



## Welcome to the Soil News

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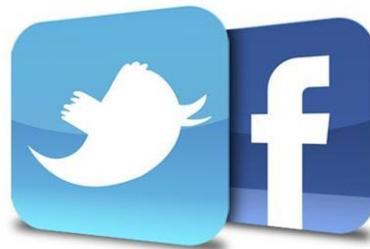
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Theme: International Cooperation

Your contributions are required - New Zealand Soil News is your newsletter

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Officers of the NZSSS

## 2019-2020

**President:** Megan Balks, University of Waikato  
**Vice President:** Tim Clough, Lincoln University  
**Past President:** Dave Houlbrooke, AgResearch  
**Secretary:** Diana Selbie, AgResearch  
**Treasurer:** Haydon Jones, Waikato Regional Council

**Council:** Brendan Malcolm, Plant & Food Research; Chris Anderson, Massey University; Tanya O'Neill, University of Waikato; Pierre Roudier, Landcare Research PN; Paul Johnstone, Plant & Food Hawkes Bay; Sam Carrick, Landcare Research Lincoln.

Dear Soil News readers,

In March I had the fortune of attending the launch of the Smart AgriHubs Horizon 2020 project in Prague. Tom Tynan of the European Commission gave one of the introductory speeches and I was greatly encouraged by the thought and investment being made in Europe into soils. Tom has kindly allowed me to reproduce his speech here, leading nicely into our theme this quarter of International collaboration. As always, your thoughts and views on this newsletter, and on soil science issues in general, are always welcome.

Best wishes,  
Gina Lucci, Soil News editor.

## Speech by Tom Tynan, EC Agriculture and Rural Development

Address to Smart-AgriHubs Conference: 'Digital technology & future Agricultural policy'  
Prague, March 5th 2019

Last month Commissioner Hogan and I were in Australia and New Zealand - free trade negotiations have commenced with both countries. The Australian government thanked Commissioner Hogan and the European Union for the help Copernicus provided in dealing with the devastating floods in Townsville, South Queensland. In the case of Townsville, they experienced more than a metre of rain per square metre in just a week - more than 20 times the average for the time of year. Many of you will have seen the devastation on your television screens. The EU has the world's most comprehensive high performance constellation of Earth imaging satellites - Townsville is just one example of the value of this technology. Copernicus also offers significant new sources of data for key existing CAP [Common Agricultural Policy] tasks such as yield forecasts and new elements like performance monitoring and data driven decisions relating to agricultural operations. Digital knowledge really makes a change.

Why do we fund digital development?

As you know, the challenges are many for our societies as a whole and for farmers in particular. The most pressing are certainly climate change and the degradation of the ecosystems. We have to reconcile productivity with environmental sustainability, in a way that is more rewarding for farmers' and closer to the expectations of

consumers. This means using fewer resources, using them more efficiently and using more ecosystem services for renewable resources. Digital technologies such as Artificial Intelligence (AI), robotics, blockchain, High Performance Computing (HPC), Internet of Things (IoT) and 5G have the potential to increase farm efficiency while maintaining or improving economic and environmental sustainability. The Commission Communication on Artificial intelligence for Europe identifies agriculture as one of the key application areas where targeted investments are needed. It provides for investments in platforms and large-scale pilots integrating AI and robotics in agriculture. Digitalisation has become a core priority. The strategic importance of a network of agricultural digital innovation hubs cannot be underestimated.

How does the current policy support digital?

Through the EIP-AGRI we not only fund projects but also important networking and knowledge exchange activities that help shape our policies. EIP AGRI is a bottom up approach and fosters a competitive and sustainable agriculture that will achieve more from less inputs. It builds a bridge between research and practice and all results from operational groups must be shared in the EIP-AGRI network. We have been very active in the past couple of years on digitalisation fostering a dialogue on digital innovation hubs, data sharing, data management, digital AKIS and digital strategies. Digital technologies have also inspired our investment at EU level through the research and innovation programme Horizon 2020. Over 2014- 2020 period we are investing €160 million in digital transformation, this has been particularly important in the current work programme for 2018 to 2020, in which about 10 per cent of the total agricultural research budget goes to digital projects. The SMARTAGRIHUBS project will build a network of agricultural digital hubs across Europe.

Turning to the future, the Common Agricultural Policy and Agricultural Research  
This audience is well aware that Commissioner Hogan has put forward ambitious CAP proposals, which set a higher ambition for environmental and climate action, in line with the environmental and climate related objectives and international commitments of the European Union as a whole. Because of their cross-cutting nature, innovation and digitisation can and should play a strong role in achieving the 9 specific objectives of the Common Agricultural Policy. This is why Commissioner Hogan made 'knowledge, innovation and digitalisation of agriculture' a cross cutting objective of future policy.

New technologies are essential to support the achievement of the 9 policy objectives, both for farmers and for the administrative management of the Common Agricultural Policy. Beyond their potential to support real simplification, digital technologies are, as we speak, transforming the way we produce our food, manage our land, the way we eat and consume our food and the way we do research. The EU has a key role to play to make sure that these technologies contribute to a more sustainable agricultural system, in line with the Sustainable Development Goals. At the same time, they should increase competitiveness, investment, growth and jobs in particular in rural areas.

Member States will have to show in their CAP strategic plan how they will support investments in modernisation, innovation, diversification and uptake of new technologies and digital based opportunities in the farm sector. They will also have

to show the development of digital infrastructure and human capital including advisors to create new opportunities and improve the connectivity and attractiveness of rural areas. In the research field Europe has very valuable assets to build on, such as the successes of Horizon 2020 and the substantial financial commitment to Horizon Europe. In Horizon 2020 we are for example funding jointly with Member States a €90 million European Joint Programme on Soils and preparing the ground for broader international cooperation on this topic.

With the upcoming Horizon Europe, we are stepping up the potential contribution that Europe will provide for agricultural research and innovation. The Commission proposal for a budget of €10 billion for Cluster 5 'Food and Natural Resources' leads to roughly doubling the resources that were previously available. The doubling of our resources will help us invest even more on crucial challenges like climate change, soil conservation and biodiversity, and on technologies that can support more climate and environmentally friendly farming, Digital transformation and digital farming will also be a core priority.

Like under Horizon 2020, we will work in very close synergy with other services, like DG CNECT to develop a significant programme dealing with digital transformation in agriculture. We will keep implementing our so called 'multi-actor approach', in which scientists, farmers, advisors and businesses work together from the initial idea to the implementation of results. This will help ensure that applied agricultural research comes up with more technical solutions directly applicable for farmers and other end users.

#### Lighthouse Farm Project

Before I conclude, I want to digress for a few moments and welcome the Wageningen University initiative of four international 'Lighthouse Farms'. The Lighthouse Farm Project is a network of farming systems that are customised for contrasting environments, climates, farmers and cultures, initially located in Brazil, Finland, Indonesia and Ireland. Commissioner Hogan and I have visited the Irish farm at Dowth in County Meath. The initial research work there is showing that carbon neutrality in a suckler beef farm can be achieved at a stocking rate of 2 livestock units per hectare - this is something many thought would not be possible. It offers a glimpse into a future where agriculture can proactively tackle climate change and greenhouse gas emissions.

#### Conclusion

To conclude, ladies and gentlemen, these are challenging and fascinating times for the agri-tech sector. The instruments available under various EU policies and programmes, like the CAP and Horizon Europe, if well combined with national, regional and local policies and initiatives, can constitute a powerful framework for the future digitisation of agriculture and rural areas. It is well-known that one of the most limiting factors for primary agriculture at present is labour. While technology cannot solve this problem, it can certainly help to alleviate the issue. The beauty about technology is that it can certainly get things done more accurately and to a better standard. We can see this in the area of heat detection in cows, diagnostics in machinery, precision technology in the tillage sector for example.

