWI situations, besides mechanical dispersion, both density and advection are significant in widening the width of the mixing zone in coastal aquifers.

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**The Effectiveness of an Educational Intervention to Improve Knowledge and Perceptions for Reducing Organophosphate Pesticides (OPs) Exposure among Indonesian Farmworkers**

Suratman  
Supervisors: Dr Kirstin Ross, Associate Professor John Edwards and Dr Kateryna Babina

This study was to determine the effectiveness of an educational intervention to improve knowledge and perceptions for reducing organophosphate pesticides (OPs) exposure among Indonesian farmworkers. This was a quasi-experimental study. Thirty farmworkers at Dukuhlo Village, Brebes Regency, Indonesia received short information using power point slides followed by discussion. Knowledge and perceptions were measured using a structured questionnaire at pre-intervention and at 3 months after the intervention. Data were analysed using paired t test. In pre and post intervention, mean [SD] of scores of knowledge about adverse effects of OPs exposure respectively were 13.07 [2.50] and 16.67 [2.78] (t = 6.52; p < 0.0001) and knowledge about self-protection from OPs exposure were 13.87 [3.34] and 16.17 [2.77]  (t = 4.70; p < 0.0001).
Scores of individual perception aspects were:

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<th>Perceived Susceptibility</th>
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<th>Perceived Benefit</th>
<th>Perceived Barrier</th>
<th>Cues to Action</th>
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<td>3.38</td>
<td>2.34</td>
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This study suggests that the provided educational intervention can improve knowledge and perceptions of the farmworkers. However, cues to action did not significantly improve.

**Turbulent velocities: moving beyond the concept of eddy diffusivity**

*Darren Cox*

*Supervisors: Associate Professor Jochen Kaempf*

It has long been debated that the Fickian model for molecular diffusion has been incorrectly applied to horizontal diffusion in the ocean. The underlying reason for this is the complex turbulent nature of ocean diffusion. At any one time, there exists a large number of turbulent transport processes acting on a variety of length and time scales. This means that the turbulent mixing occurs at a much faster rate than that described by Fick's model of diffusion.

Based upon the work of Cushman-Roisin (2008), this research looks to test the use of turbulent velocities as a simpler method for measuring the effectiveness of turbulent based diffusion. Turbulent velocity scales are values that can be obtained from field observation whereas estimates of eddy diffusivity are strongly biased by the length scale inherent with an observation. To this end, field observations are used to test a new model and apply it to improved horizontal turbulence scheme for use in hydrodynamic models.

**Spatial Distribution of Epiphytic Lichens in South Australia**

*Van Vuong Le*

*Supervisors: Professor Andrew Millington and Dr David Bass*

Lichens are an important, yet often neglected, component of ecosystems throughout the world. They are symbiotic organisms comprising a fungus and an algae. Lichens occur on a variety of abiotic and biotic substrates. In my study, there are three transects in Mid North region: East, Centre and the West have been surveyed and for the lichens on the trees (Epiphytic lichens). To be in detail, more than 400 trees, each tree which has in four aspects has been collected lichens. At this stage, the data have been analysing. Initial results shows that the bark pH at four sites (N, E, S and W) of a tree showing no significant differences. And, there is no significant differences in the lichen cover percentage, neither. The study will answer three research questions: (i) Which tree species host which species of lichens in South Australia? (ii) What are the relationships between climate and epiphytic lichens in South Australia? (iii) What is the spatial distribution of epiphytic lichens in South Australia?

**Dealing with data scarcity: mass appraisal practice in the National Land Agency of Indonesia**

*R. Ganda P. Sihombing*

*Supervisors: Professor Andrew Millington*

Mass appraisal is a systematic appraisal of groups of properties as of a given date using standardized procedures and statistical testing. In Indonesia, the main problem in meeting the standards required for mass appraisal practice is the scarcity of property sales data with an actual sales price. Even when the price is given, it is common to report a much lower price in the sale deed to reduce the transaction tax. Two approaches are set for this study. First: taking the data scarcity as a given condition. A mass appraisal technique capable of using a limited number of samples, yet with high accuracy in value prediction is required. The reputable techniques (e.g.
the spatial expansion model and geographically weighted regression) presume that land values shift continuously and change gradually over space. In Indonesia’s cities, land prices often shift abruptly between contiguous neighbourhoods. Incorporating market segmentation to the existing techniques may be an alternative solution to suit the local circumstances. Second: by focusing on the data scarcity, and developing a mechanism to get the actual sale price in the sale deed. Currently, I propose to carry out simulations of the market-enforced approach and progressive LVIT (Land Value Incremental Tax) scheme.

