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Welcome to the Soil News

February 2018

Issue # 1 - Vol # 66

In this issue...

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Your contributions are required - New Zealand Soil News is your newsletter
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Letter from the editor

Dear Society Members,
Welcome to the new on-line version of the Soil News! I hope you like the new format of our newsletter. If it looks really strange please make sure you have chosen to "download photos" as this does not happen automatically in some cases. If it still looks strange you can view the web version by clicking on the link in the top left corner ("View this email in your browser"). A lot of work has gone on behind the scenes to take it from the old word-type layout to the MailChimp version you see before you. There will be some broken links and odd-looking formats but we expect some bugs as we transition into this new brave world. Please send us any comments on the new format -both the things you like, and things you hate!

One thing that I know some of you like to do is print out the Soil News and take the paper version with you for a good read. The easiest way to do this, and preserve formatting, is to first save as a PDF by going to the web version (link in the upper left hand corner of this email), and within the browser choose print (or file -> print) and from there choose 'save as PDF' (in chrome) or 'Microsoft Print to PDF' (in explorer).

The theme for this issue is "Going Digital" which has been interpreted quite broadly. Our editorial is from Mark Shepherd who looks at our role as scientists in transitioning to new technology. In our Special features section Landcare Research has highlighted their work taking the National Soils Data Repository "digital" and soil mapping in this digital age.

Thanks again to all our contributors, many of whom have highlighted their "digital" endeavors, and especially to Isabelle for her patience and perseverance in using this new tool.
Looking forward to your feedback!
Gina Lucci

P.S. Theme for the next issue is **Soil biology and ecosystems**

Editorial Digital agriculture: changes ahead

Digital agriculture: don't think drones, think information's and communications technology and data ecosystems that support the development and delivery of timely, targeted (localised) information and services to make farming profitable and sustainable (socially, economically and environmentally) while delivering safe, nutritious and affordable food. Thus, Digital agriculture is 'Smart Farming', and it also encompasses the entire value chain.

Eight potentially transformational technologies have been identified[1]: sensors; robots; drones; artificial intelligence; augmented reality; virtual reality; blockchain; and 3D printing. However, digital agriculture will thrive not because the technologies are there but because these technologies can be used to solve the complex problems that we face globally and within New Zealand agriculture.

But we have a long way to go. Although there are farms with digital data collection, there are few examples so far of automated decision support. The technology industry is also moving at pace exponentially whereas the agricultural industry is moving incrementally. There are technical challenges such as rural connectivity, but these will be overcome. Perhaps more telling is the recent report strongly suggesting that businesses and organisations are not envisioning the potentially revolutionary changes that technologies will offer[2]. However, if these barriers are overcome and the realisation dawns, then there is every possibility that:

- In 5-10 years: the agricultural industry will rapidly adopt proven digital technologies to provide enhanced and integrated decision-making across the value and policy chains, enabling NZ Inc. to achieve multiple sustainability goals to the benefit of NZ trade.
- In 20 years: it will be possible to run farms autonomously using artificial intelligence with associated sensors and communication equipment. The decisions made will be seamlessly integrated with the value chain, including on farm decisions been made in response to the value chain requirements.

If this is to be the case, then it begs the question: what role do scientists and research organisations play in supporting, even leading, this charge? Personally, I don't think that question is any easy one to answer. But I also believe we are beholden to the agricultural industry to be a part of this digital transition so we can contribute to its progress and use these new tools to help solve the questions of sustainable food production that we have been wrestling with throughout our careers.

In essence, I guess our role is about moving the industry from technology push to market pull, i.e. clearly demonstrating a proven scientifically supported value from adoption of the technology, so the industry wants to adopt. How we do this exactly, is another question. There is a risk that technology development outstrips science progress, compromising our ability to advise the industry on the validity or usefulness of these technologies; and also this might not fit with traditional funding timetables. So there's a challenge for a funders and their need to adapt.

But there is also a challenge for ourselves: being able to work at pace and to respond and adapt (the much-vaunted 'agile' approach); being imaginative enough to capitalise on the technologies (moving beyond business as usual); developing, or accessing new skills (e.g. data science); and recognising that there will be social as well as technical barriers to uptake of digital agriculture.

Whatever the future however, there is no doubt that the technologies offer fantastic opportunity for transforming the way we do our science. Low cost data collection, combined with analytics provides opportunity for powerful new scientific capability, enabling us to better understand, and

utilise, biological variability. And I believe digital agriculture can serve as a catalyst for more effective inter-disciplinary and transdisciplinary research to tackle the complex problems we face.
Exciting times ahead: how are you going to respond?

Mark Shepherd
Principal Scientist, AgResearch

[1] Connolly, A. 2016. Disruptive Digital Technologies... with the Power to Transform Agriculture. https://www.linkedin.com/pulse/disruptive-digital-technologies-power-transform-aidan-connolly-7k-?trk=mp-author-card
[2] Disruptive Technology in the Agrifood Sector. http://bit.ly/agritech-report

President's Message

Kia ora NZSSS members. This issue marks the start of a new era in soil news as we launch our new digital delivery approach. The Council greatly appreciates the efforts of Dr Gina Lucci (as Soil News editor) who has lead us through this advancement to modern media. We are aware that for some this change will take some getting used to, however over time hopefully everyone will see the benefits of receiving the information in this way that will allow us to connect our membership to a wider range of potential source material. Of course some things will not change and so popular items such as 'news from correspondents' will very much be part of the new format.

Hopefully many of you attended December (Hamilton and Lincoln) and February (Palmerston North) Norman Taylor lecture series which was presented by Professor **Tim Clough** from Lincoln University. His talk entitled 'Developing integrated approaches to nitrogen management: defining soils role' was well received and I'm sure everyone that attended came away learning something new. With Tim's lecture series now complete I can now announce that our next presenter for the prestigious NZSSS Norman Taylor lecture will be Dr **Ants Roberts** from Ravensdown. As this is a conference year for the society, Ants will present his Norman Taylor address as the last act of our society's conference in Napier on the 6th of December. A conference update is included in this newsletter. However I can confirm that themes have been set, abstract submission is now open sponsorship revenue is rolling in. If you or your organisation is interested in sponsoring this event then please get in contact with me. More details around the conference can be found at http://nzssconference.co.nz/.

I would like to end this update by alerting you all to a recent manuscript published in the New Zealand Journal of Agriculture Research by Fiona Curran-Cournane, Nancy Golubiewski & Laura Buckthought from the Auckland Council entitled '*The odds appear stacked against versatile land: can we change them?'* This paper addresses an important and ongoing issue for our members and all people interested in the longevity and

functionality of our soil resource. The paper provides a summary of benefits for protecting our versatile land for food production and describes the political pressures that stil prioritise releasing land for commercial development. The authors suggest that a Nationa Policy Statement for soil would be the most effective way of protecting our versatile land. would encourage our membership to read more from this paper (abstract available via this link) and make your voice heard in the debate.

Regards Dave Houlbrooke – NZSSS President

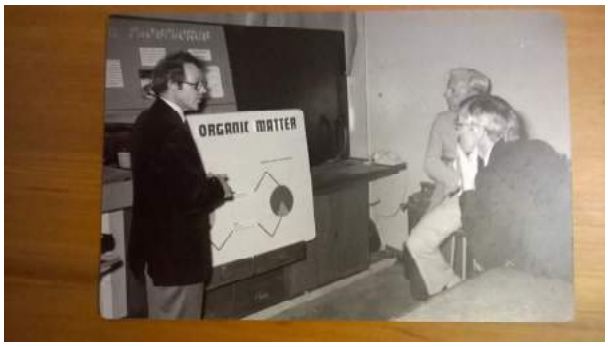
Obituary - Kevin Russel Tate FRSNZ (1943-2017)

New Zealand and the international scientific community have been saddened by the tragic loss on 22 January 2018 of Kevin Tate, who made a tremendous contribution to science and who has been such a good friend and tutor.

Kevin began his scientific career teaching chemistry at Victoria University in Wellington before becoming a soil scientist at the New Zealand Soil Bureau, DSIR, in 1968. Following a number of years leading major research programmes on greenhouse gas exchange with the terrestrial biosphere, Kevin retired in 2005 but continued working at Manaaki Whenua – Landcare Research as a Research Associate. In retirement he applied his research to the development of mitigation technologies for greenhouse gas emissions from agriculture.

Kevin was the essence of a great scientist, as well as a mentor, with a strong commitment to family, and a lifelong Christian faith. His vast intellect, and his dedication and passion for research led to major breakthroughs in our understanding of the complexities of the importance

of carbon in plants and soils. He kept NZ soil science at the leading edge through his research on soil organic matter.



Kevin talking about Soil Organic Matter to the Minister of Science, Dr Ian Shearer with Director of Soil Bureau, Dr Mike Leamy September 1981.

Kevin receiving the Grange Medal from Prof. Mike Hedley (Massey University)

This work is recognised by the many colleagues and friends in the international science community. Throughout his career Kevin received many accolades and awards. He was elected to Fellowship of the New Zealand Institute of Chemistry, 1980. He was the recipient of all the New Zealand Soil Science Society (NZSSS)'s major awards. He gave the Norman Taylor Memorial Lecture in 1988. He was an inaugural Fellow of the NZSSS in 1995 and received the M.L. Leamy Award in 2002 for the most meritorious publication by a New Zealander on soil science between 2000 and 2002. In 2011, Kevin was awarded the NZSSS's Grange Medal, the top recognition for making an "outstanding contribution to New Zealand soil science".

Elected a Fellow of the Royal Society Te Aparangi in 1995, Kevin was active in the Academy of the Royal Society Te Aparangi, serving on many of its committees. In particular, he served many

times on the Fellowship Selection Committee where he highlighted the contribution to ‘science excellence’ by Crown Research Institutes. In 2005, he was awarded the prestigious Marsden Medal by the New Zealand Association of Scientists for research into ecosystem processes and climate change – a testament to his outstanding professional achievement.

Kevin at the Royal Society New Zealand Marsden Award ceremony at Te Papa Museum, Wellington, 2005.

While Kevin was much ‘medalled’ with prestigious awards, at the other end of the scale he also worked to mentor and encourage the younger generation of scientists, as well as working with school children to show them the ‘excitement of science’, ready to engage and offer balanced opinion and advice. Between 2008 and 2011 Kevin was the Chief Judge at the Fonterra Manawatū Science & Technology Fair.

Kevin’s work continued with renewed enthusiasm after his official retirement, when he was excited to have the opportunity and freedom to start new projects. This research resulted in the development of biofilters to mitigate methane produced from dairy farm waste ponds. Most recently, he worked extremely hard editing the book *Microbial Biomass – a paradigm shift in Terrestrial Biogeochemistry* (World Scientific Publishing, 2017), which celebrates 50 years of research in soil biology. Publication of the book last year represents Kevin’s pinnacle of scientific achievement.

Kevin (in red jacket) explaining the use of soil as biofilter to remove low concentrations of methane produced from animal wastes to international delegates.

Kevin's skills and experience allowed him to communicate the findings from his research through his impressive list of scientific publications. But, much more than that, Kevin was highly respected by science managers and policy makers, and was able to transform New Zealand's approach to accounting for changes in carbon stored in plant and soil. This work formed the basis for government policy that earned New Zealand the reputation for its world-leading approach to the mitigation of the impacts of climate change.

Kevin was passionate about the need to change the way we live to slow the rate of climate change. He advocated the need for action to fellow scientists, policy makers and school groups, provided advice to the Church and, through lectures, to the general public. Kevin was also passionate about a sustainable lifestyle – he biked to work, drove a hybrid car, and had solar panels installed in his house for power generation.

Kevin speaking at the Climate Change demonstration in The Square, Palmerston North 2015 and a photo of some of the placards

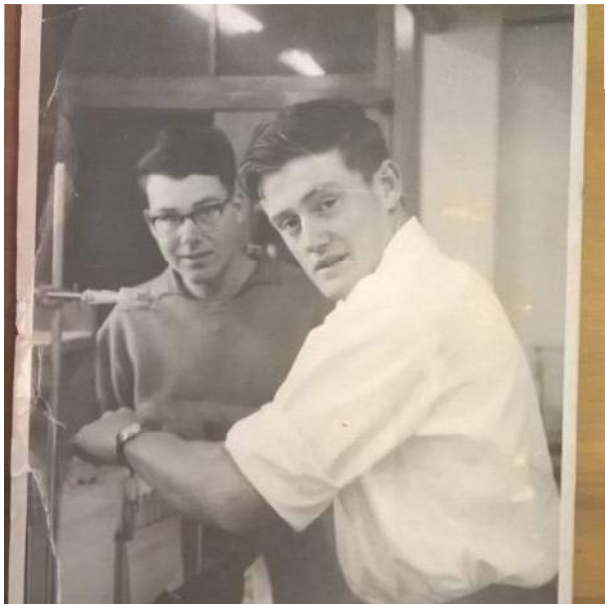
The scientific community, colleagues and friends, grieve the loss of Kevin, but we are encouraged that his enormous contribution has provided us with a legacy to better understand how we use our land-based resources to feed the worlds' growing population, protect our environment, and ensure the well-being of all people.

As we say, a great tōtara has fallen in our forest at Manaaki Whenua. Many seedlings have been nurtured by Kevin and will grow up stronger people and scientists because of him. We at Manaaki Whenua shall miss him. But we celebrate his life and time with us and assure you that his memory will live on in our values, goals, and work.

In particular, we have appreciated his humanity and concern. He is one of the people who we think of most, keeping Manaaki Whenua true to its values of caring for people and the land. Our best tribute to Kevin will be to keep his dream alive through developing technologies, strategies, and policies that slow the rate of climate change.

Kevin's Early Scientific Experiences (by Kevin's brother Warren Tate FRSNZ)

Kevin began studies at Victoria University in the early 1960s, already with a strong interest in Chemistry. This passion continued throughout his time at university and he eventually embarked on a PhD embracing a 'carbon recycling' project. The precision of clarifying and determining the chemical mechanism for a specific decarboxylation reaction appealed to Kevin's attention to detail and his highly disciplined approach to life. Amazingly, carbon recycling in a different form would become the 'touchstone' of his extensive scientific career. Kevin at Victoria University, applied chemistry, 1963 here with Graeme Tobin.While completing his PhD, Kevin combined his test tube research project using pure chemicals, with a brief experience of academic life. He was appointed as a Junior Lecturer specialising in physical chemistry and kinetic mechanisms. While he thoroughly enjoyed these experiences, something about the distance of academic life from 'real life', and the esoteric chemistry of the time from 'real life' problems led him to seek an appointment outside the university environment.



Kevin at Victoria University 1963 with Graeme Tobin

He joined the New Zealand Soil Bureau, a division of the government agency of the then Department of Scientific and Industrial Research, specialising in soil-related research and development. There he was able to advance his knowledge and experience of carbon recycling in an environment far away from the simple test tube. He loved being able to track carbon immersed in the complex chemistry of soils and with the added complication of being within a context of biological microorganisms. He embraced the field trips to collect soils and monitor

experiments that grounded him in the natural world, and fuelled his interest in sustainability. This inspired him through a subsequent career of 50 years in carbon recycling framed more recently around greenhouse gas emissions and climate change.

Tom Speir, Kevin Tate, Roger Parfitt, Karina Whale & Des Ross of the Soil Biochemistry team, New Zealand Soil Bureau DSIR, Taitā.

Kevin's DSIR research (by Benny Theng FRSNZ)

Kevin was appointed to the New Zealand Soil Bureau, DSIR, Taitā, by Morice Fieldes in 1968. Fieldes, the then director of Soil Bureau, referred to Kevin as a budding soil biochemist, a description that proved so true.

At the time as my appointment in 1970, Kevin was working on the structural constitution of soil organic matter (SOM). I recall his using sodium amalgam as a chemical hammer to break up SOM, and then characterizing the constituent parts by gel chromatography. Later Kevin used instrumental techniques for this purpose, such as pyrolysis-mass spectrometry and solid-state nuclear magnetic resonance (NMR) spectroscopy. In collaboration with Roger Newman of Chemistry Division, DSIR, Kevin was able to show by ^{31}P-NMR spectroscopy that soils under tussock grass contained a variety of phosphate esters, including a previously unknown phosphonate species. In some of these tussock-grassland soils, the organic matter had penetrated into the interlayer space of a peculiar clay mineral that Jock Churchman had previously identified as a regularly interstratified mica-beidellite.