What is perhaps more significant about agri-technology is its application in terms of farm safety which is an area very close to Commissioner Hogan's heart. For

European agriculture to remain competitive, we must embrace technological developments and transfer research and innovation to farms. We want Europe's farmers to remain locally responsible and globally competitive by having access to a broad range of technologies that are available now and in the future. Agriculture has always developed new practices and techniques. Innovation is a pre-requisite for maintaining this progress. We have both the opportunity and the responsibility to develop technologies for the transition towards more sustainable farming systems. Commissioner Hogan has continually stated that this agenda must be delivered for all farms and not just the few. I am confident we are up to the challenge and I hope I have demonstrated the EU commitment to delivering in the agricultural technology sector. Thank you for your time and attention.

Tom Tynan  
Member of Cabinet

## President's message: NZSSS strategy 2019/20.

Kia ora tatau,

We have a great new council, elected at the Napier meeting in December, with a good mix of experience and new energy! They have developed a strategy for the NZ Society of Soil Science for the next two years (reproduced in "Society News"). The strategy is written in the context of the overall objectives of NZSSS as expressed in the NZ Society of Soil Science Rules (that are kept to meet our legal obligations as an incorporated society - see <http://www.societies.govt.nz/cms> )

The scope and range of NZSSS activities is impressive when we consider what our society undertakes for each of the major objectives. It is an effort all members should be proud of. My thanks to everyone who contributes to making this effort possible, from both the council and other members.

The NZSSS supports scientific communication through Soil News, our annual and biannual meetings, and it manages an important suite of awards, including those of prestige for senior researchers, those to support students, all the way down to School Science Fair prizes for soil-related studies. Another of the major areas we support is helping tertiary students attend what is often their first professional conference - an important step for new researchers.

There is much more we could do to better support our members, and to promote the importance of our soil resource to the wider public. We will be surveying all our members in the spring to determine what more we can do to help our members. Meantime if you have an idea, know of a potential sponsor for an activity, or would like to help out in any way don't hesitate to contact us. Email [nzsss@groundworkassociates.co.nz](mailto:nzsss@groundworkassociates.co.nz) . Like all things in life the more you put into it the more you get out of it... so "ask not what your Society can do for you? but what you can do for your society?"

Looking to winter I hope you can use some of those shorter cooler days to good effect to reflect on plans for springing into the upcoming spring and summer seasons.

Dr Megan Balks.  
President, NZSSS

## Society News

### NZSSS Council Strategy for 2019-20

Preamble: The Council of the NZ Society of Soil Science had a short discussion of the 2019-20 NZSSS strategy at the Council meeting of 4 February 2019. This document summarises the conclusions and issues raised in the context of the overall objectives of NZSSS as expressed in the NZ Society of Soil Science Rules that are kept to meet our legal obligations for running an incorporated society. See <http://www.societies.govt.nz/cms> for further information. Particular areas of council responsibility are listed in Appendix 1.

“The objects of the Society shall be the promotion and encouragement of soil science and research and technology related to the land resources of New Zealand. This shall be pursued by:

1. Promoting scientific communication and cooperation among members involving appropriate meetings and publications.”

#### Activities for 2019/20:

- Soil News to be published four times per year. Action: Dave Houlbrooke and Gina Lucci.
- WaiBOP one day informal seminar/networking day to be held in Nov/December 2019. Action: Tanya O’Neill and David Lowe.
- Lincoln to organise a similar day to WaiBOP in December 2019. Action Diana Selbie and others at Lincoln
- The 2019 Norm Taylor Memorial Lecture to be given at WaiBOP, the Lincoln meeting, and Fert and Lime at Massey in Feb 2020. The 2020 NHT Memorial lecture to be given in the Joint Aust and NZ SSS meeting in Cairns. Action Megan Balks and NHT Invited Lecturers.
- Joint Aust/NZ SSS conference in Cairns, Australia, 30th November to 4th December 2020. John Bennett is chair of organising committee. Action: Megan Balks and Pierre Roudier.
- Survey members to determine ways society can best support them and canvas opinions on issues related to soils and related to work in soil science. Action: Diana Selbie.

2. “Increasing the understanding of soil and land as a natural and sustainable resource.”

#### Activities for 2019/20:

- Improve news media profile of soils and soil-related issues - encourage members to look for opportunities to provide expert advice/articles to the

news/social media. Action: Pierre Roudier, Tanya O'Neill, plus Council and all members

- Promote soils aspects at farmer field days and similar. Possibility of media day for journalists potentially in collaboration with LCR and/or AgResearch. Action: Pierre Roudier plus Council and all members.
  - Encourage members to organise activities for the wider public to celebrate World Soils Day (late Nov. or early December). Action: Pierre Roudier.
3. "Promoting sound management of the land environment, and the appropriate conservation of New Zealand's soil resources, based on the scientific understanding of soils and land and their importance in ecosystems."

Activities for 2019/20:

- Potential to identify a "soil ambassador" along the lines of the Australian example. Action: Council to consider possible candidates and what the role might be - Action: Megan Balks.
4. "Providing expert guidance on national and regional land and soil issues."

Activities for 2019/20:

- Contribute to development of National Policy Statement on High Class Soils. Action: Paul Johnstone, Haydon Jones and Sam Carrick
5. "Promoting the research and study of soils."

Activities for 2019/20:

- Our awards programme for students. Action Brendon Malcolm.
  - Regional Science Fair Prizes. Action Chris Anderson
  - Support for student soil judging competition. Action TBA
  - Potential to develop other activities that target schools eg. Adopt a scientist?? Action ?? any volunteers
6. "Promoting professional excellence in soil and land science."

Activities for 2019/20:

- Our awards programme for scientists and technicians. Action Brendon Malcolm
  - Consider introduction of an award for early career scientists. Action Brendon Malcolm
  - Promote awareness of RSNZ Code of Ethics to members. Action Megan Balks
7. "Maintaining liaison with the International Society of Soil Science and other National or International Societies as appropriate."

Activities for 2019/20:

- Ensure IUSS Bulletins and notices are forwarded to all members. Action Megan Balks
  - Ensure GSP activities are reported to members. Action Megan Balks.
8. “Assisting members to carry out the objects of the Society.”

#### Activities for 2019/20:

- Ensure NZSSS website is maintained and utilised effectively as a link for members and to promote the importance of soil to the wider public. Action: Tim Clough
- Undertake assessment of risks to NZSSS Action: Chris Anderson
- Review any changes needed to NZSSS rules as a result of proposed legislative changes. Action Haydon Jones.
- Encourage membership engagement and voluntary participation in all activities of the Society, especially those of wider outreach. Action: All Council members.
- Establish our electronic archives, ensure their on-going security, and arrange for addition of historic material. Action: Megan Balks, Sam Carrick, all council in collaboration with Groundworks.