**The Role of Land Reform in Minimizing the Probability and Resolution of Rural Land Disputes in Indonesia**

*Rahmi Yudianti*

*Supervisors: Professor Andrew Millington and Mr Brendan Grigg*

The purpose of this research is to investigate rural land disputes at different geographical scales in Indonesia, with a focus on minimizing the chances of disputes and/or resolving disputes through contemporary land reform policies; and also to identify the key-issues of rural land disputes and those parties involved.

Rural land disputes in Indonesia exist between individuals; between individuals and businesses; between individuals and government (local, provincial and national); between businesses; and between businesses and government, and it creates problems such as insecurity of land tenure and ownership, uncertainty in land-use decision making, land abandonment, and slow implementation of land reform. And those cause land productivity reduced and rural livelihoods can be compromised. Rural land disputes occur in many developing countries and, in some cases, land reform has been implemented to mitigate rural land disputes. The Indonesian focus is set in the context of international case studies relating to land reform (e.g. Bolivia, Kenya, South Korea) in which the process, execution and outcomes of land reform have been reviewed to achieve a better understanding of options that could be used in rural land disputes in Indonesia and to contribute to global theory on land disputes.

**Globalisation or changing demand: Uruguay’s contribution to the global soybean trade.**

*Ingrid Tejada,*

*Supervisors: Professor Andrew Millington, Dr. Udoy Saikia, Dr. Harpinder Sandhu*

Increasing demand for global food, feed, and fuel has been the major driver of soybean expansion in South America. Recently, there has been an increase in demand for non-genetically modified and eco-certified soybean, from European consumers. Therefore, countries such as Brazil are responding to this demand by converting soybean production and supply chain to organically certified. This has resulted in a large deficit for conventionally grown soybeans. Uruguay has been contributing to this demand for conventional soybeans. In 2013, Uruguay produced 3.2 MMT and made it to the top 10 soybean producers in the world. With an area of 176,000 km² it is the smallest country in the top 10 list. This large increase in production has occurred as a response to changing demand. This paper analyses how Uruguay has been responding to the global demand for conventional soybeans. Firstly, it examines land-use area in the agricultural sector of Uruguay from the 1960’s onwards. Second, it provides an analysis of agricultural contribution to national GDP (Gross Domestic Product) in Uruguay. Thirdly, it analyses how exports of soybean from Uruguay measure up in a global market. Whilst this study focuses on Uruguay, the results stress the importance in understanding how demand for conventional soybeans from regional and global markets is influencing land-use. The study contributes to the overarching global efforts to produce more food, understand supply chain and its impacts that are driven by global demand.

**Groundwater-surface water interaction in sandy soil provinces of southern central coastal Vietnam**

*Manh Hai Vu,*

*Supervisors: Dr Margaret Shanafield and Professor Okke Batelaan*

Groundwater-surface water interaction is increasing in importance as a scientific issue in water resources management. Generally, the aim is to provide a better understanding of the exchange between surface and subsurface water as they are linked systems. Contemporary questions focus on the dynamics of this exchange and associated biogeochemical processes at the groundwater and surface water interface. Southern central coastal Vietnam is one of the vital socio-economic regions of Vietnam. There is increasing demand on water resources for agriculture and a number of other purposes, making water
resources in this area relatively scarce. Moreover, regionally there is a lack of research in (ground) water resources management. Together, this calls for the need for studies on water resources for sustainable development. This paper will provide the main features of this recently started PhD study on “groundwater-surface water interactions in sandy soil provinces of southern central coastal Vietnam”, including: the background information, the aims and the expected outcomes of the research as well as its collaboration with an ACIAR project which is currently being implemented to support sustainable agriculture systems in the southern central coastal Vietnam. Initial results of characterizing the study area and outcomes of a groundwater sampling campaign are presented as the first steps in this research.

Visibility through the smoke in airborne remote sensing

Mirahmad Chabok
Supervisors: Professor Andrew Millington and Professor Jorg Hacker

One of the most challenging airborne and space borne remote sensing issues is scattering and absorption of electromagnetic lights which becomes more problematic due to the substantial presence of smoke particles in the atmosphere caused for instance from an active bushfire or similar situation. Although most recent satellite and air-borne hyperspectral imaging sensors are capable of capturing the energy in different electromagnetic bands, e.g. short wave and thermal infrared which penetrates through the smoke particles, all of these sensors in one hand have low spatial resolution for detecting small objects such as human or other important objects and the other hand have long temporal resolution to provide timely high resolution image from above.

This research studies a new method of penetrating through the smoke without compromising for spatial and temporal resolution which significantly improves visibility of the aerial images in near real-time, resulting data can be used to form a seamless mosaic of a large area, helping decision makers, environmental analysts, traffic and incident management, search and rescue, defence and other industries to have timely and instantaneous high resolution vision of the event.