At the NZ Soil Bureau, collaborative research among its scientists was encouraged. At the time, I was concerned with the behaviour of organic compounds at clay and mineral surfaces. My interest thus dovetailed with Kevin and Jock's research results. Assisted by Peter Becker-Heidmann of Hamburg University, Germany, Kevin and I were able to establish that the organic matter intercalated into the mica-beidellite clay, was nearly 7,000 years old. This finding strongly indicated that the material was physically protected from both microbial attack and contamination by 'modern' carbon, and would therefore qualify as the so-called inert component of soil organic matter.

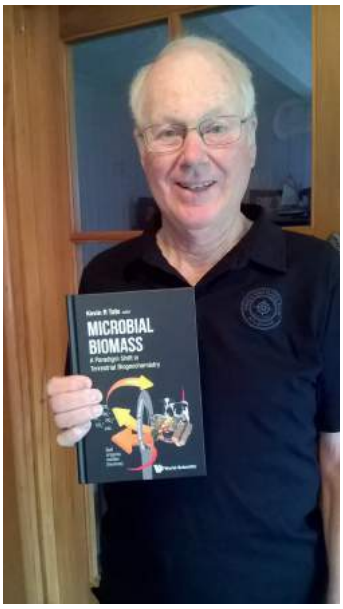
My collaboration with Kevin extended beyond conducting field and laboratory investigations. In 1980 Kevin and I contributed a chapter on the mineral-organic interaction to the book *Soils with Variable Charge* that I edited for the NZSSS. More recently, we co-authored a chapter on climate change for the 2014 book *The Soil Underfoot*, edited by Jock Churchman and Edward Landa. Kevin's humanity, his dedication to research, and his concern about the impact of human-induced climate change and pollution on the environment, are all linked to his deep Christian faith. His broad range of research interests have been an inspiration to all who have worked with him. I mourn the passing of a friend and colleague; at the same time I am very glad to have known, and worked with, Kevin over most of his scientific career.

Kevin's collaboration with Rothamsted Research (by Prof. David Powlson)

Kevin spent a sabbatical at Rothamsted in 1980–81. He worked with David Jenkinson and his group on aspects of soil microbial biomass, specifically building on the method for measuring ATP in soil that David had developed during his earlier sabbatical in Australia. One publication (Tate & Jenkinson, *Soil Biology & Biochemistry* (1982) 14, 331–335) was an improved method for measuring ATP in soil. The second publication (Brookes, Tate & Jenkinson, *Soil Biology & Biochemistry* (1984) 15, 9–16) was highly significant. It showed that the soil microbial biomass maintained high values of both ATP and adenylate energy charge (AEC), values similar to organisms in active growth. Yet most soil organisms cannot be in active growth because the energy input into soil through plant material is far too small. This result implied that the soil population must have a previously unknown mechanism for survival in the harsh and substrate-poor environment of soil. This discovery has had a major influence on later thinking about soil microbes and their survival and physiology. To my knowledge, the details of this mechanism are still not fully understood.

An unplanned aspect of Kevin's sabbatical was that he inspired me to start research on the application of nuclear magnetic resonance (NMR) spectroscopy to soil with the aim of identifying functional groups present in soil organic matter. Kevin had already published the first paper on the application of ^{31}P-NMR while in NZ. This work, on acid tussock grassland soils, had identified an unusual form of organic P in these soils, namely phosphonate that contains a direct P-C bond. In most forms organic P, P is bonded to C via O. After discussions on this with Kevin, I made contact with Professor Ed Randall, an NMR specialist at Queen Mary, University of London. Sodium hydroxide extracts of soils from various long-term experiments at Rothamsted were analysed at Queen Mary using ^{31}P-NMR, using the methods developed in NZ by Kevin and colleagues. Results showed that an acid soil from the Park Grass experiment did contain phosphonate (like the NZ tussock grassland soils) but a soil at near-neutral pH did not. The main forms of organic P were identified in these soils as well as the decline of the more labile forms in a soil converted from long-term grass to bare fallow. This unexpected collaboration with Kevin led me to embark on several years of NMR studies on soils, turning from identifying forms of organic P to organic C.

In about 2015–16 Kevin took on the role of editor of a book on soil microbial biomass planned to mark 50 years since Jenkinson's first paper introducing the concept in 1966. Attached is a photo of Kevin proudly displaying the first copy of the final product.



While staying in Harpenden, Kevin, Heather, and their children attended High Street Methodist Church, Harpenden, and made many friends there.

Microbes to National Carbon Accounting (by Neal Scott)

As a Postdoctoral Fellow fresh from Colorado State University I was one of many lucky individuals whom Kevin mentored in 1994. Kevin and Heather welcomed my wife and me to New Zealand, and were instrumental not only in helping us establish ourselves quickly in Palmerston North, but also steering us towards appropriate medical care – our first child was born 4 months after we arrived. Their kindness and generosity over this transition was never forgotten.

Our research initially focused on soil organic matter under different land-cover types. Subsequently the Ministry for the Environment contracted Manaaki Whenua – Landcare Research to scope and develop a national soil carbon monitoring system that could be used for international reporting under the United Nations Framework Convention for Climate Change.

As a relatively new scientist, this project, and Kevin's leadership, taught me a lot about being an effective scientist and project leader. While incredibly knowledgeable about soil carbon dynamics, Kevin was quick to realize when he needed other expertise, and would seek out and engage people with the necessary skills. He easily made the transition from microbial biomass to incorporating satellite and other spatial data into this system. Although a long step from the study of microbial processes, Kevin built an effective team of experts with the requisite knowledge base to produce a viable system for the Ministry. Witnessing his project management skills, and how he interacted with government officials, was perhaps some of the most valuable training I received while in New Zealand.

Kevin Tate (middle), Late Des Ross (left) and David Powlson (right) collecting forest soil and plant biomass data.

Kevin was a great source of guidance in many ways. As a new father, he always had advice for me, emphasizing the importance of family. He instilled the value of “practice what you preach” by relying on his bicycle for transportation (even when he got knocked off by a car). His management of paper, however, was something I tried not to emulate (but have failed). Kevin’s desk would slowly develop larger and larger piles of paper, to the point that you could barely see him when you walked by. When the piles reached critical height, it was time to clean the office! But the most important thing I learned from Kevin was the value of good colleagues, and how to work with teams of scientists from a range of disciplines so that everyone could do their best work and contribute to a project goal. We will miss his vibrant smile and personality.

From a colleague and family friend (Jock Churchman)

With the tragic loss of Kevin, we have lost a valued and reliable colleague, an internationally well-recognised scientist, a man of integrity, a natural leader who worked hard in the community to help make a better world, and, above all, a warm and loyal friend.

Kevin trained as a chemist and, on joining the Soil Bureau at DSIR, quickly became an expert on soil organic matter, at a time when research on soil organic matter was bogged down in archaic chemical dissolution procedures and was apparently getting nowhere. His reading, his great interest in new instrumental and analytical techniques and his scientific creativeness, together with the opportunity to travel for a year to the well-respected Macaulay Institute for Soil Research (now the James Hutton Institute) in Scotland in the early 1970s, meant that he was on the crest of a new wave that treated soil organic matter as a whole. This approach uses mainly NMR, but also such techniques as pyrolysis gas chromatography-mass spectrometry. Kevin pioneered work on both techniques. Among his most cited papers, several from the 1980s on ^{31}P-NMR for identifying organic phosphorus, important for plant nutrition, feature quite heavily. I recall that his work in this area was so highly prized that he was invited to set up a laboratory overseas on this

topic. He stayed in New Zealand, for the sake of his family and also to the benefit of New Zealand science and the wider community.

Kevin developed an interest in the measurement of respiration and the emission of gases from soils and has several well-cited papers on these topics dating from the 1980s but peaking in the 1990s. His work on these topics and their microbial origin had a considerable boost from his collaboration with the 'father' of soil microbial biomass studies, David Jenkinson, when Kevin gained a fellowship to work for a year at the then prestigious Rothamsted Research laboratories at Harpenden, UK in the early 1980s. Quite recently he was invited to edit *Microbial Biomass* (2017) with authors from around the world as a tribute to David Jenkinson's memory, and this book stands also as a tribute to the high regard in which Kevin's contributions are held world-wide.

It was a logical step for Kevin from his work on respiration and gases emitted from soils to work on greenhouse gases, carbon dioxide, nitrous oxide, and methane, and on climate change. Typically, Kevin decided to pursue this logical step with gusto so that he became not just a seeker after the truth in this area but a purveyor of that truth and its implications for us all through talks to community groups and chapters in appropriate books. I am personally grateful that, together with Benny Theng, Kevin wrote the opening chapter on climate change of a book I edited, and wrote it with typical enthusiasm.

Kevin in front of a building offering an exhibition on climate change on Jeju Island, South Korea while attending the 20th World Congress of Soil Science in 2014.

Kevin was a natural leader. He was friendly and wise. At Soil Bureau, he came to be the leader of the Soil Biology and Biochemistry group. In the wider community, he had considerable involvement in education, particularly when his four children, Lauren, Fraser, Andrew and Emma, were at their various schools. It is remarkable that Kevin not only served on the School Committee of Tawhai Primary School in Stokes Valley and the Taita College Council, but was also instantly chosen to be Chair of both these groups. He was never just an ordinary member.

Kevin and Heather at the 20th World Congress of Soil Science in Jeju, South Korea in 2014.

Kevin was devoted to his family and was well supported in all of his activities by Heather, his wife of almost 50 years.

My lasting impressions of Kevin include his cycling to work, an activity he continued at Manaaki Whenua – Landcare Research in Palmerston North, his keenness for conversation, and the fact that he never gave the impression of hurrying, albeit that he achieved so much. He always had time to listen to others. His office, not unlike those of many of us, was a busy place, replete with papers, journals and books, but he knew where to find anything. He was a good speaker – clear and logical – and this made him a good advocate for those causes in which he believed, particularly the importance of facing up to climate change.

Kevin's office – busy as usual.

Kevin had a ready sense of humour and an interest in music, particularly jazz – I remember his delight when one of his overseas conferences took him to New Orleans. When he could find the time, he was a keen gardener. He was always encouraging and positive to work with and it was a pleasure to know him both in and out of the work environment. We will all miss him a great deal.

Kevin's funeral in Palmerston North was very well attended. It was not a sad occasion, but rather a celebration of his achievements. Kevin's brother, Warren, and several family members spoke, as did David Whitehead, Benny Theng, Surinder Saggar (Manaaki Whenua – Landcare Research), and Mike Hedley (Massey University, NZSSS Council Member). Mike Hedley thanked Heather and the Tate family on behalf of the wider soil science community in New Zealand for allowing Kevin to make his impressive contribution to the discipline of Soil Science in New Zealand. A contribution that advanced the strong international reputation held by New Zealand soil scientists, in particular the reputation for innovative science addressing globally relevant environmental problems. Mike reminded us of the role Kevin also played in mentoring young scientists and postgraduate students who worked in the DSIR Soil Bureau, Manaaki Whenua – Landcare Research and the wider University and Crown Research Institute networks. Mike also mentioned Kevin's dramatic presentation of "*Gathering Storm Clouds: Carbon and Nutrient Management for a Warmer World*" at the Fertilizer and Lime Centre Workshops at Massey in 2008 (and other public lectures). With this one talk, Kevin, armed with facts fresh from his European trip, raised the awareness of scientists, policy makers, and rural professionals of the impact of man and agriculture on climate change. Mike concluded by farewelling Kevin the "biogeochemist".

The family celebrating Kevin's 70th birthday, all wearing T-shirts saying 'I love Methanotrophs'

Surinder Saggar[1] & David Whitehead[2]

[1]Manaaki Whenua – Landcare Research Private Bag 11052, Palmerston North 4442, NZ

[2]Manaaki Whenua – Landcare Research PO Box 69040, Lincoln 7640, NZ

***Acknowledgements**: Special thanks to Kevin's brother, Warren Tate, his wife Heather, and members of Tate family for providing much of this material, and colleagues and friends Anne Austin, Benny Theng, Brent Clothier, David Powlson, Jock Churchman, Mike Hedley, Neal Scott, Peter Berben and Richard Gordon, who wrote personal tributes or provided photographs.*

Society News

Report on Waikato-Bay of Plenty regional soils conference: Wai-BoP Soils 2017

David J. Lowe

School of Science (Earth Sciences), University of Waikato, Hamilton (david.lowe@waikato.ac.nz)

The University of Waikato hosted the 4th regional one-day soils conference, "Wai-BOP Soils 2017", on Tuesday 5 December 2017, a day designated globally as "World Soil Day". Events to commemorate WSD were held all around the world but we were the first out of the blocks with our conference here in New Zealand, thanks to our geographical relationship to the international date line. The meeting was convened by Prof David Lowe

with support from Prof Louis Schipper, Dr Megan Balks, and Dr Tanya O'Neill (Earth sciences group, School of Science, University of Waikato, UoW) on behalf of the New Zealand Society of Soil Science (NZSSS). It attracted around 56 participants, some of whom had travelled from as far as Napier and Palmerston North to take part and enjoy the presentations and networking opportunities (Fig. 1).

Fig. 1. Some of the audience enjoying a presentation at Wai-BOP Soils 2017 at Waikato University, Hamilton. Photo D.J. Lowe

The conference was generously sponsored by NZSSS, Waikato Regional Council (WRC) Manaaki Whenua (Landcare Research), and AgResearch. The conference day was dedicated to the memory of the late Wim Rijkse, an experienced pedologist and stalwart supporter of previous Wai-BOP soils meetings (Lowe et al. 2017). The Wai-BOP soils one-day conferences are biennial, being convened in years between biennial national conferences of NZSSS or 4-yearly international ANZ conferences of Australian and New Zealand soil scientists. The first was held in 2011 and the rationale for the event is summarised in Schipper and Lowe (2012).

Around 23 oral papers organised into 5 sessions were presented, including six papers by students. Topics were quite wide-ranging and, with only 12 minutes per talk, the day rattled along at a good clip. The first talk was a very interesting and insightful 30-minute keynote address by Dr Peter Singleton (formerly WRC) entitled "Challenges for resource management". Other talks included "LAWA land cover – introducing the first land and soil module on the Land Air Water Aotearoa (LAWA) reporting platform" (Dr Haydon Jones WRC), "Land suitability analysis of Wairoa district" (Jonno Rau, UoW), "Measuring soil

organic matter turn over and carbon stabilisation in pasture soils using ^{13}C enrichmen methodology" (Jasmine Robinson, UoW), "Soil testing from the sky?" (Dr Ants Roberts Ravensdown), "Impact of dung beetle activity on soil water quality" (Dr Malcolm McLeod Manaaki Whenua), "Predicting nitrogen supply from dairy effluent applied to soil" (Moira Dexter, AgResearch), "Can incorporating brassica tissues into urine-affected soil reduce nitrous oxide emissions?" (Sheree Balvert, UoW/AgResearch), "The phosphorus mitigation project: mitigation of storm water surface runoff driven P-loss from farms using detainment bunds" (Brian Levine, Massey University), "Nutrient transfer pathways and nitrate attenuation at two artificially drained sites on the Hauraki Plains" (Dr Roland Stenger, Lincoln Agritech), "Across scales: employment of a quantum cascade laser to detect static chamber-derived N_2O emissions" (Anne Wecking, UoW), and "From soil to water: tracing opportunities to reduce nitrate impacts" (Prof Troy Baisden, UoW).

The conference concluded with the annual N.H. Taylor Memorial Lecture of NZSSS presented by Prof Tim Clough of Lincoln University (Fig. 2). Tim's well-prepared comprehensive yet clear talk was entitled "Developing integrated approaches to nitrogen management: defining soil's role".

Fig. 2. Prof Tim Clough with the soil auger of N.H. Taylor after presenting his N.H. Taylor Memorial Lecture in Hamilton. Dr David Houlbrooke, president of NZSSS, is on the right. The auger, mounted by 2014 N.H.T lecturer Dr Malcolm McLeod on rimu timber from a desk from the now-demolished Hamilton office of Soil Bureau, DSIR, and protected in a special 'gun' case provided by 2016 2014 N.H.T. lecturer Prof Louis Schipper, is awarded to the N.H. Taylor lecturer each year. Photo: D.J. Lowe

The convenors wish to emphasise (i) their appreciation for the support provided by the soil science communities of Waikato and Bay of Plenty, and other regions, for the one-day conference event in Hamilton, (ii) the willingness of the sponsors to support the event, (iii) all the speakers for their hard work in preparing and delivering a most interesting mix of talks within narrow time limits, (iv) session chairs (Drs Megan Balks, Haydon Jones, Gina Lucci, Diana Selbie, and Prof Troy Baisden) who kept everyone on task and on time (more or less), and (v) Gloria Edwards and Fiona Martin (School of Science, UoW, administrative staff) for logistical support.