### Appendix 1: Council Roles 2019/20.

#### Roles & Responsibilities of council members for 2019-20:

- President - Megan Balks
- Past President - Dave Houlbrooke
- Vice President - Tim Clough
- Secretary - Diana Selbie
- Treasurer - Haydon Jones
- Awards Convenor - Brendon Malcolm
- Science Fairs - Chris Anderson
- Student Liaison - Tanya O’Neill, Chris Anderson, Tim Clough
- RSNZ/IUSS - Megan Balks/Dave Houlbrooke
- Public outreach, world soils day, promotion of soil - Pierre Roudier
- Records and Information management - Sam Carrick
- Social Media & Website Support - Tim Clough, Tanya O’Neill
- Public Policy, National Policy Statement - Paul Johnstone, Sam Carrick, Haydon Jones
- GSP, International Soil Initiatives - Sam Carrick, Pierre Roudier, Megan Balks
- Soil news liaison - Dave Houlbrooke

#### Positions outside council:

- Soil News Editor - Gina Lucci (Dave Houlbrooke liaison)
- Soil News support - Isabelle Vanderkolk
- Kai Whakahaere - Selai Letica
- Social Media - Trish Fraser
- Website Support - Hamish Lowe and Robyn Chapple at Lowe

#### Environmental

Groundworks Secretarial support

- Simon Hinchco
- Judith Drabble

## Notice



New Zealand Society of Soil Science

### WAI-BOP Soils Biennial Conference 2019

*One-day regional soils conference commemorating Mendeleev and his pioneering roles in pedology (143 yr ago) and periodicity (150 yr ago)*

Friday 29 November, 2019, University of Waikato, Hamilton

Convenors: David Lowe and Anne Wecking, School of Science (Earth Sciences),  
University of Waikato, Hamilton

For further information contact David: [david.lowe@waikato.ac.nz](mailto:david.lowe@waikato.ac.nz)



Painting of Dmitri I. Mendeleev (1834-1907)  
by Ivor Kramskoi, 1878

(From C.J. Giunta, 2017. Dmitri Mendeleev's Nobel-prize-losing research. Pp. 31-49 in: E.T. Strom and V.V. Mainz (eds), "The Posthumous Nobel Prize in Chemistry. Volume 1. Correcting the Errors and Oversights of the Nobel Prize Committee." ACS Symposium Series; American Chemical Society: Washington, DC, 2017). DOI: 10.1021/bk-2017-1262.ch003

## News from the Regions

### Waikato/Bay of Plenty Waikato University

**Reminder: save the date for WAI-BOP SOILS 2019: Friday 29 November**

WAI-BOP Soils 2019 is a biennial one-day regional conference being held on behalf of NZSSS at the University of Waikato, Hamilton, on Friday 29 November, 2019. Convenors are David Lowe and Anne Wecking. Please see notice elsewhere in this issue. For further information contact David at [david.lowe@waikato.ac.nz](mailto:david.lowe@waikato.ac.nz)

#### **Noel Bates joins the Earth sciences team**

Noel was appointed in late October 2018 to supervise the soil and environmental sciences lab, and to help students and staff with field and lab work in soils generally, and in various other subdisciplines in the Earth sciences. Noel replaces **Janine Ryburn**, who left the university earlier that year after quite a few years of first-rate service. Noel is originally from Edmonton, Alberta, Canada, where he acquired extensive technical and health and safety experience in thermal power generation and petrochemical plant operations. He shifted to New Zealand in 2012. Having had a lifelong interest in a broad swathe of Earth and biological sciences, Noel completed a BSc and then MSc in Earth Sciences at Waikato University. His MSc thesis, completed in 2018, was a micropalaeontological and sedimentological palaeoclimate investigation of deposits in a rare mid-Miocene maar lake near Hindon in Otago (with Beth Fox - now back in the UK at Huddersfield University - his chief supervisor). Hindon maar is about 20 km from the globally unique Oligocene/Miocene Foulden maar deposits that are currently in the news for being at risk of export out of the country as stock feed supplement.



*Noel Bates. Photo: University of Waikato.*

Megan Balks has been in Rome in May to attend the ITPS (Intergovernmental Technical Panel for Soils) meeting that is held at the FAO United Nations headquarters just down the road from the Colosseum. The ITPS is set up under the GSP (Global Soil Partnership) and comprises 27 members, each representing a region of the world. Megan is one of two representatives for the south-west Pacific which includes New Zealand and Australia as well as a number of Pacifica nations. She also attended the Global Symposium on Soil Erosion which was in the same week. The ITPS have key roles in the Global Symposium - Megan chaired the policy section of the meeting. On her way home she spent three days in Brisbane attending a meeting of the Pacific Soil Partnership (which also operates under the GSP) where a group of people led by Peter Wilson from Australia got together to develop an implementation plan to work towards improved sustainable soil management in the region.

Tanya O'Neill and Megan Balks are both on the steering committee for SouthCOP the "First Southern Hemisphere Conference on Permafrost" which is an IPA (International Permafrost Association) regional meeting being held in Queenstown in early December (<https://southcop19.com/>). There will be about 150 delegates, most from overseas attending with pre and post conference fieldtrips planned to get participants from Christchurch to Queenstown and back.

Femke Rambags, a PhD candidate, completed her PhD oral exam and received her doctorate. Femke examined how denitrifying bioreactors can remove pollutants from runoff including treating pathogens and nitrate. She also demonstrated that ANAMMOX can reduce nitrate to nitrogen gas along with denitrification. Femke was supervised by Louis Schipper and in accordance with lab tradition brought the team her #researchcake (effectively a real-life 'graphical abstract'): see <https://waiber.com/research-cake/>

David Lowe at the time of writing is the (temporary) Acting Dean of the School of Science, part of the newly formed Division of Health, Engineering, Computing, and Science (HECS) that replaces the former Faculty of Science and Engineering. HECS comprises four schools including science and is headed by Prof Geoffrey Holmes, who was Dean of the Faculty of Computing and Mathematical Sciences until his appointment recently as PVC of HECS. The university is undergoing a major restructuring with schools and faculties being reorganised into new divisions including HECS. Earth sciences continues as a strong subject, as shown in part by great results from the 2018 PBRF exercise, within the School of Science alongside chemistry and biological sciences. In late July, David is heading to Dublin to participate in the INQUA Congress, where he is co-convening one of two INTAV-led tephra sessions with a total of 60 papers (attesting to the strong growth in the discipline of tephrochronology), presenting papers, and representing New Zealand on the International Council of INQUA.

### **New Waikato University campus opens in Tauranga in April**

(notes below mainly from <https://www.waikato.ac.nz/news-opinion/media/2019/new-tauranga-campus-new-vision-for-the-bay-of-plenty>)

The newly-developed Tauranga campus of the University of Waikato was officially opened on 15 April 2019. The building in Durham Street (see photo) cost \$60M. The new campus development, led by the University of Waikato on behalf of the Bay of Plenty Tertiary Partnership, enhances the range of qualifications and study options available to students in the Bay of Plenty. The development, many years in the making, was made possible through the support of Tauranga City Council, Bay of Plenty Regional Council, and the Tauranga Energy Consumer Trust alongside the University of Waikato.



*University of Waikato at Tauranga: new building in Durham St, Tauranga. Photo: Mark Scowen for the University of Waikato.*

Vice-Chancellor Professor Neil Quigley said that it was the beginning of a new era for the University of Waikato in the Bay of Plenty, with the institution becoming deeply embedded in the Bay's social and economic systems, and transforming Tauranga into a true university city.

“To us this means enhancing social outcomes, contributing to economic growth and being a catalyst for change, regionally, nationally and internationally. We see ourselves as an enabler of education - giving people the opportunity to access higher education and transform their life prospects.” So far in 2019, over 900 individual students are using the new campus, a 32% increase on the same time last year. There are 31 general staff in Tauranga: 50 academic staff, and 36 academics visiting regularly from the Hamilton Campus.

Papers in Earth sciences are being taught including, for the first time, one of the two introductory papers offered in the discipline at Waikato University. The year-1 paper, and others later in the year, are being taught by Dr Shari Gallop together with support from Dr Casey Davies and Elizabeth Copeland (see photo). All three staff members were appointed to the University of Waikato at Tauranga early this year.