Awards

Another feature of the meeting was the presentation of a number of the New Zealand-wide awards to students by the current president of NZSSS, Dr David Houlbrooke. These

awards are competed for fiercely each year by soil science students nominated by Massey, Lincoln, and Waikato universities.

Jasmine Robinson (UoW) was awarded the Sir Theodore Rigg award for her 'masterate thesis of exceptional merit in soil science in New Zealand' for 2017 (Fig. 3).

Fig. 3. Jasmine Robinson receiving the Rigg Award for best masterate thesis from Dr Houlbrooke. Photo: D.J. Lowe

Sharee Balvert, a PhD student at UoW and based at AgResearch, was awarded the Dr Bert Quin Bursary for students entering, or about to enter, their third year of PhD studies and who are 'most likely to make a significant contribution to soil science and its application in New Zealand', 2017 (Fig. 4).

Fig. 4. Sharee Balvert (above) receiving the Bert Quin Bursary award from Dr Houlbrooke. Photo: D.J. Lowe

Charlotte Tomlinson was awarded the NZSSS prize of ‘best completing undergraduate student in the subject of soil science’ at Waikato University, 2017 (Fig. 5).

Fig. 5. Charlotte Tomlinson, best completing undergraduate student in soil science at Waikato University.

Dr Sam McNally (UoW) and **Dr Jen Owens** (Lincoln University) were jointly awarded the Dr Morice Fieldes award for ‘doctoral thesis of exceptional merit in soil science in New Zealand’ for 2017. This award was presented to Sam at the N.H. Taylor Memorial Lecture event held at Lincoln University on 11 December 2017 (Fig. 6). Dr Owens was overseas

at the time of the awards and so the award was received on her behalf by Prof Tim Clough.

Fig. 6. Dr Sam McNally (Waikato University) (left), joint winner of the Dr Morice Fieldes doctoral award for 2017, being presented with his award by NZSSS Council awards convenor Dr Brendon Malcolm at the N.H. Taylor Lecture event at Lincoln University on 11 December.

Congratulations are extended to all the nominees and prize winners.

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Lowe, D.J., Tonkin, P.J., Leslie, D.M., Cotching, W.E. 2017. Obituary – Willem 'Wim' Cornelis Rijkse (1936-2017). *New Zealand Soil News* 65 (4), 10-20.

Schipper, L.A., Lowe, D.J. 2012. WaiBOP Soils - a "flash" conference? *New Zealand Soil News* 60, 18-19.

Norman Taylor Lecture

Tim Clough's NTL was recorded at Massey -Check it out here if you missed it!

New Zealand Soil Science Society Awards 2018

Award	Presented	Nominations close	Nominee eligibility	Nominator eligibility
NZSSS Fellowship	Annually	31 July 2018	Nominees must be active members of the Society at the time of nomination.	Nominations must be made by two Full Members, or Life Members of the Society.
The Grange Medal	Biennially (conference year)	31 July 2018	Open to both non-members of the Society as well as members, fellows,	Nominations must be made by two or more active members of the Society.

			or life members of the NZSSS.	
The Blakemore Award	Biennially (conference year)	31 July 2018	Open to technicians/support staff who have been employed in the field of science for at least three years.	Any two active members of the NZSSS can nominate an eligible candidate from a university, CRI, or other organisation (e.g. a Regional Council).
The Leamy Award	Biennially (conference year)	31 July 2018	Open to the author or authors of the most meritorious New Zealand contribution to soil science, published in the previous three calendar years.	Any two active members of the NZSSS can nominate an eligible candidate(s) from a university, CRI, or other organisation (e.g. a Regional Council).
The Quin Award	Annually	31 July 2018	Open to postgraduate (PhD) students in soil science about to enter their third year of study. Candidates must be either student or full members of the NZSSS and should not be on the academic or technical staff of the department that nominates them.	Nominations must be received in writing from the Head of the Soil or Earth Science Department/Group at a New Zealand University. Only one nomination will be accepted from each University Department/Group.
The Fieldes Award	Annually	31 July 2018	A PhD thesis submitted within the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate the best PhD thesis from their department/group.
The Rigg Award	Annually	31 July 2018	A Masterate thesis submitted within the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate the best Masterate thesis from their department/group.
Undergraduate Prizes	Annually	31 December 2018	A third-year student in Soil or Earth Sciences.	The Head of the Soil or Earth Science Department/Group at Massey, Lincoln, and Waikato University may each nominate the

				best third-year student from their department/group.
The US/NZ Exchange Award	Annually	14 March 2018 for initial submission (21 March for final submission)	Nominees are required to have at least seven years of membership in SSSA or the NZSSS. Former recipients of this Award are not eligible.	This award allows self-nominations. See Opportunities section for more info

Nominations and requests for further information regarding NZSSS awards should be addressed to:
Dr Brendon Malcolm
NZSSS Awards Convenor
C/O Plant and Food Research
Private Bag 4704, Christchurch Mail Centre, Christchurch 8140
New Zealand

Email: Brendon.Malcolm@plantandfood.co.nz

News From the Regions

Waikato/Bay of Plenty

Waikato University

Dr Megan Balks is retiring from the University of Waikato in mid-February having taught first year Earth Science students for 30 years. Megan will be continuing her links with the University as an "Adjunct Senior Fellow". She has plans to continue some graduate student supervision, writing work, and some ongoing Antarctic work in collaboration with **Tanya O'Neill**. She will also continue her strong association with the New Zealand Society of Soil Science (she is currently vice-president). Megan is looking forward to escaping from the 9-5 work commitment and having a bit more time to pursue many of her other interests including her farm, garden, and art and craft, work.

Louis Schipper, **Jasmine Robinson** and **Liyin Liang** attended American Geophysics Union meeting in New Orleans – a massive conference but really well organised. It featured a rapper on climate change (Fig. 1), mardi gras floats, great food and music. Louis co-chaired a session on "The temperature response of the biosphere from enzymes to ecosystems" and presented a poster on eddy covariance measurement of nitrous oxide. Liyin presented on a global convergence of leaf respiration response to temperature and Jasmine presented on a new method for determining temperature response of two carbon pools in soil at the same time. **Vic Arcus** and **Erica Prentice**

(molecular biology, University of Waikato) also attended and presented in the temperature response sessions.

Fig. 1. Baba Brinkman rapping on climate change at American geophysics Union. Another way to tell the story. A video of a similar talk can be found here.

Louis also spent a week in Queensland with **Ian Layden** (Department of Agriculture and Forestry) touring sites where denitrifying bioreactors might be installed in their agricultural systems (Fig. 2). Great swaths of sugar cane, bananas and pineapples.

Fig. 2. A denitrification wall sited below a pineapple farm (Queenslands) intercepting nitrate in groundwater. Project led by Ian Layden Fabio Manca and Peter Grace.

David Lowe was busy late last year with the Wai-BOP Soils meeting in Hamilton on 5 December (see report here). Before then, he led a field trip with **Peter de Lange** (Unitec)

to Rangitoto Island as part of the Geoscience Society annual conference in late November in Auckland that was attended by a strong contingent of staff and students from Earth sciences at Waikato.

He has also been working with the International Focus Group on Tephrochronology and Volcanism (INTAV), which is an international collective of tephrochronologists that lies under the umbrella of the International Union for Quaternary Research (INQUA). INTAV is convening an international tephra conference "Crossing New Frontiers: Tephra Hunt in Transylvania", 24-29 June, 2018, near Brasov, Romania. The venue is in a stunning location in the Carpathian Mountains, where the terms 'rhyolite' and 'dacite' originated, and where loess and buried soils were described and mapped as long ago as 1726. If you or your students are interested in attending this meeting, which promises something for everyone including a one-day intra-conference field trip to a basaltic volcanic field and a visit to Bran (Dracula's) Castle, and a three-day post conference trip to see proximal rhyolitic tephras, distal tephras, loess, and buried soils (etc) along the Danube River and through to the Black Sea, then check out the second circular (registration site), which has all the details (including very reasonable costs).

Other News

We are sorry to announce the recent deaths of Emeritus Professor **Michael Selby** and **David Burns.**

Emeritus Professor Michael J. Selby died in Auckland on 21 January 2018 aged 82. He played a pivotal role in helping to establish the Department of Earth Sciences, and its unique, integrative multi-disciplinary approach, at the University of Waikato from 1970. Michael was a geomorphologist/geographer trained at Oxford University (after a two-year stint in the Military Police of the British Army), receiving an MA as well as a BA(Hons) and a DipEd. He was appointed as a junior lecturer in physical geography in the Waikato Branch of the University of Auckland (in Hamilton) and then transferred to Waikato University in 1965, when the first intake of students occurred after the university's founding in February, 1964.He transferred again to the new Department of Earth Sciences with foundation professor John McCraw in 1969, helping to prepare the department and others in the School of Science to open their doors to students in 1970 (McCraw 2002). Harry Gibbs joined McCraw and Selby soon after and the three set out to teach Earth sciences, with new staff being appointed as student numbers grew rapidly. Michael's DPhil thesis was on the erosion of Pumice Soils in central North Island using different vegetation covers, rainfall, etc, together with novel factor analysis, in an experimental and computing approach (Selby and Hoskins 1973). His DPhil thesis, conferred in 1972, was the first to be awarded for the Department of Earth Sciences, and one of the first three doctorates to be awarded at University of Waikato.

Michael, who studied landsliding in the Whitehall hills area near Cambridge early in his career, had already made a name for himself by writing two text books, “Surface of the Earth” volume 1 (1967) and volume 2 (1971). These books included sections on soils in all its guises, with “The geography of soils” making up one third of volume 2. The books were used in some high schools as well as universities, and were responsible for attracting a number of students to the fledgling department. Being awarded a personal chair in 1980, Michael’s career morphed into rock and soil mechanics, bringing together geomorphology (making it more quantitative) and engineering geology. He wrote two editions of what is now seen as a classic text, "Hillslope Materials and Processes, 2nd edition” (1993). Michael published seven books in all. He undertook four expeditions to Antarctica, leading three of them (Fig. 3). In 1984 he was awarded a DSc from Oxford University in recognition of publication of highly regarded texts and papers on rock slope stability.

Fig. 3. Michael Selby atop Derrick Peak in the Britannia Range, Transantarctic Mountains, 11 December 1978. The higl peak in the background at right is Mt Selby. Photo: David Lowe.

Michael became deputy vice chancellor of the university later in his career, including leading negotiations for the Tainui settlement for the campus lands on behalf of the university. He retired in February 2002 and also became an Officer of the New Zealand Order of Merit (ONZM) for services to education in 2005. An obituary appeared in the Waikato Times on Saturday 10 February 2018; a more comprehensive obituary is in preparation.

David A. Burns (known as “Davey” to many) died in Auckland on 27 January 2018 at the age of 64. He had been ill for some time. David was a graduate of Waikato University’s Department of Earth Sciences (Fig. 4), beginning in 1972, where he completed an MSc with Cam Nelson on carbon and oxygen stable isotope geochemistry of Cenozoic calcareous sedimentary rocks in New Zealand in 1980. David then embarked on a career in a new direction, engineering geology, initially in Tauranga and then in Auckland, finishing as a highly-respected technical director in ground engineering at AECOM (Auckland). David spent considerable time overseas including in Belize and Vietnam as well as throughout New Zealand as an engineering geologist. He also served in the New Zealand Geotechnical Society. Towards the end of his career, as ill-health slowed him down, David undertook a lot of editing, helping colleagues with less experience to knock their reports into excellent shape.

Showing his versatility and connections to pedology, David also worked with Gary Orbell in the Hamilton Office of Soil Bureau, DSIR, over two summer periods, 1976-77 (Waikato survey) and 1977-78 (Matamata survey).

Fig. 4. Some staff and former students, including David Burns, of the Dept of Earth Sciences at Prof John McCraw’s retirement 12 December 1987. From left Ken Murray, Terry Healy, David Lowe, John McCraw, David Burns, Nick Rogers, Cam Nelson, Peter King, and Peter Kamp. Photo: Ross Clayton.

References

McCraw, J.D. 2002. Geology or Earth sciences? In: Adams, J.A. (editor), “Jubilee Reminiscences: Fifty years of soil science memories”. New Zealand Society of Soil Science Occasional Publication 3, 40-42.

Selby, M.J., Hoskins, P.J. 1973. The erodibility of pumice soils of the North Island, New Zealand. Journal of Hydrology (New Zealand) 12, 32-56).

Scion (Rotorua/Christchurch

Monitoring soil from the air

The high variability in soil properties greatly complicates efforts to understand how site and climatic conditions influence the performance of different tree genotypes and species at the scales used in plantation forestry. Scion soil scientists are currently working with the Forest Industry Informatics team to explore new opportunities to use UAVs and electromagnetic sensors to improve our ability to resolve soil variability, and more effectively link it to plant performance. This work is being done at three of the large Accelerator Trials (part of the Growing Confidence in Forestry's Future MBIE programme; https://gcff.nz/) that Scion established in 2015 and 2016.

UAV

Regular UAV overflights have collected an array of data that enables individual trees to be clearly identified, and the level of weed growth and soil disturbance to be assessed.

Photo: Rangipo Trial site, 28/6/17

The impacts of extensive soil surface modification treatments, such as mounding, is being assessed with high-resolution imagery and multispectral imagery to determine organic content of mounds, which provides new capability to remotely characterise soil texture and other properties over the forested area.

Photo: Southern Kaingaroa Trial site, 9/10/17, showing mounds with varying levels of organic matter

Dual EM

Alterations in the soil electrical conductivity (SEC) at these sites are also being measured by a DualEM electromagnetic sensor. This device senses changes in the combination of soil mineralogy, salts, moisture, and texture of a given area. The collected information car be used alongside ecophysiological, meteorological and other above/belowground data tc better understand limitations for tree growth at both microsite and plantation scales.

Photo: Tony Evanson calibrating the DualEM in the field

The soil at the sites where these devices are being tested is already exceedingly well characterised, and will continue to be sampled at high levels of resolution for the foreseeable future. Continued data collection with both the UAV imagery packages and the DualEM is helping to build a library of data from which important and consistent correlations between measured soil properties, remotely sensed soil properties and tree performance can be identified and used as the basis for improved monitoring and treatment in the wider forest estate.

Nutrient leaching trial in Kaingaroa Forest

Scion soil scientists, in collaboration with Prof. Brian Strahm from Virginia Polytechnic Institute and State University, have recently finished installing a leaching trial in Kaingaroa forest. Nutrient movement through the soil will be monitored using soil sampling (isotope tracer) as well as resin lysimeters and leachate collectors at depth (1-m and 2-m soil depth). The trial incorporates the different surface forms created by spot mounding (inter-rows, mounds and windrows) and different levels of nitrogen (N) fertiliser application (0, 250 and 500 kg N ha^{-1}). The results of this trial will inform the timing and rate of N application to the adjoining Accelerator Trial. The trial is in a young Pinus radiata stand on a low-fertility Immature Orthic Pumice Soil; fertiliser use could significantly improve productivity at this site, and the leaching study will be a key step towards understanding how to do so in a sustainable manner.

Photo (above): Loretta Garret and Stephen Pearce preparing the scaffolding for the soil pits

Photo (above): Amanda Matson installing lysimeters in a soil pit

Photo: completed pit directly after fertiliser application

Manawatu

Plant & Food

The Production Footprints team welcomes a new research associate, **Robert Ward**, to the team in Palmerston North. Robert completed a Masters in Physics at the University of Canterbury in 2011. His thesis was on the topic of modelling sea ice around Antarctica, and he travelled to Antarctica twice for fieldwork. After university he spent a few years in Korea and then Japan teaching English. Robert is pretty new to soil science, but he has a lot of experience with scientific instruments. In his words, “I’m looking forward to getting stuck in!”