Shari is a physical marine scientist focused on the coast and nearshore, including oceanography, sediment transport, and geomorphology. She was a masterate student at Waikato before undertaking a PhD at the University of Western Australia and was then a research fellow at the University of Southampton and a lecturer at Macquarie University most recently. Casey has a PhD in biophysical chemistry from Otago University where he was a teaching fellow. Elizabeth, from Sydney, has qualifications and experience in molecular biology and ecotoxicology.



*Leading the first-year Earth sciences students in Tauranga into the field at a site at Ohauti*

*on a warm summery day of 11 March 2109. From left are Dr Shari Galllop, Dr Casey Davies, and Elizabeth Copeland. They are standing in front of an Allophanic Soil representing the Katikati series: what could be better as a first soil profile for the students to see? Pale Rotoehu Ash (c. 50 ka) is just visible at the base of the profile that has formed by developmental upbuilding pedogenesis since c. 50 ka. Photo: David Lowe.*

### **Sydney Wright**

We are saddened to report that Mrs Sydney Wright - well known to many hundreds of students who studied Earth sciences at the University of Waikato, and colleagues - passed away on Saturday 4 May 2019. A funeral for her on Friday 10 May on the Hamilton campus was packed out. Sydney was a true character in the School of Science at Waikato for three decades, being appointed as secretary (later becoming administrator) of the then Department of Earth Sciences in August 1985. She retired in December 2015 after 30 years of service.

Sydney had the distinction of serving all five chairpersons of the department, and (initially) the head of department, Prof John McCraw (who appointed her), during her career. Sydney was intensely loyal to all the chairs and to the department, the school of science (of which Earth sciences was a part), and the university as a whole. She helped with marketing the department and school and developed the popular 'Destinations' publication that showcased our postgraduates in their jobs. Sydney also provided great support to our graduates and postgraduates, especially the international students, and raised funds from local geoscience organisations for our annual postgraduate conference as sponsored prizes.

Sydney was always immaculately presented and professional in running the office, which was well organised and in exemplary order. Sydney was greatly respected, appreciated, and admired.



*Sydney Wright shortly before her retirement in 2015. Some of the department's masterate and doctoral theses are visible behind her. Photo: Peter Kamp*

## Lincoln Agritech

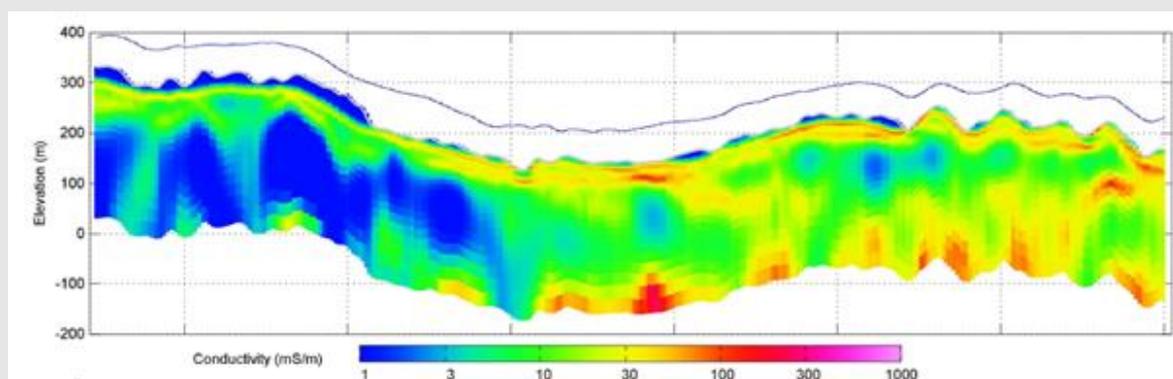
Responding to a well-recognised knowledge gap, our new MBIE-funded Critical Pathways Programme (CPP) aims to elucidate the relatively shallow and short contaminant transfer pathways operating at the sub-catchment scale (10s of km<sup>2</sup>), and to represent them in water flow and contaminant transfer models.

To obtain catchment-scale information on the subsurface environment at high spatial resolution, in February 2019, we introduced the world-leading SkyTEM system for airborne electromagnetic surveys to New Zealand. While such surveys have been carried out elsewhere to map water resources for consumptive use (drinking water, irrigation, etc.), the primary goal of our application was to gain understanding of the flow of water (and contaminants transported by it) from a parcel of land to a surface water body. Our collaboration with the developers of the SkyTEM system at Aarhus University (Denmark) has enabled us to optimise the survey set-up specifically for our focus on the shallow subsurface environment (upper 20m below the ground surface).

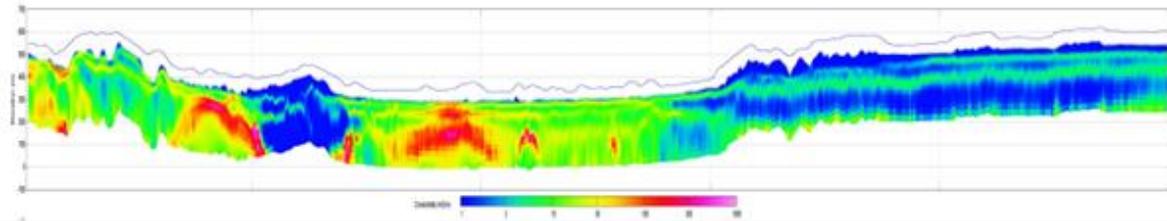
Two contrasting Waikato catchments, the Waitapu Stream catchment (approx. 300 km<sup>2</sup>) and the Piako River headwater catchment (approx. 100 km<sup>2</sup>) were surveyed, which took only seven flight days to complete. For a brief video clip showing the helicopter in action, please visit:

[https://www.youtube.com/watch?v=cEMLwi\\_B20U&feature=youtu.be](https://www.youtube.com/watch?v=cEMLwi_B20U&feature=youtu.be).

Using parallel flight paths (200 m apart) enabled us to get high-resolution data across the entire catchment areas (Figs 1 and 2). This starkly contrasts with the conventional approach that uses a limited number of point-scale lithology data from the installation of groundwater bores.



*Fig. 1: Example of conductivity cross-section from the Piako River headwater catchment (Upper Hauraki).*



*Fig. 2: Example of conductivity cross-section from the Waiotapu Stream catchment (Upper Waikato).*

Building on innovative machine learning workflows that he developed in previous projects, Mike Friedel has started developing workflows for integrating the new airborne electromagnetic data with a wide range of other hydrogeophysical data to enable continuous 3D characterization of aquifer properties and their uncertainty. The derived hydrogeophysical units will subsequently be used by Scott Wilson for the realistic modelling of sub-catchment scale and catchment scale water flows and contaminant transfers.

## **AgResearch**

Karla Mena Sota from Costa Rica is spending 6-months at Ruakura on a LEARN fellowship looking at developing methods to determine the carbon footprint of milk from Costa Rican dairy systems and the benefits of moving to pasture-based systems. She is working with Stewart Ledgard and Liz Wedderburn from AgResearch, and Steve Davis from LIC. This follows a visit of AgResearch and LIC to Costa Rica to identify options for lower-cost pasture-based dairying and reducing GHG emissions, since their dairy subsidies are soon to disappear and currently their dairy farms rely on a lot of expensive grain imported from USA.

A joint project with CAS China and AgResearch recently finished with Nannan Zhang completing her PhD, jointly supervised by Jiafa Luo and Stewart Ledgard, on environmental impacts of Chinese and NZ dairy system intensification. Nannan is soon to return to Ruakura for 6 months on a joint international project of FABLE (Food, Agriculture, Biodiversity, Land and Energy) examining future trends and implications of increasing food demand from China on countries across the globe. Nannan will be evaluating the role of NZ in it and global environmental implications.