Valerie DesRochers, a graduate student from Université de Montréal, has been working with **Ian McIvor** over the summer on a project investigating variable root development of *Salix nigra* willow grown in varying river bank substrates (stones, sand, silt). The effect of giant willow aphid on willow root strength and hence stability under flood conditions for willows along our river systems has come under question following serious bank protection failure on Whakatane River and other rivers, and this research is investigating how roots develop in the various river bank substrates normally and under giant willow aphid feeding pressure.

Salix growing in boxes (L) variously layered with silt, sand and stones; and (R) roots growing in silt (upper layer) and sand (lower layer).

Back in Quebec Valerie is conducting research on ways to establish shrub willow under high tension powerlines carrying hydro-electricity from the north of Quebec to the populated regions in the south. The aim is to establish a dense shrubbery to suppress forest trees e.g. maples, sycamores from growing in the open corridors under the power wires which requires more costly maintenance.

Our team farewells our two summer students, **Amber Brooks** and **Irene Setiawan**, who have been working with **Robert Simpson**. Amber was working on the eDNA project and testing metabarcoding for the detection of invertebrate ecosystem service providers in soi samples. Irene is a 4th year Agricultural Science degree student at Lincoln University. Irene's summer studentship was part of the "TeaTime4Science" project, where decomposition rates of plant material in soil are measured and mapped globally.

TeaTime4Science

The project uses the simple Tea Bag Index (TBI) method, where rooibos and green tea bags are buried for three months, and then measured for their weight losses (Keuskamp et al., 2013. Methods in Ecology and Evolution 4:1070-1075). The method uses Lipton tea bags as they are available in many supermarkets. The experiment is inexpensive to conduct, but also standardised. It is a great way to get the public involved in a scientific study! Who says that science experiments need to use expensive and fancy equipment all the time? Rooibos and green tea are used because they display contrasting decomposition patterns; green tea is rapidly decomposed, while rooibos is much slower.

Decomposition rate data across different biomes is needed to make global climate

predictions in terms of soil respiration, and to estimate global soil carbonflux on a higher resolution (Keuskamp et al., 2013). The scientists who developed the TBI aim to generate a global decomposition rate map by engaging the public worldwide to participate in burying tea bags and gathering data through crowdsourcing (Keuskamp et al., 2013). Anyone who is interested can get involved in collecting decomposition rate data, including school children (for more info please visit teatime4science.org).

The objective of Irene's summer studentship was to delve into the TBI method. The aims were to: (i) characterize the concentrations of different enzymes present in the soil following the addition of tea bags, and (ii) relate the enzymes present to the extractable carbon and microbial biomass. The soil enzymes measured were: (i) β-glucosidase, (ii) Phosphatase, (iii) β-galactosidase, (iv) Xylanase, (v) Chitinase, (vi) Sulfahydratase, (vii) Tyrosinase, and (viii) Peroxidase. The first six enzymes are responsible for cellulose breakdown, while the last two enzymes are responsible for lignin breakdown. Rooibos and green tea bags were buried in a maize paddock. The tea bags and the soil around them were collected at twelve different time periods following burial, to identify how the measured variables change with time. The sample collections were focused during first twenty days following burial to capture the enzyme activity during the initial rapid phase of green tea decomposition.

Irene collecting the tea bags and the soil around them using a core in a maize paddock.

The results so far confirm that green tea decayed more rapidly than rooibos. We found that green tea induced the highest soil enzyme activity overall, compared to rooibos and control soil without tea bags. The exceptions were the sulfahydratase, tyrosinase and peroxidase enzymes, which didn't show clear differences amongst the tea treatments. β-galactosidase enzyme activity had the most pronounced increase in response to the green tea bags; it reached up to sixty times more activity compared to the no tea bag

treatment.

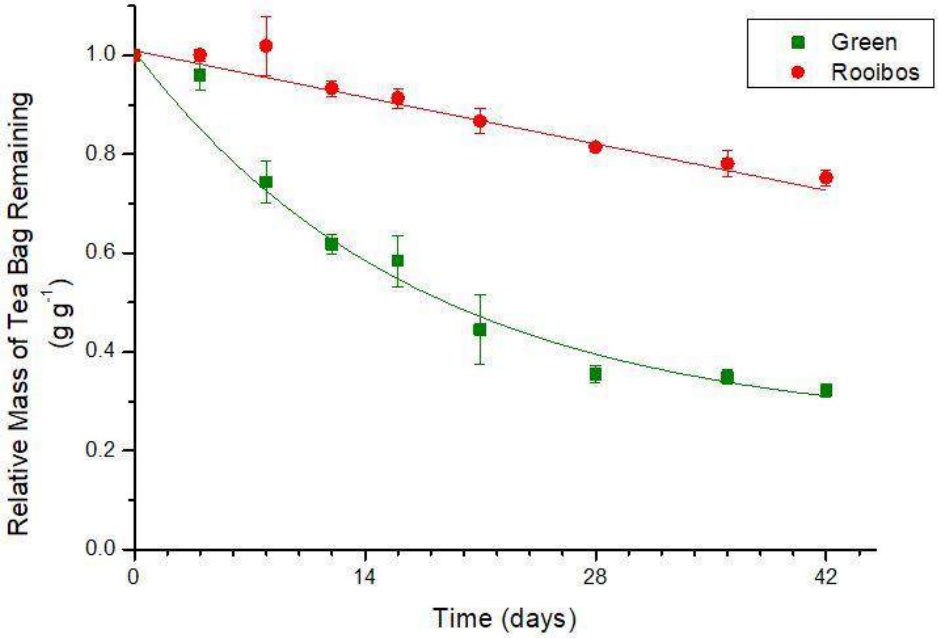


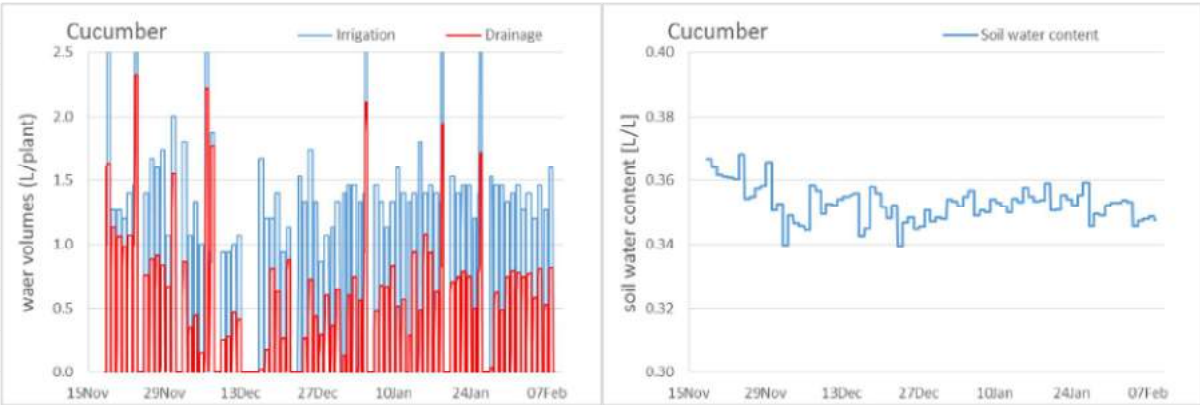
Figure. The tea bag weights relative to their initial weights, fitted to an exponential decay curve.

To conclude, the addition of tea bags significantly changed the overall soil enzyme activity. Green tea induced the greatest increase in soil enzyme activity, particularly β-galactosidase. This confirms the high decomposability of green tea. TBI is a valid and robust method to measure litter decomposition rate and stabilisation. Ongoing work in the project will relate measures of soil carbon to enzyme activities and identify the bacterial community composition.

Steve Green and **Brent Clothier** have expanded their work in the United Arab Emirates to include developing a crop calculator for vegetable crops with Environment Agency Abu Dhabi (EAD) and Abu Dhabi Food Control Authority (ADFCA). They have installed lysimeters with load cells in field trials to monitor drainage, calculate the soil water balance and determine crop water use. At present, they are working with cucumber, capsicum, cabbage, eggplant and tomatoes.

Photographs of the crop-calculator site at Al Salamat (taken Feb 3, 2018). The crops (listed in a clockwise direction starting at the top left) are: cucumber, capsicum, cabbage and eggplant.

Steve Green *(Left) carrying out a maintenance check on one of the tipping spoon devices used to record drainage rates from the lysimeters and* ***Brent Clothier*** *(Right) taking notes on the cucumber plot.*



The water balance of the cucumber crop. The left figure shows daily totals of irrigation and drainage volumes averaged from the four lysimeter pots. The right figure shows the temporal pattern of soil water content. Daily crop water use is currently about 0.8 L/plant/day, as indicated from the difference between irrigation (~1.4 L/day) and drainage (~0.6 L/day). Irrigation could be reduced during the latter part of the growing season.

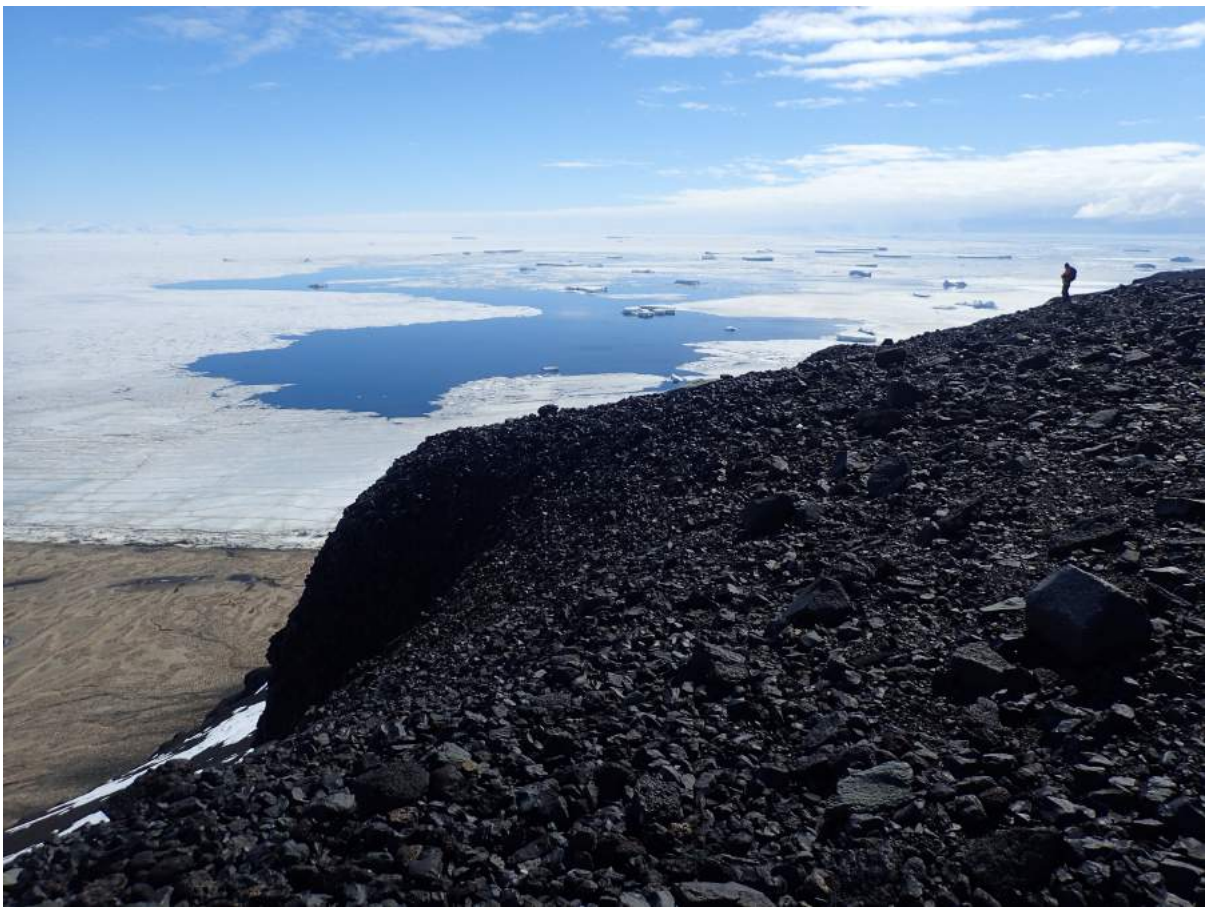
LandcareResearch

It was with great sadness that we farewelled our colleague and friend, **Kevin Tate**, who

passed away peacefully at his home on Monday 22 January, 2018. Kevin was a great science leader, dedicating himself to climate change studies in more recent years, and he will be greatly missed by our community.

On a happier note, we welcome **Matteo Poggio** to our Palmerston North site. Matteo, originally from Italy, and having recently completed a post-doctorate position at Washington State University, brings proximal soil sensing, soil spectroscopy, pedology and digital soil mapping skills to our Manaaki Whenua Soils & Landscapes Team. Matteo, Michael Blaschek, Pierre Roudier, PhD student Ahmed El-Naggar and Carolyn Hedley attended the international precision agriculture conference, PA17, in Hamilton at the end of last year, and a full report about that conference and the 2-day Digital Soil Mapping master class that Pierre led is provided separately in this newsletter (here).

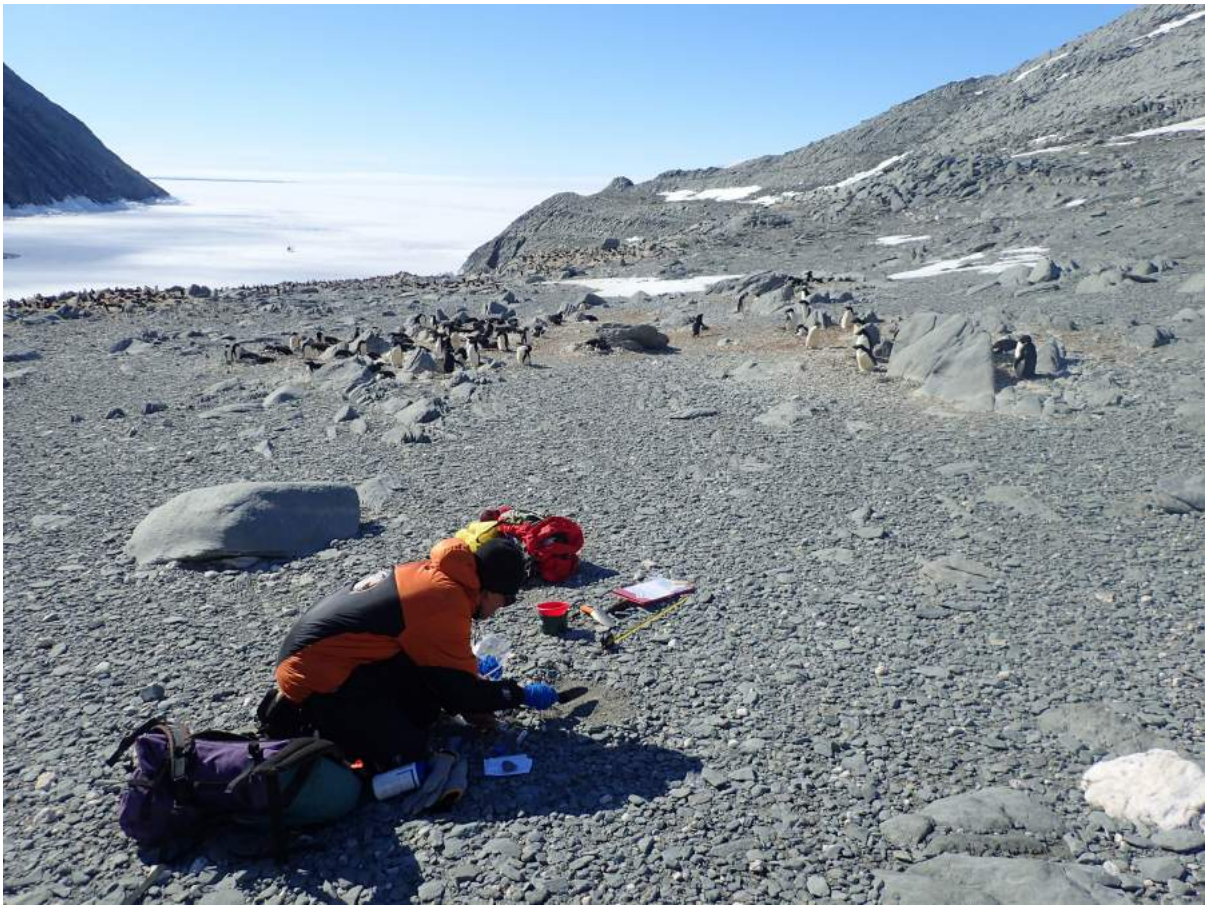
Pierre Roudier (Manaaki Whenua, Palmerston North) spent the month of November down in Antarctica. This year, Pierre has been focusing on the Northern Victoria Land part of the Ross Sea Region, some 800 km north of Scott Base, New Zealand's home away from home. Along with four other colleagues supported by Antarctica New Zealand, they teamed up with colleagues from KOPRI (the South Korean Antarctic Programme), setting up a major camp on the sea ice at Cape Hallett. From this basecamp, the Edisto Inlet and the Cape Adare regions were the focus of the field event. Soils were sampled at more than 50 locations, along with invertebrate and lichens, to paint a picture of the biodiversity in the region.