*Photo: Dr. Jiafa Luo and Moira Dexter at a farm in front of the wheat field trial in China.*

Dr Jiafa Luo and Moira Dexter, AgResearch, Ruakura visited China in April as part of the New Zealand-China Collaboration Project on Water Quality: Phase II. They were members of a Science Expert Group who attended a workshop at a dairy farm and gave feedback on experiments run by local science provider. The studies look at the feasibility of applying effluent, collected from the housed cows on the farm, to crops (in this case wheat and corn). They also visited members of MFAT at the New Zealand Embassy in Beijing to report on the project. While in Beijing they also visited a research centre of the Chinese Academy of Agricultural Sciences. There they observed research on fertiliser, manure, biosolids and effluent combinations after application to crops.

Gina Lucci, Stewart Collie, Gerald Cosgrove and Stewart Ledgard have utilised Royal Society Te Apārangi Catalyst funding to support the creation of an international partnership to develop alternative uses for pasture biomass. Their recent trip to Ireland to visit three Teagasc Research Centres and University College Dublin, was an opportunity to learn from European examples. Many researchers argue that grass is not only a feed for ruminants (cows and sheep), but that it can be an important resource for other purposes. Considering that grass is a source of protein, lignin and carbohydrates, higher value, and lower environmental impact products are possible. The researchers discussed technologies to produce higher value, protein-rich animal feed, gut-health promoting feed, fibres and bio-fuel from grass.



*Photo: JJ Lenehan of Teagasc (in yellow) showing off their new anaerobic digestion facility at Grange that uses manure mixed with silage to produce energy.*

At the end of April, AgResearch hosted four researchers From CSIRO in a linkage workshop to investigate opportunities for developing a collaborative research plan on technology to aid grazing management. We also invited Dr Philippe Faverdin from INRA, Rennes, because of his expertise with on-animal monitoring, animal

nutrition and linking data collection from multiple sources with data analytics. We had key individuals from AgResearch in attendance from all science groups. The outcome was the identification of two potential research projects, both ambitious in nature and both with potential for science and industry impact. The next steps in the next month are to develop the outline proposals into more detailed plans for sharing with AgResearch and CSIRO management including identifying appropriate funding mechanisms.

Another AgResearch-CSIRO linkage workshop was held in Ruakura to build new, relationships between scientists on the topic of the circular bioeconomy. Gina Lucci, Stewart Ledgard, Cecile de Klein, Jiafa Luo along with other researchers from meat, dairy and bio-products teams hosted four visitors from CISRO: Dio Antille, Cate Paull, Mark Farrell and Simon Fielke. Plans are underway to use our own research farms to test and evaluate circular bioeconomy strategies to reuse organic resources.



*Photo: Left to right -Clare Rutherford (Food Agility), Friendly European, Tom Tynan (DG-Agri), and Gina Lucci, at the Smart AgriHubs kickoff event in Prague.*

In March Gina Lucci attended the kickoff meeting of the Smart AgriHubs and Internet of Food and Farming Horizon 2020 projects. These large European projects, led by Wageningen University Research, are using digital technologies to transform the European agrifood sector. These projects are highly aligned with AgResearch's NZ Bioeconomy In the Digital Age (NZBIDA) project and the aim of this visit was to find avenues and opportunities for collaboration to enrich both projects.

## **Manawatu**

### **Plant & Food**

Plant & Food Research has its first eddy covariance tower up and running! Roberta Gentile and Robert Ward have worked hard to navigate approvals and H&S requirements to get it off the ground (quite literally), with expert mentoring from our collaborators at MWLCR. The tower is monitoring CO<sub>2</sub> and H<sub>2</sub>O fluxes from a vineyard block in Hawke's Bay. The initial aim of this project is to establish an annual carbon budget for a perennial horticulture system.



*Top: View of what the eddy covariance instruments are “seeing”. Bottom: Robert Ward finalising the tower instrumentation.*

We welcome Ntwanano Moirah Malepfane, who is here for 6 months on a CLIFF-GRADS Scholarship. Moirah is a PhD candidate at the University of KwaZulu-Natal, South Africa. Her thesis topic is: The effect of land use on soil carbon stocks, pools and CO<sub>2</sub> emissions in humic soils. Here in New Zealand, Moirah is working with Roberta Gentile on a project comparing deep soil carbon stocks under kiwifruit and pasture land use.



Brent Clothier recently spent two weeks in China with Beijing Forestry University (BJFU). Last year, Brent hosted Dr Xi Benye, an Associate Professor at BJFU, for 6 months in Palmerston North. Brent, Xi, along with students Nan Di, Jinqiang Liu

and Yang Liu, visited Xi's experimental site on the North China Plain, near Gaotang in Shandong Province. Xi and his team are carrying out studies on soil-water use and the tree-water dynamics of *Populus tomentosa*, a short-rotation plantation tree used for pulping.



*Brent and Xi (right) with local officials looking at the rhizotron pit in a plantation of *P. tomentosa* in Shandong Province on the North China Plain.*

Brent and Xi met with local Government officials in both Gaotang and Liaocheng.

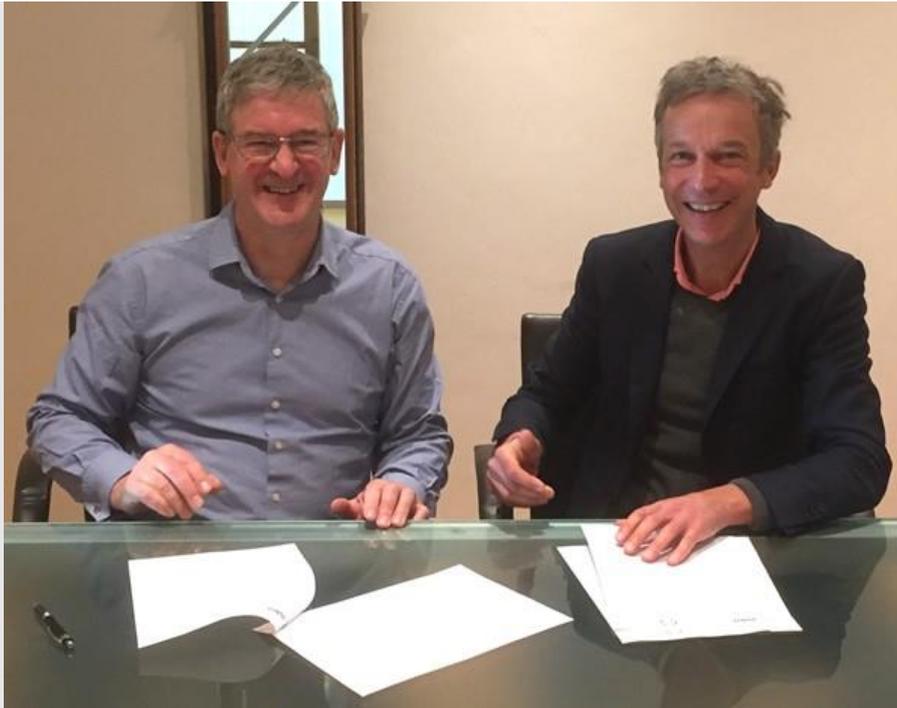


*Brent receiving greetings, and eventually baijiu, from a local Government official in Liaocheng City. Dr Xi Benye is seated on the right, and his PhD student, Nan Di, is seated on the left.*

## **Manaaki Whenua - Landcare Research**

### **Manaaki Whenua signs Collaborative agreement with ISRIC - World Soil Information**

David Medyckyj-Scott, of Manaaki Whenua Palmerston North, reports that in November 2018, while visiting the University of Wageningen in the Netherlands, Manaaki Whenua - Landcare Research CEO Richard Gordon visited [ISRIC - World Soil Information](#) where he met the Director, Rik van den Bosch, and signed an agreement between Manaaki Whenua and ISRIC to collaborate and share expertise.