Overlooking the largest Adelie penguin colony in the world, at Cape Adare

Soil sampling with a view, in the Edisto Inlet region

The NZ part of the expedition in front of the Basler bringing them back to Jang Bogo Station



Sampling assistants in large numbers at that site, on King George Island, near Cape Adare

Massey University

Following a visit to Massey University in October 2014 of a delegation of the OCP Group (the Moroccan producer of phosphate rock) led by the Sales Management responsible for the Oceania region, **A/Prof Marta Camps-Arbestain** and **Prof Ralph Sims** from Massey University were invited to visit Morocco in November 2016 and see some of the company's activities first hand. This visit also provided the opportunity to discuss potential areas for collaboration between OCP and Massey University. A first contract was signed in September 2017 between Massey University and the Phosboucraâ Foundation – the organisation that supports the corporate social responsibility of OCP Group in the southern regions. The objective of this first phase of partnership was to allow a team from New Zealand evaluate the challenges faced by the agricultural sector in the Saharan region of Laâyoune-Sakia-El Hamra during a 2-week visit and propose actions to (i) promote the development of a sustainable, modern and competitive Saharan agriculture and animal husbandry, and (ii) fight against rural poverty by increasing the agricultural revenue. **Prof. Marta Camps-Arbestain** and Ing. MSc. **Adolfo Alvarez** visited the Laâyoune-Sakia-El Hamra region during the weeks of the 13 and 20 of November. The region is characterised by harsh pedoclimatic conditions and scarce and saline water resources, which limits the production of crops/forage. During the visit, first-hand information on the activities carried out at three cooperatives was obtained. From this visit, a document will be developed so that potential actions to improve the efficiency of

the different systems with the use of smart farming technologies are proposed.

The Massey team visiting the owners of a "grara" (these are depressions filled with alluvial clay deposits) nearby Laâyoune

Massey team with staff members of the "HALIB-SAKIA-EL HAMRA" dairy cooperative nearby Laâyoune

Congratulations to **Sam Pike**, who was presented with the NZSSS Massey University Undergraduate Student Prize for 2017 when he returned to Massey to discuss enrolment in his Masters of Science degree in 2018. Sam currently has summer project work with AGFirst's Erica van Reenen in Feilding. Sam has been involved in a number of Farm Environment Plan projects across the dairy and sheep and beef sectors. As part of his postgraduate programme Sam will include papers on Sustainable Nutrient Management and is looking forward to a research focus that will contribute to a more sustainable beef production sector in New Zealand.

Sam Pike receives his award from Mike Hedley

The 31st Annual Workshop was held by the Fertilizer and Lime Research Centre (FLRC) on the 7th-9th of February 2018 and was a very well attended and productive event. The organisers continued with the sustainable farming theme from the past several years, with the title of the workshop this year being 'Farm Environment Planning - Science, Policy and Practice'. With AGMARDT as a major sponsor – two keynote speakers were invited and both delivered very insightful presentations.

Dr Anker Lajer Højberg from the Danish Ministry of Energy, Utilities and Climate in Denmark gave a keynote address titled 'On the Track of Targeted Regulation of Nitrate – Experiences from Denmark'. Presently, new nitrogen measures are implemented at catchments scale, for which the farmers are compensated, and this will be complemented by a targeted regulation in 2019. The strategy for targeted regulation has not been defined in detail, but several recent national projects have been devoted to study how spatial variation can be identified at relevant scale with sufficient certainty and included in national regulation. This talk had close parallels with research and policy issues in the New Zealand agricultural sector and provoked very useful discussion among delegates at the Workshop.

Craig Thornton from the Department of Natural Resources Mines and Energy, Rockhampton, Queensland, Australia gave a presentation titled 'The Brigalow Catchment Study: The impacts of developing acacia harpophylla woodland for cropping or grazing on hydrology, soil fertility and water quality in the Brigalow Belt bioregion of Australia'. The Brigalow Catchment Study commenced in 1965 to quantify the effects of agricultural development on water and soil resources. It is a paired, calibrated catchment study consisting of three catchments that were monitored in their virgin state for 17 years. One catchment remained virgin brigalow as a control and the other two catchments were cleared and developed for cropping or grazing. Post-development monitoring commenced in 1984 and continued for 27 years. In 2010, land management practices for cropping and grazing were modernised and another two adjacent catchments with alternative management practices were incorporated into the study. All five catchments have been monitored since 2010.

In all at this years Workshop, there were 77 presentations (solicited and volunteered) during the three days and more than 260 delegates, representing universities, CRI's, fertiliser industry, private consultancies, DairyNZ, Fonterra, regional councils and national policy-makers in New Zealand attended.
It was an impressive line-up of quality presentations and particularly pleasing to see a

significant amount of young talent being attracted to the agriculture/environment industry.

Following the FLRC Workshop Craig Thornton (left) and Anker Højberg took a closer look at the Manawatu River with a trip through the Manawatu Gorge with Ranvir Singh.

Canterbury

Lincoln University

Soil Science Prize Giving: Prizes are awarded each year to the top 3 students in Soil Science at each level of study at Lincoln University. The 2018 awards were presented on Wednesday 21st February 2018. The prizes are awarded by the Centre for Soil & Environmental Research in recognition of excellence and to encourage top students to continue their high level of performance in Soil Science. The prize winners receive a Certificate and book tokens. Many of the previous prize winners have gone onto study for a post-graduate degree in Soil Science leading to careers in industry, farming, CRIs, regional councils, universities and government ministries.

Photo: From left front row: Dr Carol Smith, Jennifer Tregurtha, Akika Takada, Flora Wang, Irene Setiawan, Prof Keith Cameron and Ros Dodd (obscured). Middle row: Prof Hong Di, Louisa Hall, Chris Chisholm, Tim Craig, Tessa Schmidt, Nicholas Simpson, Assoc Prof Jim Moir and Judith Van Dijk. Back row: Josh Nelson and Prof Tim Clough.

New Zealand Society of Soil Science undergrad award:

Prof Tim Clough (NZSSS Secretary) presenting the New Zealand Society of Soil Science award for best undergraduate student in Soil Science for Lincoln University (2017) to BAgS Hons Irene Setiawan. NZSSS offers this award annually to the best 3rd year student in Soil and Earth Sciences at Lincoln, Massey and Waikato universities.

On Thursday 15 February, the Department gathered to celebrate the start of the new academic year. This year we combined a BBQ with a tour of the new research facilities at the Ashley Dene Research Farm. The 355 ha Farm was purchased by the Canterbury Agricultural College (as Lincoln was then known) in 1909, and was run as a facility to investigate dryland pastoral systems and dairy wintering systems. In 2016, a new 190 ha Research and Development Station was created to conduct farm systems research to improve the profitability, environmental and welfare performance of dairy and livestock farming systems. Many of the Department's research programs and Postgraduate studies are located at Ashley Dene; with collaborative research between soil, plant, animal and farm management colleagues at Lincoln, CRI's and associated industry partners. Our thanks for Keith Cameron who was our tour guide.

Plant and Food Research

The Soil Water & Environment group at Lincoln is hosting a year-long visit from Zihuan Fu from Tianjin University, China. Mr Fu's PhD research is co-supervised by Wei Hu and Mike Beare and focusses on understanding how soil organic matter affects soil hydraulic properties. He will conduct research on soil organic matter and soil water storage which will also contribute to meeting the objectives of the MBIE Soil Health and S-Map programmes that are both led by Manaaki Whenua – Landcare Research.

Marcus Schiedung, an MSc student in the Institute of Geoecology at the Technical University Braunschweig, recently returned to Germany after a very successful three month visit to Plant & Food Research at Lincoln. The purpose of Marcus's visit was to resample sites on the West Coast of the South island to quantify the effect of soil modification (i.e. flipping) on soil C sequestration during soil redevelopment. The sampling and measurements made during his visit were very successful and we expect this work to produce one or more joint scientific papers. It has also helped us to formalise our collaboration with the Thünen Institute of Climate Smart Agriculture and the Technical University Braunschweig, where we are now involved in several joint projects. Marcus revisited the modified land forms of Cape Foulwind, Buller, where a chronosequence of

flipped soils from 1-20 years post modification, and unmodified sandy Pakihi soils were sampled for C content and bulk density. Marcus was especially interested in C content at depth, even down to the flipping depth, up to 2.8 m in places. He was joined a technician from Braunschweig for three weeks to help with the very intensive field sampling campaign. **Craig Tregurtha** and **Sam Wilson** had a large input into the field work too, with Craig having contributed to the work previously done in the region as part of a Landcorp scoping study, many years ago in Crop and Food Research. Marcus's work was complimentary to this previous work and he was able to access our data extending his timelines. The team brought large amounts of soil back from the Cape. Over 1000 samples were taken using a specialist auger for sampling sandy soils to depth. These samples were processed at Lincoln for C content and bulk density, with Marcus sending many samples to Germany for further measurements. Marcus' initial findings were that there has been extensive C buildup over time since flipping as the soil redevelops, and that C content is still increasing in the the oldest modified land forms.

Cameron Marshall, a degree 3 Lincoln University student, has been working with us over the summer, mostly in the Field Crops team, and leaves shortly to return to his studies. Cameron has been a great asset to the team, being a diligent, hard worker, easily fitting into the team and proving to be very capable at all tasks presented to him. Good luck for the future.

Plant & Food Research hosted a visit from Professors **Fengwang Ma** and **Pengmin Li**, and Drs **Chao Li** and **Changhai Liu** of the Northwest Agricultural and Forestry University (NWAFU), Yangling, Shaanxi Province, China at the end of January. Their visit included discussion of our common interests in soil, water & environmental issues pertaining to both annual and perennial cropping systems and opportunities for scholarly exchanges and collaboration. The visit also contributed to the objectives of the NZ/China Water Research Centre, hosted by Lincoln University.

Dr. **Wei Hu** has been invited to the role of Associate Editor for the Elsevier BV (the "Publisher") journal 'Journal of Hydrology' and NRC Research Press journal 'Canadian Journal of Soil Science'. His term will be two years beginning on 1/1/2018 and concluding on 31/12/2019. Journal of Hydrology is a top journal in the fields of hydrological sicences and water resources with an impact factor of 3.483. It publishes original research papers and comprehensive reviews in all the subfields of the hydrological sciences including water based management and policy issues that impact on economics and society. Canadian Journal of Soil Science, a quarterly journal, publishes new research on the use, management, structure and development of soils and draws from a range of disciplines including soil science, hydrology, environmental science etc.

Brendon Malcolm reports that two large Forages for Reduced Nitrate Leaching (FRNL) paddock trials have just been completed in Waikato and Canterbury, assessing the

effectiveness of catch crops to reduce soil nitrogen at risk of leaching following autumn/winter grazing of fodder beet. This has involved an intensive soil sampling regime to account for urine patch variability. At each sampling, deep soil cores were taken every 1-metre along a 10–20 m transect within each plot. This method was guided by Landcare's Urine Patch Model, that determines a theoretical urine patch distribution and the sampling strategy required to intercept a proportionate number of urine patches. 450+ cores were taken at a single sampling – a huge effort by the team, which was made up of staff from both 'Field Crops' and 'Soil, Water & Environment'. The efforts have been rewarded though with some nice clear trends observed by grazing management approaches of fodder beet and the subsequent establishment of catch crops, in terms of soil mineral nitrogen.

From left to right, Jian (Frank) Liu, Nathan Arnold and Steven Dellow taking post-grazing soil samples at the Waikato site.

Major new research programmes have also kicked off in the last 2-3 months. This includes a Plant & Food Research and FRNL-funded trial on the Lincoln University Research Dairy Farm investigating the potential for no-tillage establishment of Fodder Beet and Kale to reduce soil compaction and N losses following winter grazing. It also includes a major GPLER-funded trial aimed at assessing the potential for pasture renewal using full inversion tillage to increase soil C stocks compared to other common renewal practices. The trial will also evaluate the agronomic impacts and environmental trade-offs of FIT pasture renewal.

The FRNL forage and tillage trial at the LURDF with fodder beet (front) and kale (back) being irrigated.

Further field work is being done by **Alex Michel** (Lead), **Sarah Sinton** and **Steven Dellow** looking at the effect of bed configuration on potato yield. The current work follows initial small plot work two years ago and now extends to large scale plots on farms. The team are looking at three layouts, conventional farmer ridge and furrow, and flat top ridge and furrow and formed flat bed, with two seed depths. The investigation is looking at how the planting configurations influence plant water availability, soil physical properties and subsequently, potato and root biomass.

Formation of two row flat-bed (left) and flat-top bed (right, using a modified Grimme planter

Site post planting showing differing bed architectures

A FAR hosted grower field day was held mid season at the Mid Canterbury site where UK potato agronomist **John Sarrup** was the guest speaker. It was attended by 20 growers and industry representatives. A range of issues facing growers in the NZ and the UK were discussed as was the field trial.

L to R John Sarrup (UK), Steven Dellow, Alex Michel (PFR) and Jen Linton (FAR potato research manager) speaking at a field day in Mid Canterbury.

Visual assessment shows differing root architecture between the treatments, with the roots able to extend more laterally in the flat bed treatment than in the ridge/furrow systems, where there is significant soil compaction from moulding and wheel marking.


Flat bed planting system (L) showing root distribution extending more laterally than conventional ridge and furrow system (R) showing reduced root biomass in furrows due to compaction.

Steven Dellow (L) and Cameron Marshall sampling for soil bulk density and root biomass

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Special Feature on Digital Technology

How a "Viking" is helping revive New Zealand's National Soil Database
Manaaki Whenua Soil Information Team

Manaaki Whenua – Landcare Research has recently built a data entry tool, currently called 'Ragnar' after the fabled Viking hero and ruler, Ragnar Lodbrok, to help grow the coverage of the National Soils Data Repository. Below we describe the rationale for the creation of this tool, the tool itself, and its potential use in other areas where observation data are collected in the field.

The vital importance of soil point data

It is often stated that New Zealand is highly dependent on a 'biological economy', and that this is fundamentally underpinned by the availability and condition of its soil resource. For a pedologist, in plain language, this means that a lot of soil pits have to be dug. Since the 1930s, Manaaki Whenua – and its predecessor, DSIR Soil Bureau – have invested

considerable time and effort establishing and describing soil profiles across the country. Digging soil pits not only allows us to collect soil samples for analyses, the site and soil descriptions made at these locations help us understand how soil properties vary with geology, rainfall, vegetation, topography, and land management. They also inform soil classification, and are decisive ‘point’ information in the soil mapping of larger areas, as well as in hydrological and land management modelling efforts. Despite advances in remote sensing technologies, it is generally agreed that the ‘humble’ soil pit will continue to serve as the base unit for soil data.

A revived national database for soils

Over time, Soil Bureau staff had compiled descriptions and data for some 1,500 soil profiles which were stored in the National Soils Database (NSD). All these profiles have a least soil chemical analyses for a number of soil horizons, and some also have the complete set of moisture retention, mineralogy, XRF analyses, and particle size. Mainly due to a lack of funding for the maintenance and development of land resource databases and information, soil data gathered since the mid-1990s were no longer incorporated into the NSD, but remained as accessory temporary datasets spread over multiple locations and in a variety of file formats.

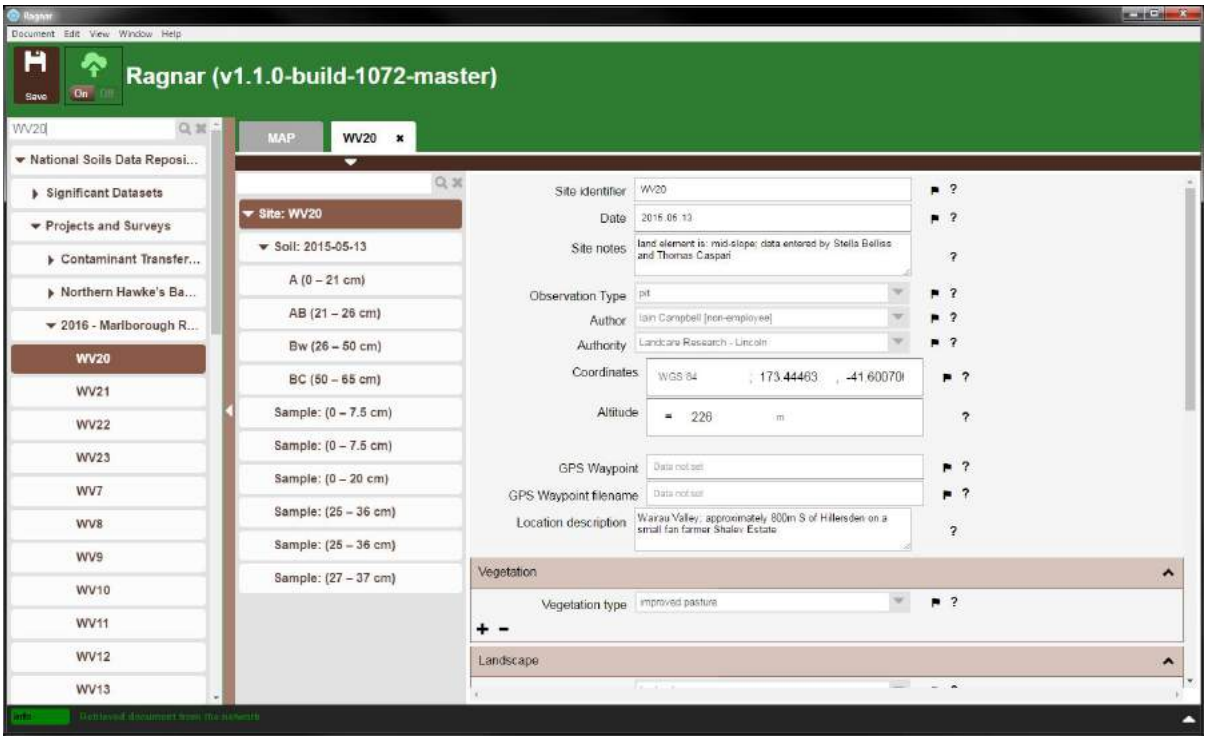
With a renewed focus on the importance of soils information and associated funding successes, the nationally significant collections and databases Land Resource Information System (LRIS) programme has been working to revitalise the NSD. Effort has focused on two major areas: the design and implementation of a world class soils observation data system able to meet today’s needs for soil data and a tool for capturing new and legacy soil data.

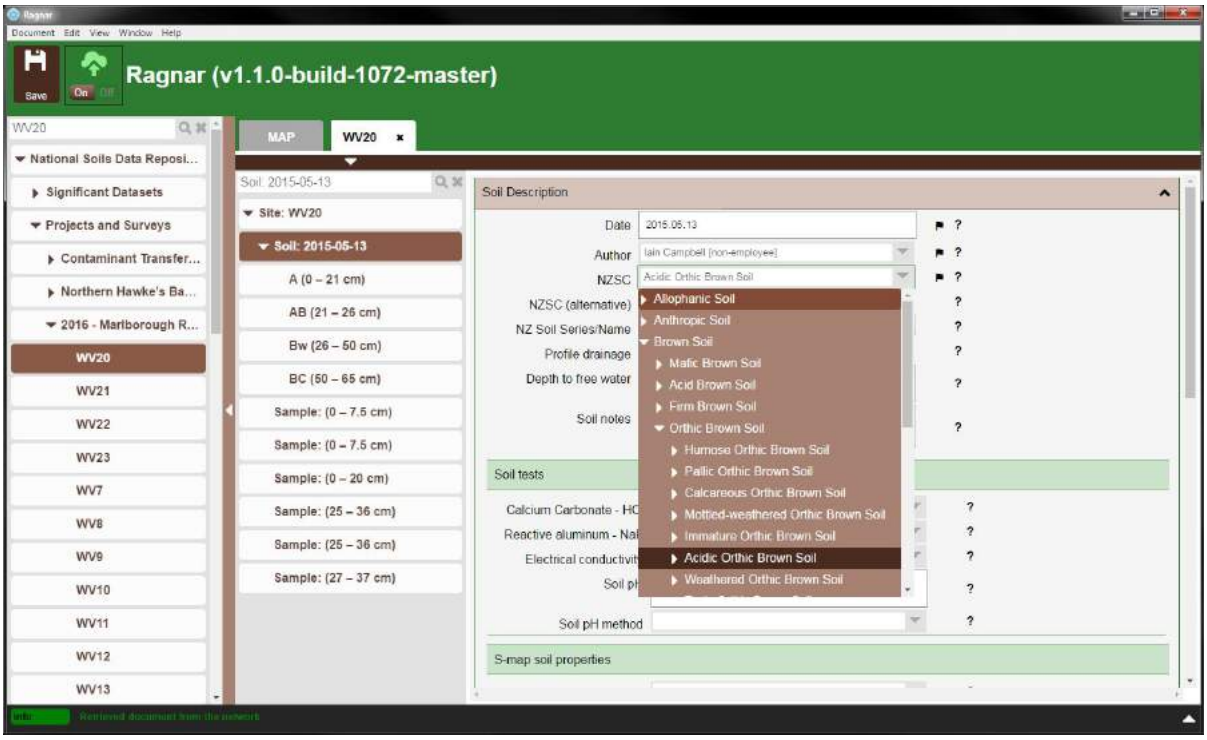
The resulting National Soils Data Repository (NSDR) is a versatile soil observation database that now hosts the original NSD. Whereas the original NSD was very specific in purpose (for storage and presentation of pedological data sampled by horizon with a minimum suite of analytical results), the NSDR database has been specifically designed to be capable of housing a variety of soil datasets that differ in content, format and utility (such as accommodating soils sampled by depth intervals or sites resampled over time).

Capturing soil data

An important requirement was a computer-based data entry tool to resolve the bottleneck of actually getting more data into the NSDR. This tool – with a working title of ‘Ragnar’ bu which will be suitably renamed for each application area it’s used in – allows the user to upload site and soil information directly into the NSDR database. Samples taken in the field can also be registered, and associated lab analysis results downloaded to Ragnar from the laboratory databases once they become available and linked to the related site data in the NSDR.

Ragnar is a ‘client’ application that can be installed on Windows, OS X or Linux and provides access, over the web, to the central NSDR system. It manages access to the NSDR (no user can see a dataset without permission), allows data to be created and updated, and helps ensure that the data meet appropriate rules for quality and content. Ragnar can be quickly configured to support project-specific data requirements without rewriting the application itself. It is one of several ways of interacting with the NSDR, and most importantly, is complemented by a secure web viewer allowing read-only access to soil data.





Securing the treasure of soils data 'hidden' for some 25 years is not a task that one or two researchers could tackle alone. Realising this, Ragnar has been flexibly designed to maintain data integrity for data entry by all. Unlike Ragnar Lodbrok, whose existence has actually been doubted by historians, Manaaki Whenua's Ragnar software tool is very much real and alive! Built by the Informatics team and tested by the Soils and Landscapes team, Ragnar is now used on a daily basis by staff to capture both old ("legacy") and recently collected soil data.

Through co-funded projects with Canterbury, Waikato, Hawkes Bay, Southland and Marlborough Regional Councils, together with EnviroLink and Fertiliser Association of New Zealand, there is currently a big push to upload legacy soil water storage data to underpin the soil information that S-map is supplying to a range of stakeholders. Overall, current projects have provided funding to add about 20% of the entire database that existed up to 1992! A recently conducted audit of Manaaki Whenua's legacy soil data has identified another 3,000 priority soil descriptions and related lab data that could be added to the NSDR.

Now that Ragnar is alive – what's next?
Ragnar looks to be a game-changer when it comes to resolving the bottleneck of soil data entry into the NSDR. But there are several other ways in which internal and external parties can profit from this development.
As described above, soil point data in the NSDR are the crucial foundation underpinning all other soil datasets. The wealth of soil information now being added to NSDR will inform all other information products delivered through S-map, or the LRIS portal. Some of the data entered are from locations not yet covered in our existing soil information systems, meaning that the diversity of NZ soils will be better represented. Also, Manaaki Whenua's efforts in the field of digital soil mapping and environmental modelling will profit from an increase in good soil data.
On the technical side, Ragnar currently requires a constant internet connection to its data store, but has been implemented with a standalone version in mind. This would allow for on-site data capture using laptops or tablets that would store data locally if a network connection was unavailable. More importantly, Ragnar's technical framework is such that it can be adjusted for the type and intensity of data capture, making it suitable for a wide range of environmental data applications. Ragnar's design is based on tools pioneered for the capture of other earth science data (geology, hydrology, and climate) and an experimental version has been successfully developed to capture pasture sampling and field and laboratory spectroscopy data. For example, an experimental version has been trialled with hyperspectral data obtained from the sides of intact soil cores in our soil carbon monitoring research projects.
Please do get in touch with us at Manaaki Whenua if you have ideas for collaborative work in data entry, or if you simply want to learn more about the Ragnar tool.

More information
Contact Dr David Medyckyj-Scott (medyckyj-scottd@landcareresearch.co.nz) if you want to learn more about Ragnar.
NSDR viewer: Explore soil point (profile) data across New Zealand
https://viewer-nsdr.landcareresearch.co.nz/search
Manaaki Whenua – Landcare Research Soils Portal
https://soils.landcareresearch.co.nz/

Back to the future: Soil mapping in a digital age
David Palmer, Scott Fraser, and Sharn Hainsworth

Generally in New Zealand, soil survey and mapping has been undertaken at map scales between 1:15 000 and 1:250 000, with S-map online requiring a minimum map scale of 1:50 000. More recently, land managers and regulators have shown interest in the development of maps at finer resolutions. With the advent of LiDAR we are now able to develop maps that represent the Earth's surface at 5-m, 2-m, or even 1-m cell-size resolution (pixels). Add to this Landcare Research's ability to predict soil chemical and physical properties from existing databases through S-map online, and we now have a powerful method to deliver high quality soil information not available before.

Soils are mapped across the landscape, based on the soil surveyors' knowledge and conceptual ideas of where and how a soil occurs, using resources like aerial photographs Digital Soil Mapping (DSM), and modelling follows a similar approach, except it builds quantitative statistical relationships between the soils observed and described and maps representing the Earth's surface. These maps may include attributes like slope, elevation, curvature, distance to streams, exposure to wind, areas of erosion, and landscape position on the Earth's surface. Climate maps of rainfall, temperature, solar radiation, and soil moisture are also frequently used, as are maps of parent materials, and vegetation cover. The idea is that maps are chosen to represent the main soil forming factors: climate, organisms (including humans), relief, parent material, and time. As a generalised example, waterlogged, poorly oxygenated soils with pale subsoil colours are likely to occur in parts of the landscape where water accumulates (e.g. valley bottoms and in swales and hollows), compared with well-drained soils that are more likely to occur on parts of the landscape shedding water (e.g. hill tops and ridges).

The main advantages of DSM over other mapping techniques are that the techniques are transparent, repeatable, and able to be up-dated (when more information becomes

available), and that probability maps are provided along with model and validation statistics.

So far we have up to 2,000 km2 of new S-map coverage in the following areas:

Coastal Hawke's Bay: Random forests to account for majority of soil pattern in hill country, particularly driven by rainfall and geology. In some landscapes conventional maps were used in preference to the DSMM map, where fieldwork showed more accuracy could be provided from localized soil-landscape models.

Papanui Catchment: Similar method to Coastal Hawke's Bay, but the soil patterns were predicted with more accuracy buy the DSMM due to the LiDAR based high resolution DEM.

Southern Hawke's Bay: Mixture of DSMM models for different areas, all from Random Forests. In the Ruataniwha Plains used manual digitizing of higher resolution orthophotos and LiDAr based hill-shade models to increase spatial delineation of mainly geomorphic unit based conventional soil map units. Soil landscape models proved to be more accurate than Random Forests by new fieldwork in the greywacke foothills, gravel hills (Gwavas, Mason Ridge), limestone landforms, and Maraekakaho terraces.

Tutaekuri, Ahuriri, Ngaruroro, Karamu catchments near Napier: Random Forests DSMM used for most locations, but "tacit points" were used to force the model to predict soils into some landform components where fieldwork showed strong soil-landform relationships eg Gley soils in some hollows.

Currently working on Northern Hawkes Bay from Esk Valley to Wairoa

South Waikato: Random Forests dominated by a layer predicting on the depth of Taupo tephra/ignimbrite.

Waipa: Random Forests. Very high accuracy, because of precise delineation of soil-forming geological units.

Franklin: Random Forests, DSMART (data disaggregation of legacy maps) and conventional soil landscape modelling tested alongside one another. DSMM using Random forests proved to be most accurate because of a custom-built precise geology map.

Digital Technology in the news

Negative emission technologies
In a new report by the European Academies' Science Advisory Council (EASAC), senior scientists from across Europe have evaluated the potential contribution of negative emission technologies (NETs) to allow humanity to meet the Paris Agreement's targets of avoiding dangerous climate change.

Scientists develop urine sensors on dairy cows to find ways to reduce nitrate leaching
Urine sensors are being connected to the rear of dairy cows in a world first environmental project by scientists to work out how much nitrogen is being excreted by them. AgResearch scientists expect the project will provide insights into the best way to prevent nitrates from escaping into water from farm paddocks.
Listen here

Technological breakthrough for monitoring and predicting landslides
New technology from a student-led research project at Victoria University of Wellington looks set to revolutionise the way geotechnical engineers monitor and predict landslides, potentially helping to save countless lives and cut costs.

Conference Report

International precision agriculture PA17

New Zealand hosted its first international precision agriculture conference in October 2017, and here is a brief report of these meetings.

PA17 – The International Tri-Conference for Precision Agriculture combined the 7th Asian-Australasian Conference on Precision Agriculture (**7ACPA**), the 1st Asian-Australasian Conference on Precision Pasture and Livestock Farming (**1ACPLF**), and Digital Farmer & Grower 2017 (**DF&G2017**). It was organised by The Precision Agriculture Association of New Zealand (**PAANZ**), chaired by Dr Armin Werner of Lincoln AgriTech, and took place between 16 – 19 October 2017 in Hamilton, New Zealand.

PA17 attracted around 500 delegates from across the globe. Alongside 428 attendees, the event attracted 56 exhibitors, with half of the delegates from 14 overseas nations of Australasia, Asia, Europe and the US. Over 3-days a wide range of PA topics were covered, including proximal soil sensing, precision management, data analytics, robotics, postharvest systems, technology transfer, adoption and on-farm adaptation.

PA17 commenced with a two-day **Master Class "Data analysis and digital mapping for precision agriculture"**, organised by Carolyn Hedley and Pierre Roudier, with tutors Pierre, Nathan Odgers and Michael Blaschek of Manaaki Whenua-Landcare Research. An initial Introduction to R session was followed by a background to digital soil mapping methods and how to handle high resolution proximal and remote sensor data. Some spatial soil predictive functions, and does and don't for calibration and validation were also covered in the lectures that accompanied the hands-on computer sessions (see photos).