ISRIC is an independent, science-based foundation and the world data centre for soils. It was founded in 1966 following a recommendation of the International Society of Soil Science (ISSS, now the International Union of Soil Sciences) and UNESCO. Its mission is to serve the international community with information about the world's soil resources to help address major global issues.



Over the years, a number of Manaaki Whenua staff have visited ISRIC, collaborated on research, and worked together on projects such as the [OGC Soil Interoperability Experiment](#). One of our staff, Thomas Caspari, joined Manaaki Whenua from ISRIC in 2017.

The agreement identifies a number of collaboration activities including researcher exchanges, joint research and joint paper publication. There is also potential for working with ISRIC to bid for European research funding. There are a number of areas right now where Manaaki Whenua are looking to collaborate with ISRIC.

These include:

- the design of federated soil information systems
- developing soil data standards
- new approaches to digital soil mapping
- proximal sensing workflows
- new digital soil applications
- soil data quality and uncertainty, and
- sustainable land management.

Manaaki Whenua staff are already assisting ISRIC with the design of FAO Global Soil Partnership's [Global Soil Information System \(GLOSIS\)](#). This system will be used by national soil institutes to share their soil data and is a critical element of the FAO's Global Soil Partnership which Manaaki Whenua is involved in with the support of the Ministry for Primary Industries. Starting in July, Manaaki Whenua will be working with ISRIC on a 1-year project investigating and implementing interoperability between national and global soil information systems with a focus on science users of soils data.

### **IUSS Working Group WRB signals interest for 2021 field workshop in New Zealand**

Thomas Caspari, Manaaki Whenua Lincoln, reports that The World Reference Base for Soil Resources (WRB) is one of the leading international soil classification systems for naming soils and creating legends for soil maps. A [working group](#) of the International Union of Soil Sciences (IUSS) oversees the maintenance and development of the system. The group is organising one major excursion per year and is currently targeting New Zealand for the year 2021. Manaaki Whenua - Landcare Research has been approached by Peter Schad, current chair of the working group to explore the potential for a joint 2-week field workshop on this topic.



*Participants of the International WRB Soil Classification 2017 Field Workshop in Latvia during discussions at a soil profile (photo: Raimonds Kasparinskis)*

This is a wonderful opportunity and benefits for New Zealand are many, including: better recognition of specific national soil features in international classification systems; improved soil data sharing with international partners; development of new professional contacts and collaborations for our pedologists. We are currently in the process of exploring support options for this potential visit. If you are keen to get involved, please get in touch with Sam Carrick ([carricks@landcareresearch.co.nz](mailto:carricks@landcareresearch.co.nz)) or Thomas ([casparit@landcareresearch.co.nz](mailto:casparit@landcareresearch.co.nz)).

We would also like to share with you that Brian Daly, past lab manager of our Palmerston North Environmental Chemistry Lab, who sadly passed away on July 20<sup>th</sup> 2018, has been recognised by the Australasian Soil and Plant Analysis Council (ASPAC) in the following way:

#### **2019 Brian Daly Memorial ASPAC Travel Award**

It is a pleasure to announce that the 2019 ASPAC Travel Award will be named after Brian Daly. Sadly, Brian passed away on July 20<sup>th</sup> 2018 at the age of 70 years. His contribution to ASPAC was enormous, spanning at least 10 years on different committees, including the ASPAC Executive as Secretary, and on the Laboratory Proficiency Committee. Training laboratory technical staff was his passion and his contribution to the South Pacific Analytical Chemistry Laboratory Network (Spacnet) and to ASPAC soil and plant technician training workshops, over many years, was exemplary. He was a very good friend to so many and will be sadly missed.

Some tributes paid by past Chairmen of ASPAC

- “One of nature’s gentlemen” - *Ken Peverill*
- “A warm, jolly and compassionate man” - *Leigh Sparrow*
- “Brian was a pillar in the soil analysis community and was very highly regarded” - *Roger Hill*

- “I enjoyed his company and always held him in the highest regard professionally. He was a great servant for ASPAC” - *George Rayment*

This is a great tribute to Brian and his family.

## Massey University

### Manawatu Field trip for the Advanced Soil Conservation Professional Development Course

A field trip for the new Advanced Soil Conservation professional development course was run in the Manawatu this May and involved students throughout New Zealand with an interest in soils. The field trip was hosted by experienced Horizons Regional Council Land Management staff Malcolm Todd and Kevin Rooke and examined eroded soils and a dairy farm in the Pohangina Valley with the aim of reinforcing the issues around erosion, sediment, nutrient, and pathogen loss that the students have been learning about in their online course. These courses are being run by Lucy Burkitt and Mike Bretherton (Massey University) and are tailored for professionals working in the area of land and water management. The close collaboration and support from the Regional Councils is critical to help expose students to regionally relevant issues facing practitioners in the land and water management field. Each course includes a field trip which examines a diverse range of erosion types and nutrient/sediment loss mechanisms from a different region in New Zealand. If anyone is interested, then please contact Fiona Bardell [F.M.Bardell@massey.ac.nz](mailto:F.M.Bardell@massey.ac.nz).







Professor Marta Camps-Arbestain with graduate, Yan Xia

Yan Xia graduated with his degree in Agricultural Science this month. Yan has been working in the Massey University soils group since December, being involved in different projects supervised by Prof Marta Camps-Arbestain. Initially this was part of his degree, and thereafter working part-time. He will start his MSc in an Australian University soon but will continue to work with Massey in the meantime.

## Canterbury

### Scion (Rotorua/Christchurch)

#### Three decades of archived soil samples

Jeff Hatten, Associate Professor from Oregon State University USA, on a six-month sabbatical at Scion has recently won a United States Department of Agriculture funded project to investigate forest soil organic matter resilience to disturbances such as fire and harvesting. Jeff's new project will bring together 3 decades of archived forest soil samples and data from North America and New Zealand and key

soil scientists from both America and New Zealand focused on long-term sustainability and management of soil organic carbon. The samples and data from Scion will focus on the Long-Term Site Productivity (LTSP) trial series established between 1986 and 1994 on sites across a range of climates and soils. The trial series is focused on the impact of different levels of organic matter removal through harvest residues when a planted forest is harvested.

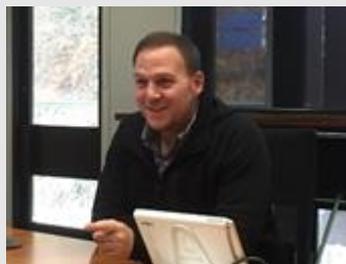
### **New Zealand and China forest hydrology collaboration**

Pingheng Li, Associate Professor from Zhejiang Agriculture and Forestry University China, has just finished his one-year sabbatical at Scion. He worked with Scion's Dean Meason on modelling rainfall storage and release dynamics at Puruki forested catchment, part of the iconic Purukohukohu Experimental Basin near Taupō established in 1968. Their work has provided valuable new insights in how forested catchments store more water than pasture during storm events and release more water during dry periods. This project has created the foundation for NZ and China collaboration in forest hydrology research and to develop more collaborative projects in the near future.



### **Drivers of forest productivity across the landscape**

Brian Strahm, Associate Professor from Virginia Tech USA, is visiting Scion for two weeks to co-develop a project to identify drivers of productivity of commercial forests throughout New Zealand. They are looking to identify key site indicators, including soil, that will predict and quantify forest productivity.