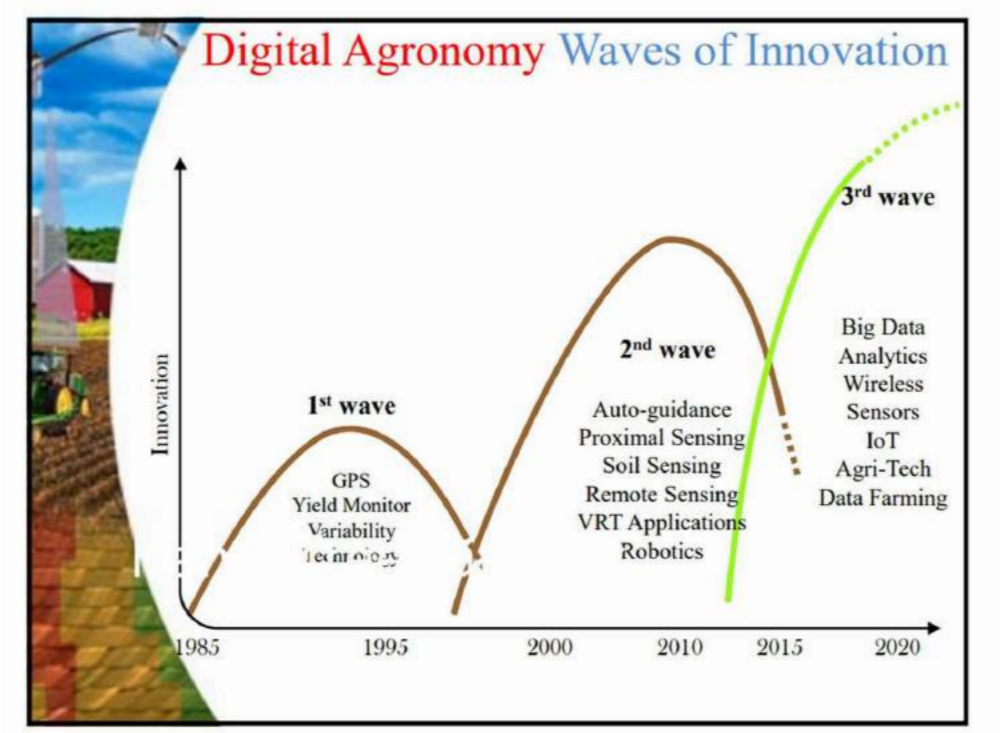
During the subsequent PA17 meetings, some excellent invited keynote presentations included those from: Raj Khosla (Colorado State University) on the topic of "Future of Farming: Digital Agronomy and Analytics" (see photo); Nicolas Tremblay (for V Adamchuk, McGill University, Canada) on new developments in proximal soil sensing; Sjaak Wolfert (Wageningen UR) on the Internet of Food and Farm 2020, Simon Blackmore (Harper-Adams University) on the role of robotics, and New Zealander, Miriana Stephens (Wakatu Incorporation) on new business sustainability models.

ACPA is one of three large international PA conference that are run biannually at a series of locations around the World; the other two being the International Precision Agriculture Conference (ICPA) held biannually in the USA and the European Precision Agriculture Conference held biannually in Europe. ACPA has previously been held in Japan, South Korea and China.

The1st Asian-Australasian Conference on Precision Pasture and Livestock Farming (1ACPLF) was established, acknowledging New Zealand's focus on pastoral livestock farming and interest in precision applications for these farming systems. It focussed on knowledge and tools for managing pastures and animals. Presentations included those on digital tools for land managers to measure pasture growth or monitor animal welfare, health and productivity. Such tools also assess environmental impact from livestock.

The Digital Farmer & Grower Digital Farmer and Grower (DF&G2017) was dedicated to farmers, growers, their consultants and counterparts in service and support organisations of the

primary sector. The main aim was to demonstrate how to adapt precision agriculture technologies for use in production systems, addressing how practitioners can meet growing demands of consumers by the use of precision technologies and ensure future sustainability. Farmers and growers presented their experiences and panel discussions allowed deeper discussions.



Reference: Raj Khosla, 2017, Future of Farming: Digital Agronomy and Analytics. Keynote talk to PA17

Hands-on PA17 Master Class "Data analysis and digital mapping for precision agriculture" held at PA17, October 2017, Hamilton, New Zealand (Photo: Nathan Odgers)

Attendees at the PA17 Master Class "Data analysis and digital mapping for precision agriculture" (Photo: Carolyn Hedley; Tutors: Michael Blaschek, Nathan Odgers, Pierre Roudier are in the back row, third to fifth from the left).

As a belated Valentine's Day gesture, the UN environment wing is urging everyone to 'break up' with single-use plastic. In *It's not me, it's you*, a short video for its #CleanSeas campaign, the UN environment wing takes a lighter look at the very serious problem of marine litter and urges everyone to give up the use of single-use plastic products such as disposable cutlery, water-bottles, food containers and shopping bags.

Related Society Notices

International Union of Soil Sciences

IUSS Bulletin 131 (December 2017)
From the desk of Rattan Lal: Out of nothing comes nothing
From the desk of Rattan Lal: Soil: The Hidden Treasure of Nature

In 2018 IUSS intends to publish a book on Global Soil Proverbs. Therefore, the editors kindly ask you and your society members to contribute to this book. This would be a great opportunity to work together under the umbrella of the International Decade of Soils 2015 – 2024 and to reflect the variety of soil-related proverbs on the globe. It shall show that the term soil is very commonly used in every day language and shall help to give this precious resource more visibility and attention. If you wish to contribute a chapter, please let us know by sending a Letter of Intent until March 31, 2018 to yangjay@kangwon.ac.kr and in Cc to iuss@umweltbundesamt.at

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New Zealand Royal Society

Call for nominations: Royal Society Te Apārangi Awards and Medals 2018 . A web portal is set up for nominations, which close 30 April.

Climate change: stormy weather ahead: Free public lecture by Jim Skea from the IPCC

Wellington | Te Papa, Soundings Theatre
6pm Wednesday 21 March 2018
This will be a popular event, please make sure you register to guarantee a seat.

European Soil Data Centre (ESDAC)

- An Assessment of the global impact of 21st century land use change on soil erosion
- LUCAS: Land Use/Cover Area frame Statistical Survey

Abstracts

Is there a potassium-based solution to sensitive soil slipping within the Bay of Plenty?

T. Robertson, V.G. Moon, D.J. Lowe
School of Science, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand

Abstract
Landslides are common in sensitive, weathered pyroclastic soils in the Bay of Plenty (BOP). The clay mineralogy of these soils is dominated by halloysite, an inactive 1:1 clay mineral. Manipulation of cation content within the pore water of sensitive soils has been shown to improve in situ soil strength in illite-dominated soils in Norway. We present results of laboratory tests on the impact of altering cation status of a sensitive soil from the base of a large landslide at Omokoroa near Tauranga, BOP. Addition of KCl and KOH both reduced the liquid limit of the

soil, a negative effect. In contrast, addition of K_2CO_3 caused an increase in the plasticity index of soil pastes. Soaking intact samples in K_2CO_3 for three weeks resulted in a considerable increase in peak stress in effective stress triaxial testing. These early results suggest that mitigation of sensitive soil landslides through increasing peak strength by addition of appropriate salts to the soil profile may be an option for mitigation of landslides in sensitive BOP soils.

In: Alexander, G.J., Chin, C.Y. (eds) (2017), *Proceedings 20th New Zealand Geotechnical Society Symposium NZGS2017*, 24-26 November 2017, Napier (8 pp.).

Evaluating soil and landscape models to predict liquefaction susceptibility in the Hinuera Formation, Hamilton Basin

A.M. McKay, D.J. Lowe, V.G. Moon
School of Science, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand

Abstract
Cone Penetration Tests (CPT) derived from the Hamilton section of the Waikato Expressway were analysed within CLiqTM software. The derived liquefaction potential index (LPI) from each CPT was then combined with LIDAR, pedological and geological maps for statistical analysis. A soil model that incorporates the conditions of modern soil development with these derived LPI values was developed as a preliminary assessment tool for liquefaction potential within Hamilton Basin soils. The model shows that liquefaction is more likely to occur on interfluvial areas where there is little topographical relief. Pedological soils with high organic component are also a likely indicator of high liquefaction susceptibility.

In: Alexander, G.J., Chin, C.Y. (eds) (2017), *Proceedings 20th New Zealand Geotechnical Society Symposium NZGS2017*, 24-26 November 2017, Napier (8 pp.).

Sensitive pyroclastic soils in the Bay of Plenty, New Zealand: microstructure to failure mechanisms

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Abstract
Sensitive soils derived from weathered rhyolitic pyroclastic materials are associated with many landslides in the Bay of Plenty. Undrained, consolidated static triaxial tests show contractive p’-q’

plots, strain-softening stress-strain behaviour coupled with rising pore water pressures, shear band formation after peak strength, and considerable strain softening. Cyclic triaxial tests confirm brittle failure and extensive softening of the soil. Pore pressure gradients developed during shearing initiate collapse of clay microstructures into shear zones; further excess pore pressure generation in the shear zone leads to progressive failure. Halloysite, a low-activity clay mineral, is associated with sensitive layers within the pyroclastic sequences. Mushroom cap –shaped spheroidal halloysite results in weak short-range interactions between exposed clay surfaces on incomplete spheroids. This weak bonding allows disassociation of clay aggregates during slope failure, leading to strain softening and the development of flow post-failure.

In: Alexander, G.J., Chin, C.Y. (eds) (2017), *Proceedings 20th New Zealand Geotechnical Society Symposium NZGS2017*, 24-26 November 2017, Napier (8 pp.).

Advancing tephrochronology as a global dating tool: applications in volcanology, archaeology, and palaeoclimatic research

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Abstract
Layers of far-travelled volcanic ash (tephra) from explosive volcanic eruptions provide stratigraphic and numerical dating horizons in sedimentary and volcanic sequences. Such tephra layers may be dispersed over tens to thousands of kilometres from source, reaching far beyond individual volcanic regions. Tephrochronology is consequently a truly global dating tool, with applications increasingly widespread across a range of Quaternary and geoscience disciplines. This special issue of the International Focus Group on Tephrochronology and Volcanism (INTAV) in *Quaternary Geochronology* showcases some of the many recent advances in tephrochronology, from methodological developments to diverse applications across volcanological, archaeological, and palaeoclimatological research.

Quaternary Geochronology (2017) 40, 1-7. DOI: 10.1016/j.quageo.2017.04.003

Rangitoto Island field trip, Auckland

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Abstract
Rangitoto, Māori for 'blood red sky' (also 'lava, scoria'), derives from the phrase Ngā Rangi-i-totongia-a Tama-te-kapua (the full name for the island) meaning "the day the blood of Tamatekapua was shed", referring to a battle between Tamatekapua and Hoturoa, commanders of the Arawa and Tainui canoes, respectively, at Islington Bay. The Island is arguably Auckland's most beloved and omnipresent landscape feature. It is a symmetrical, ~6-km wide, basaltic shield volcano that last erupted c. 550–500 calendar/calibrated (cal.) yr BP (c. 1400–1450 AD), not long after arrival and settlement of Polynesians in the Auckland region (c. 1280 AD). It is by far the largest, and the youngest, volcano in the Auckland Volcanic Field (AVF). The AVF consists of ~53 individual eruptive centres, all of which lie within the boundaries of the Auckland urban area. Recent research on deposits in a 150-m-long drill core obtained from Rangitoto Island in February, 2014, and on cryptotephras in sediments from Lake Pupuke on North Shore and on tephras in wetlands on adjacent Motutapu Island, has revealed Rangitoto's complex history, with three main phases (1–3) suggested. The flora on Rangitoto is unique among the islands situated in the Hauraki Gulf because of the island's young age, and the fact that technically Rangitoto is an 'oceanic' island. Its flora and fauna are derived entirely from long distance dispersal. The island contains some 582 vascular plant taxa of which 228 (39%) are indigenous. Following a short introduction and summary, the the guidebook comprises three parts. **Part 1** provides a summary of volcanic textures on Rangitoto together with notes about archaeology, soils, and flora (including vegetation succession). Then various geological features at stops along the Summit track are noted in brief (with map). **Part 2** comprises a summary of the volcanic history of Rangitoto Island, including reference to the findings of the Rangitoto drill-core project, and recent work on tephra deposits on Motutapu Island and on tephras and cryptotephras in sediments of Lake Pupuke. Cryptotephras (from Greek *kryptein*, 'to hide'; *tephra*, ash or ashes) are tephra-derived glass shard (and/or crystal) concentrations preserved and 'hidden' in sediments but insufficiently numerous and too fine grained to be visible to the naked eye as a layer. **Part 3** takes a wider view by way of short introduction to the AVF, and includes mention of new Ar/Ar and palaeomagnetic dating and tephrostratigraphic work on the deposits in the field, and maar-based palaeoclimatic research.

In: Brook, M. (compiler). Field trip Guides, Geosciences 2017 Conference, Auckland, New Zealand. *Geoscience Society of New Zealand Miscellaneous Publication* 147B, 56 pp.

Papers and abstracts from the Plant and Food team:

Baldock JA, Beare MH, Curtin D, Hawke B 2015. Predicting the content, composition and management impacts on stocks and vulnerability of soil organic carbon using mid-infrared spectroscopy. Soil Research (Revised)

Brown H, Carrick S, Müller K, Thomas S, Sharp J, Cichota R, Holzworth D and Clothier B 2017. Modelling soil-water dynamics in the rootzone of structured and water-repellent soils. Computers

and Geoscience (Submitted).

Clough TJ, Moldrup P, Wollesen de Jonge L, Beare MH, Thomas SM 2017. Soil density effects on soil-air characteristics and gas diffusivity. Soil Science Society of America Journal (Submitted)

Ding Y, Li Y, Li L, Yao N, Hu W, Yang D, Chen C 2017. Spatiotemporal variations of snow characteristics in Xinjiang, China over 1961–2013. Hydrology Research. DOI: 10.2166/nh.2017.035.

Jamieson P, Michel A, George M, GIllespie R, Maley S 2017. Using Surface Temperature and Vegetation Indicies to estimate variation in evaporation. Agricultural and forest meteorology (Submitted).

Liu Y, Hu C, Hu W, Wang L, Li ZG, Pan JF, Chen F 2018. Stable isotope fractionation provides information on carbon dynamics in soil aggregates subjected to different long-term fertilization practices. Soil & Tillage Research, 177, 54-60. DOI: https://doi.org/10.1016/j.still.2017.11.016.

Malcolm BJ, Cameron KC, Curtin D, Di HJ, Beare MH, Johnstone PR, Edwards GR 2017. Organic matter amendments can reduce nitrate leaching losses from winter-applied urine under simulated fodder beet grazing. Agriculture, Ecosystems and Environment (Submitted).

McNally S, Beare MH, Curtin D, Tregurtha C, Qiu W, Kelliher F, Baldock J 2017. Assessing the vulnerability of organic matter to C mineralisation in pasture and cropping soils of New Zealand. Soil Research (Submitted)

Schon NL, Curtin D, Beare MH, Mackay AD, Gray RA, Dodd MB, van Koten C 2017. Transfer of dung-carbon between particle size fractions in the presence of earthworms. Biology and Fertility of Soils (Submitted)

She DL, Wang HD, Yan XY, Hu W, Zhang WJ, Li JY, Wu CX, Xia YQ 2018. The counter-balance between ammonia absorption and the stimulation of volatilization by periphyton in shallow aquatic systems. Bioresource technology 248 (Pt B), 21-27. DOI: 10.1016/j.biortech.2017.07.100.

Sun J, Kang Y, Wan S, Hu W 2017. Influence of drip irrigation level on salt leaching and vegetation growth during reclamation of coastal saline soil having an imbedded gravel–sand layer. Ecological Engineering, 108, 59-69. DOI: 10.1016/j.ecoleng.2017.08.004.

Trolove S, Thomas T, van der Klei G, Cichota R, Beare MH, Meenken ED 2017. Tillage, forage crops and grazing affect nitrate leaching losses during pasture renewal. Agriculture, Ecosystems and Environment (Under revision).

Vezzani FM, Anderson C, Meenken ED, Gillespie R, Peterson M, Beare M 2017. The importance of plants to development and maintenance of soil structure, microbial communities and ecosystem functions. Soil & Tillage Research 175: 11.

Zhang YK, Huang MB, Hu W, Duan LX 2018. How shallow and how many points of measurements are sufficient to estimate the deep profile mean soil water content of a hillslope in the Loess Plateau? Geoderma, 314, 85-94. DOI: https://doi.org/10.1016/j.geoderma.2017.11.013.

Books

Young, Anthony 2017 *Thin on the Ground: Soil Science in the Tropics* Second revised edition, xiv + 350 pages with 38 photographs. Published by Land Resources Books, Norwich, UK. ISBN-10: 0995656606. Available from amazon (UK, USA, Europe).

A summary of the book, setting out new material and emphasis in this edition, with notes on the author and sample images, can be found on here .

Conferences and Training

ALGA 5th Contaminated Land Conference, Christchurch New Zealand: 1 – 3 May 2018
This is the inaugural event for Christchurch. More information here

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2018 NZ Land Treatment Collective Annual Conference: 7-9 March, Rotorua.
Speakers from NIWA, the University of Waikato and the University of Washington will give presentations of the latest innovations in land and wastewater treatment. More information here

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Soil Classification and Education Conference, Torun, Poland: May 18 - 20 2018
Globalization and global environment issues, as well as unification of scientific research and teaching on the EU and global levels require harmonization of technical languages, such as the terminology used in soil Science. The aim of this conference is to present solutions for international education in soil science. More information here.