**Lincoln University**

Graduation



### Climate Change workshop

Tim Clough was one of twenty invited participants to partake in an OECD funded workshop on “Climate change, reactive nitrogen, food security and sustainable agriculture”, held at Garmisch-Partenkirchen, Germany, 15-16 April. View details [here](#). The objective of this workshop was to bring together leading experts in the field of food security, soil science and greenhouse gas emissions from soils to discuss the current knowledge on and establish a global research network for N<sub>2</sub>O mitigation and denitrification in fertilised cropping systems. The participants presented and discussed their latest research findings and policy developments on the trade-offs between crop productivity, N fertilizer use, and GHG emissions of agricultural ecosystems around the globe, with the aim of identifying hotspots and knowledge gaps of denitrification and N<sub>2</sub>O emissions, reducing uncertainty of flux estimates, and establishing consistent standards for methodologies. This workshop will provide a framework for international cooperation in key research and policy areas of food, soil, water and climate change with proven international experts.

Outputs from the workshop will include 1) a summary paper (and policy brief) describing the current state of knowledge on agricultural denitrification and N<sub>2</sub>O emissions with a focus on how to best address existing knowledge gaps; 2) a common and comprehensive database for collective data sharing that will aid in the refinement of existing biogeochemical models for the development of robust globally significant management strategies for environmentally and economically sustainable food production; and 3) standardization of methodologies to further reduce uncertainties and enhance model development. During the workshop, there



was also the opportunity to stop for coffee and stunning views of the Zugspitze, at 2,962 m above sea level; the highest peak in Germany.

**Agri-innovation award winner**  
'Cleartech' won the 'Agri-Innovation Award' at the South Island Agricultural Field Days. "The Agri-Innovation Award seeks to award New Zealand-made innovation or invention that provide benefit to the farmer and includes machinery, implements or attachments, or tools for use in agriculture or other forms of primary production." The award was presented by Amy Adams MP.



## Plant & Food

Lucy McLean joined the Field Operations team as a Research Associate in February. Lucy comes from a pastoral sheep and beef farming background and graduated with a B.Ag. from Lincoln University on 3<sup>rd</sup> May. Congratulations Lucy!

Dirk Wallace graduated Ph.D. from Lincoln University on 3<sup>rd</sup> May. His thesis was titled "Amendment incorporation to increase soil water retention" and was

supervised by Assoc. Professor Peter Almond (LU), Dr Steve Thomas (PFR) and Dr Sam Carrick (Landcare). It focussed on how soil porosity could be modified through the incorporation of soil amendments to increase the soil's ability to retain irrigation water. Congratulations Dr Dirk!

A cheerleading team of Dirk and Lucy's colleagues gathered on Gerald St to congratulate Dirk and Lucy as they passed by in the graduation parade from the university to the Lincoln Event Centre.

Denis Curtin, Craig Tregurtha, Weiwen Qiu and Mike Beare hosted Ed Gregorich (Agriculture and Agri-food Canada) for three weeks in March to continue their international cross-ecosystem study of crop residue decomposition.

The Lincoln-based soil science team at Plant & Food Research is also continuing their international collaborations with Teagasc and Trinity College Dublin in Ireland and the Thünen Institute for Climate Smart Agriculture in Germany to investigate the cost and benefits of full inversion tillage pasture renewal to reduce agricultural greenhouse gas emissions under a project funded by the Global Research Alliance programme.

The soil science team at Lincoln is also hosting two visiting scientists from China. Jun Yi is a visiting scholar from Central China Normal University who is exploring applications of the Hydrus Model to describe soil hydraulic processes, including nitrate leaching, under winter grazed forage crops. Lingying Xu is a PhD student from the Institute of Soil Science in the University of the Chinese Academy of Sciences who is investigating the effects of tillage on soil structure.

Mike Beare attended a meeting of the Cropland Research Group for the Global Research Alliance on Greenhouse Gases, which was held in conjunction with the World Congress of Soil Science in Rio de Janeiro, Brazil. He also attended the International Soil Science Conference in San Diego, CA in January 2019 where he presented a keynote talk entitled: *Soil, land-use and climate change impacts and mitigation in New Zealand* to a symposium sponsored by Soil and Water Management and Conservation Division of Soil Science Society of America.

Edmar Teixeira and Brendon Malcolm recently hosted Dr Christian Kurt, a senior scientist from Leibniz Centre for Agricultural Landscape Research (ZALF) in Germany. They collaborated on setting up and testing computer simulations on the effectiveness of catch crops to reduce N leaching after winter grazing. Dr Kurt brought with him a wealth of experience on biophysical modelling in the context of crop rotations, both at paddock and catchment scales. This collaboration resulted in the drafting of a paper, targeting regional, climatic, soil and management effects of catch crops on N leaching losses.

Trish Fraser and Abie Horrocks, Foundation for Arable Research, spent a very interesting day in northern Southland recently with a very keen group of farmers who have received some funding via the Red Meat Profit Partnership (RMPP), a Primary Growth Partnership programme. RMPP works with farmers and sector businesses to develop, test and introduce new ideas, new technology solutions and new ways of working. This group is independently facilitated by Ben Trotter, Agricom and they have collectively decided to focus on learning more about their soils and

understanding more about what management they can employ to nurture their soils and overall conduct more sustainable practices. Each farmer in the group plans to alter different aspects of their soil management on their respective farm relevant to their particular style of operation and then come back to the group later and discuss/show their findings. They visited three different farms with a wide range of differing management practices e.g. from lots of cultivation to no-tillage situations. It will be interesting to see what changes the farmers each choose to make and what they discover along the way.



*Trish discusses the effects of long term wheat rotations on soil physical properties with Southland farmers*



*Trish shows differences in colour and root mass between soil that is long term cropped and permanent pasture*

Dirk Wallace and Trish Fraser hosted eight agronomists from Farmlands at PFR Lincoln recently. These agronomists work with farmers at various locations around the South Island. They were very interested to see our lysimeter facility and get a greater understanding of the controlled leaching measurements that are possible using this technology. They also requested to learn more about earthworms, as they

are seeing a revival in farmers' interest in soil health at the moment. Trish showed several different species that they might come across on-farm and explained about their respective roles in the soil. These agronomists are very keen to get more up to date information about various crops and cropping systems and generally assist PFR with any relevant technology transfer of new findings and/or to help us get in touch with farmers in different areas of the country should we need to.