5th Annual Future Farms Conference: 14-15 March, Palmerston North.
Agritech, agrifood and innovation – unleashing the potential of the future farmer. More information here

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Australasian Environmental Isotope Conference 26-28 March, Wellington
At AEIC2018 attendees will engage on a wide variety of environmental applications of isotopes. More information here

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Soil Improvement: Impact of Management Practices on Soil Function and Quality, Leicester UK, NOW 16-17 October 2018.
The application of soil improving techniques is crucial to maintain soil functions, long-term productivity and the broad range ecosystem services provided by soils. These techniques include tillage, crop diversity, crop management, cover crops and the use of organic amendments. More information here

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17th World Fertilizer Congress of the International Scientific Centre of Fertilizers, 3 – 9 September 2018, Shenyang, China

The northeast of China has been traditionally the center of fertilizer production and fertilizer research so that Shenyang was the predestined location to host the 17th World Fertilizer Congress. More information here

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ASA National Soils Conference 2018, 18 – 23 November 2018

The National Soils Conference 2018 will be held at the Hyatt in Canberra between the 18th and 23rd of November. The conference will have the theme *Soil: The key to past, present and future* and we expect that the conference will be a great opportunity for you to showcase your work and to network with your colleagues. There will be significant emphasis on the practice of soil science. Sponsorship opportunities will be available, and a prospectus will be sent to each member of the society. More information here

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2018 NZSSS Conference, 3-6 December 2018, Napier, New Zealand

Soils2018 will be held in Napier from 3 to 6 December 2018. This biannual conference is a must attend event organised by the NZ Society of Soil Science and OnCue Conferences, and will cover a range of topics under the theme **'diverse soils - productive landscapes'**. The wider Hawke's Bay region is home to a diverse mix of primary production, from forestry and sheep and beef production on the coastal and northern hill country, intensive dairy systems on the flat and rolling terraces abutting the ranges, to highly productive horticulture and cropping on the fertile Heretaunga and Ruataniwha plains. During the 4-day conference you'll get a chance to hear from a wide range of researchers, industry leaders, consultants and advisors, regulators and land managers on all things soil-related, anchored by a range of exciting keynotes focused on soilscapes, food production and hot topics around water use and environmental indicators. The conference will be held at the new Napier War Memorial Conference Centre, a great venue on Napier's iconic Marine Parade that looks out on Cape Kidnappers and the city coastline. Centrally located, the NWMCC is across the road from local hotels, restaurants and the downtown shopping precinct. Around the conference you'll have a chance to connect with your colleagues during social activities at some of the Bay's well known wineries, and look at a wide range of offerings from our event sponsors. All of the details about this event can be found at the conference website http://nzssconference.co.nz/. The call for abstracts is now open so please visit the website http://nzssconference.co.nz/call-for-abstracts to see the instructions and submit an abstract.

This year we have the following conference themes:
- Education, outreach, extension, employment/career advice
- Macro Influences – Global Food, Water Scarcity, Regulatory Requirements, Climate Change, The Digital Age
- Soil carbon and greenhouse gases
- Soil contamination, degradation and remediation
- Soil biology and ecosystems
- Soil fertility, nutrient management and plant nutrition
- Soil quality and function
- Soil physics and water management
- Use of soils for wastewater/effluent treatment
- Soils in the landscape (Pedology) – Past, Present and Future
- Sustainable management – paddock to catchment scales
- Natural capital and ecosystem services
- Our Land and Water National Science Challenge

If you have any further queries about the science programme please contact Diana Selbie Diana.Selbie@agresearch.co.nz. Conference registration opens on March 14

Rebecca Withnall and Paul Johnstone, co-convenors
Lea Boodee, On-Cue Conference

Soil-art exhibition - invitation and advance warning!

After our successful inaugural soil art exhibition at the Hamilton conference in 2014 we are planning to again hold a soil-related art exhibition at our NZSSS conference in Napier in December 2018. We would like to showcase the widest possible interpretation of soil-related art, produced by you, the New Zealand Soil Science community.

Everyone can participate - all forms of art will be accepted including: sculpture from soil/clay/earth materials or with a soil-related theme, paintings related to soils or made using soil materials, poems or short statements that can be displayed on a wall poster, photography, fibre art, computer generated art, soil peels, sand paintings, cartoons – everything is possible.

WHY??

- Art is fun to create and to view.
- Art is a way to reach a non-science audience with messages about the importance, beauty, vulnerability and versatility of soil.
- Art (done by the science community) is a means to break down stereotypes about the sorts of people who are scientists.

Thus, the challenge is to get creative. Start now while there is lots of time to work on it. There is still time for you to join a pottery, art, or sculpture class to get some upskilling to create your masterpiece. Do something to show off some of your interpretations of soil or soil materials.

Get committed, let Megan Balks megan.balks@waikato.ac.nz or Diana Selbie diana.selbie@agresearch.co.nz know if you plan to contribute so we can ensure we have enough suitable display space.

Opportunities

America/New Zealand Soil Science Travel Award

The America/New Zealand Soil Science Travel Award encourages scientists in the U.S. and New Zealand to foster enhanced cooperative soil science research. Funds for the travel award are provided through the Agronomic Science Foundation and the selection process is administered by the Soil Science Society of America and New Zealand Soil Science Society. The award consists of a certificate, a complimentary ticket to the award ceremony, and a travel grant is in the amount of $5,000 for 2018. The 2018 Awards Program will accept proposals to support a New Zealand based soil scientist to travel to the United States. The deadline to submit nominations (self-nominations are encouraged!) is March 14 with reference letters and final submission March 21.

https://www.soils.org/awards/view/77

PhD studentship: Soil health metrics for sustainable farming systems, Rothamsted Research
The closing date for applications is 2 March, click here for details

PhD studentship: Design of robust and sustainable biomass value chains that are synergistic with the food-energy-water-environment nexus, University of Bath
The closing date for applications is 16 March, click here for details

Call for papers: Special issue of journal 'Sustainability' on governance for climate smart agriculture
A special issue of Sustainability will be devoted to the topic of governance for climate smart agriculture. Professor Jonathan Verschuuren at Tilburg University, Netherlands is guest editor of this issue. The special issue will focus on a wide range of governance issues related to these questions from a multidisciplinary perspective, including, but not limited to, law, economics, business administration, policy, public administration, sociology and psychology.
Deadline for manuscript submissions is 30 May 2018. Further information can be found here

2018 Rutherford Discovery Fellowships Funding Round and Roadshows announced. These prestigious Fellowships will support the recipients for a five-year term and provide funding up to $160,000 a year. Closing date 12 April.

MPI New Postgraduate Science Scholarship opportunity. The scholarships value from $12,000-$40,000 and are open to Masters and PhD candidates who are or will be engaged in primary industry relevant research at a New Zealand tertiary education institution. Closing date 12 March.

NZSSS Award Recipients

President's Invitation Lecture
1972 W A Pullar
1973 T W Walker

The T W Walker Prizes
1992 (oral paper) —S T Olykan
(poster)—G N Magesan

1974 A J Metson
1975 H S Gibbs

Norman Taylor Memorial Award
1976 I L Baumgart
1977 G D Smith
1978 J D McCraw
1979 G G Cossens
1980 A C S Wright
1981 C During
1982 C G Vucetich
1983 N Wells
1984 G M Will
1985 J K Syers
1986 L C Blakemore
1987 W M H Saunders
1988 K R Tate
1989 P J Tonkin
1990 E J B Cutler
1991 C Childs
1992 D R Scotter
1993 No award
1994 A Sinclair
1995 B Clothier
1996 A Hewitt
1997 K M Goh
1998 A Mackay
1999 J Watt
2000 V Neall
2001 S Saggar
2002 D J Lowe
2003 P Singleton
2004 G Sparling
2005 R McLaren
2006 G Yeates
2007 A Carran
2008 M. Balks
2009 P Fraser
2010 C de Klein
2011 T Webb
2012 M McLeod
2013 M Hedley
2014 S Ledgard
2015 R McDowall
2016 L Schipper
2017 T Clough

NZSSS Postgraduate Awards
1971 D W Ives
1972 I Nairn
1973 -none-
1974 V E Neall
1975 -none-

Morice Fieldes Memorial Award for PhD Thesis
1976 J C Ryden
1977 -none-
1978 A N Sharpley
1979 K W Steele
1980 -none-
1981 A G Hogg
1982 A W Limmer
1994 (oral paper)—J Luo
1995 J Zanders & S Park
1998 (oral paper)—J Menneer
(poster)—C P Rooney
2000 (oral & poster papers)
—L Barton
2002 (oral paper)–D Houlbrooke
(poster)—K Wilkins
2004 (oral paper)–J Singh
(poster)–D Dewar
2006 (oral paper)-R Parkinson
(poster)–F Scherr
2008 (oral paper) – P. Mudge
(poster) – G M Lucci
2010 Not awarded
2012 Not awarded
2014 (oral paper) O Jordan
(poster) J Owens
2016 (oral paper) – R Woods
(poster) – A Carlton

Undergraduate Prizes
1994 R McDowell
(Lincoln University)
R Hodgson
(Massey University)
M Boyes
(Waikato University)
1995 W R Cookson
(Lincoln University)
A Reyland
(Massey University)
J C Menneer
(Waikato University)
1996 R Dragten
(Waikato University)
1997 J McCaw
(Lincoln University)
C Eastwood
(Massey University)
V Gough
(Waikato University)
1998 L Garrett
(Waikato University)
N Treloar
(Massey University)
C Rissman
(Lincoln University)
1999 A Manderson
(Massey University)
K McLauchlan
(Waikato University)
S Petrie
(Lincoln University)
2000 S Pitcher-Campbell
(Massey University)
N Dunn
(Waikato University)
C Ducey
(Lincoln University)
2001 C Davies-Colley
(Waikato University)
M Buchan

1983 A B Cooper
1984 A D Mackay
1985 R A Petch & P J Tonkin
1986 I R Phillips
1987 D J Horne
1988 J S Rowarth
1989 A W Young
1990 P B Greenwood
1991 C D A McLay
1992 A W Rate
1993 L A Schipper
1994 D Tambunan
1995 No award
1996 R Lieffering
1997 H Wang
1998 P Almond
1999 B Robinson
2000 T J van der Weerden
2001 B Miller
2002 G Barkle
2003 C Rooney
2004 J Menneer
2005 H Jones / F Moreno
2006 D Houlbrooke
2007 S Gaw
2008 M Hughes
2009 M Bloomberg
2010 S Carrick
2011 N Schon
2012 A Eger
2013 N Balaine
2014 P Mudge
2015 B Welten
2016 D Huang
2017 S McNally & J Owens

Sir Theodore Rigg Award for Masterate Thesis

1976 K D Earl
1977 T H Webb & N E Logan
1978 -none-
1979 D A McKie
1980 C Hedley (née Hubbard)
1981 D Karageorgis
1982 D J Lowe
1983 L A Benny
1984 K B Marsh
1985 B McLaughlin
1986 -none-
1987 C D A McLay
1988 B E Green
1989 S P Cameron-Lee
1990 P J de Lange
1991 G N A Wigley
1992 R B Doyle
1993 -none-
1994 P L Carey
1995 J Moir
1996 -none-
1997 S Park
1998 S Thiagarajan
1999 H Jones (Lincoln University)
P Nelson (Massey University)
2002 A Souness (Lincoln University)
T A O'Neill (Massey University)
D Worthy (Waikato University)
2003 S O'Driscoll (Waikato University)
F Shanhun (Lincoln University)
2004 M Clancey (Waikato University
J Bertram (Lincoln University)
2005 Vanessa Coombe (Waikato University)
Samuel Dennis (Lincoln University)
2006 Laura Buckthought / Georgina Mackie (Lincoln University)
Louise Fisk / Paul Mudge (Waikato University)
2007 Paul Bowater (Lincoln University)
Hamish Mulcock (Massey University)
Georg Kruger (Waikato University)
2008 Glen Treweek (Waikato University)
Emma Anne Phillips (Massey University)
Nicola Jane Kelland (Lincoln University)
2009 Rebecca Bylsma (Waikato University)
Helen Free (Massey University)
Sean Gresham (Lincoln University)
2010 Josh Scarrow & Jack Pronger (Waikato University)
Louise Anne McCormack (Massey University)
Aimee Elizabeth Robinson (Lincoln University)
2011 AM Carter (Waikato University)
Joel Perry (Massey University)
Roshean R Fitzgerald (Lincoln University)
2012 L Creswell (Waikato University)
J Howes (Massey)
A Whitley (Lincoln)
2013 H Bredin-Grey (Waikato)
Massey – N Hyslop

2000 R Dragten
2001 B Robinson
2002 S Tutua
2003 D J Palmer
2004 M W Hughes
2005 R Standish
2006 D Dewar
2007 E Hoftsee
2008 N Watkins
2009 DA Lloyd
2010 P Mudge
2011 DF Wallace
2012 E Harris
2013 A Barnett
2014 A Robinson
2015 T Norris
2016 N Laubscher
2017 J Robinson

Bert Quin Award 2014
Was Summit Quinphos Bursary
(renamed Altum Award 2012)
1993 J Luo
1994 W J Morrell
1995 I Vogeler
1996 C W Gray
1997 B Robinson & B Miller
1998 A Mitchell
1999 A Khan
2000 Chengrong Chen
2001 Suman Mishra
2002 S Gaw
2003 D Houlbrooke & R Bhandral
2004 D Palmer
2005 J Singh
2006 S Khan
2007 B Kusomo
2008 S Carrick
2009 P Jeyakumar
2010 G Lucci
2011 N Wells
2012 R Dodd
2013 No award
2014 S McNally
2016 J Pronger
2017 S Balvert

The L C Blakemore Award
(Biennial award)
1992 N P Smith
1994 H Kettles
1996 No award
1998 L Currie
2000 B Daly
2002 P Theobald
2004 T Hendry
2006 B Toes
2008 C. Smith
2010 M Sprosen
2012 C Tregurtha
2014 M Premaratne
2016 J Jiao

N Mesman – (Lincoln)
2014 D Le Lievre – (Waikato)
J Winters – (Massey)
S Rayner – (Lincoln)
2015 T Leabourn (Massey)
B Robertson (Lincoln)
F Garrity (Waikato)
2016 M O'Grady (Waikato)
H Jensen (Lincoln)
SA Whiteman (Massey)
2017 C Tomlinson (Waikato)
S Pike (Massey)
I Setiawan (Lincoln)

Fellows of the NZ Society of Soil Science

L C Blakemore	R G McLaren
M R Balks	R Naidu
N Bolan	V E Neall
K C Cameron	R L Parfitt
I B Campbell	J A Pollock
C W Childs	AHC Roberts
J Churchman	S Saggar
B E Clothier	A G Sinclair
I S Cornforth	G Sparling
H J Di	T W Speir
K M Goh	J K Syers
P Gregg	K R Tate
R J Haynes	B K G Theng
S F Ledgard	P J Tonkin
D J Lowe	T W Walker
J D McCraw	J H Watkinson
A Mackay	G W Yeates
L Schipper	A Hewitt
L Condron	M Beare
D Ross	M Hedley
T Clough	C De Klein
R McDowell	R Monaghan

Honorary Fellow
B Miller

Life Members of the N.Z. Society of Soil Science
L C Blakemore
I B Campbell
C W Childs
R J Furkert
R Lee
R B Miller
V Orchard
W M H Saunders
J K Syers
P J Tonkin
T W Walker
J P C Watt
J Adams
R McLaren
P. Gregg
A Mackay
P Fraser

The M L Leamy Award (Biennial award)
1992 B E Clothier
1994 A Hewitt
1996 No award
1998 S Cronin
2000 H J Di
2002 K R Tate
2004 N S Bolan
2006 S Saggar
2008 R. McDowell
2010 Not awarded
2012 D Curtin
2014 L Schipper
2016 D Selbie, L Buckthought, M Shepherd (jointly)

Grange Medal
K Tate
B Clothier
G Rys

Deadline... For the May issue of Soil News is Friday 18th May 2018

Theme for next issue: **Soil biology and ecosystems**

We are the New Zealand Soil News:

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