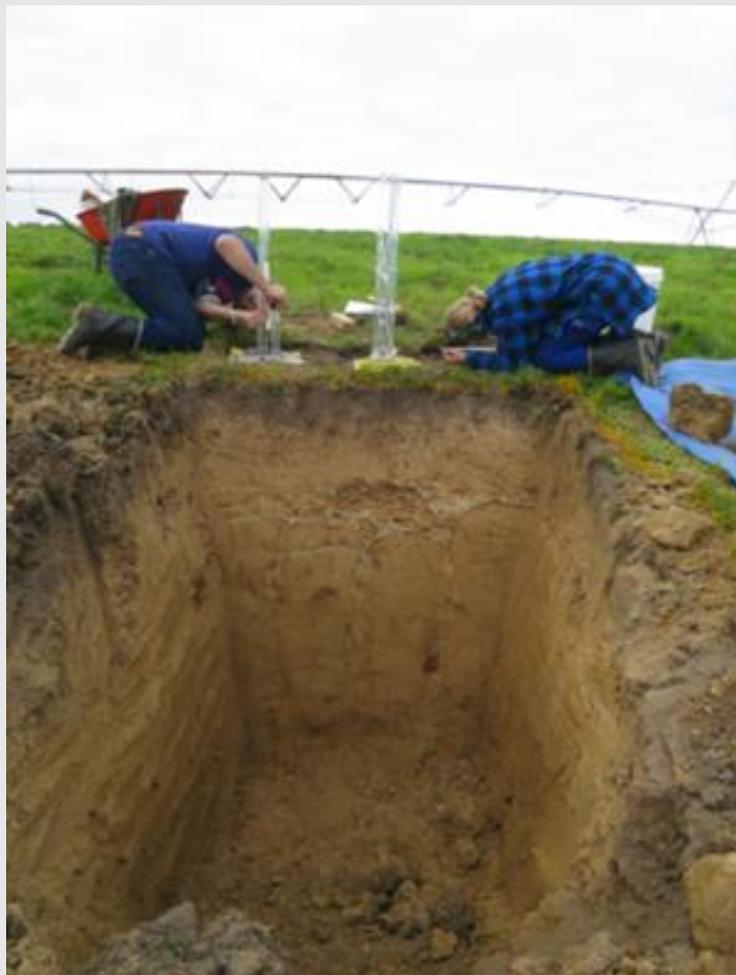


*Dirk Wallace explains how Plant and Food Research use lysimeters to understand water and nutrient movement in shallow soil*

A team from Plant and Food, Lincoln (Gina van der Klei, Stephanie Langer, Robyn White, Rogerio Cichota, Wei Hu, Steve Thomas and Dirk Wallace) in conjunction with Environment Canterbury, Lincoln University and NIWA have been working on a collaborative hillslope hydrology project near Timaru. The site is an irrigated dairy catchment. The team recently went down to work with Peter Almond and Kirsten Deuss from Lincoln University who described the soil profiles moving down slope. Soil hydraulic properties each soil horizon moving down slope were described by the team from PFR and sensors were installed to monitor fluctuations in water content over winter. The team plan to return in late winter to install runoff plots with the aim of modelling the infiltration and runoff of water under rainfall and irrigation.



*Pits are dug to describe soil profiles and for the installation of monitoring equipment near Timaru. L to R: Dirk Wallace, Stephanie Langer, Robyn White, Rogerio Chicota and Kirsten Deuss*



*Rogerio Chicota and Robyn White measuring unsaturated hydraulic conductivity rates*



*A soil profile at the site showing characteristics to 1.5 m depth*



*Peter Almond and Kirsten Deuss from Lincoln University characterise a soil profile*

Emmanuel Chakwizira recently presented at the International Conference on Plant, Soil and Crop Sciences in Cape Town, South Africa, from 16-17<sup>th</sup> April. His paper was titled “Macronutrient accumulation and partitioning for six wheat genotypes grown at contrasting nitrogen supply” and is co-authored with Derrick Moot, LU, and Edmar Teixeira, PFR. Preliminary field experiment results showed that three of the six wheat genotypes: Discovery, PFR-2021 & PFR-3026, produced higher biomass

and grain yield. Of these three, nutrient uptake, specifically, P and Ca was lower for PFR-3026. This resulted in high nutrient internal efficiency for PFR-3026, a trait that will need to be confirmed in future experiments.

Mike George is travelling to the USA in July to work with former PFR Lincoln staffer, now Assoc. Prof. Plant Pathology Sarah Pethybridge at Cornell University. Mike will be working with Sarah to improve drone technology using hyperspectral imagery with a focus on plant diseases. There are potential benefits using digital agriculture tools to broad acre cropping and Mike will be exploring the use and application of this technology to NZ crops and field trials.

## **In the News: Soil Scientist awarded prestigious Lincoln University Bledisloe medal**

Recently retired Manaaki Whenua–Landcare Research soil scientist Allan Hewitt was awarded the prestigious Lincoln University Bledisloe Medal at the 2019 Graduation ceremony on 3<sup>rd</sup> May 2019. The presentation was made at this year's Lincoln University Graduation Ceremony, 3 May 2019, by Chancellor Bruce Gemmell. The citation was read by the President of the Lincoln University Alumni Association, Andrew O'Regan. The ceremony was held in the Lincoln Event Centre, Lincoln.

The award is in the form of a gold medal, instituted in 1930 by the then Governor-General of New Zealand, Lord Bledisloe. Dr Hewitt was the 86<sup>th</sup> recipient of the medal (in some years since 1930 no award was made).

The Bledisloe Medal, initiated in 1930 by the late Viscount Bledisloe, former Governor-General of New Zealand, is awarded to a former student or past or current staff member of Lincoln University who, in the opinion of the Lincoln University Council, has made an outstanding contribution in his or her chosen field, advanced New Zealand's interests, and/or brought credit to Lincoln University.

**The following is an edited version of Allan's Bledisloe Medal nomination.**

Allan has made an outstanding scientific contribution to soil classification, land evaluation and soil mapping, both in New Zealand and overseas. He is sole author of the New Zealand Soil Classification (NZSC), which has become the accepted source for naming, characterising, mapping, sampling and reporting for the national inventory of soils in New Zealand. Allan's lifetime contribution to soil classification has provided the foundation for training an entire generation of under-graduates, emerging scientists and farmers with the critical skills for soil and land management across New Zealand. The wide use of Allan's soil classification has enhanced the reputation of New Zealand for its teaching and research in soil science.

After completing a BSc (Hons) (Geology), at the University of Canterbury in 1973, and a Post-Graduate Diploma in Agriculture Science (Soil Science) at Lincoln University in 1974, Allan began his career in soil classification inspired by comments by Eddie Cutler while on a Lincoln University field trip.

Allan joined the New Zealand Department of Scientific and Industrial Research, Soil Bureau, in 1974. After completing a PhD in Agronomy at prestigious Cornell University in the USA (1982) he returned to DSIR Soil Bureau as a District and then Regional Pedologist, before becoming Senior Pedologist and Research Leader at Landcare Research, until his retirement in 2015. Allan continues to actively mentor the next generation of New Zealand's pedologists in his role as Research Associate at Manaaki Whenua - Landcare Research and is preparing to publish a book "Soils of New Zealand" with Dr Megan Balks under contract with Springer Publishers.

The publication of "New Zealand Soil Classification" by Allan in 1992 was 'a major milestone in New Zealand soil science' (quotation from Prof David Lowe, University of Waikato). The classification was the culmination of over 10 years of work by Allan and others that began in 1983 when the New Zealand Soil Bureau decided not to adopt "Soil Taxonomy" as the principal means of soil classification. At all stages during development, draft copies of the New Zealand Soil Classification were sent to interested soil scientists throughout New Zealand for review and testing, and specialists were asked to contribute by defining diagnostic features for specific soil classes. Allan documented the progress of the classification through seminars and reports. Allan considers his most important contribution was the development of a large computer database of soil profiles throughout New Zealand, now known as the National Soil Database Repository (NSDR).

International recognition of the New Zealand Soil Classification is evidenced by (a) full translation into Spanish; (b) summary translation into Chinese and subsequent adoption of many of its features in the new Soil Classification for China; (c) consideration of features for inclusion in the International Soil Reference Base and input to the Soil Taxonomy classification of Andisols; and (d) numerous keynote speaker invitations at international conferences.

Allan's New Zealand Soil Classification is the foundation for teaching programmes and has been used widely for undergraduate and postgraduate teaching in soil science throughout universities in New Zealand, especially at Lincoln and Waikato. Allan's desire to pursue a career in soil science was enabled by his completion of a Diploma in Agricultural Science (Soil Science) at Lincoln University. Subsequently, he has enhanced the University's reputation through his high international standing. Allan has also contributed to Lincoln University through lecturing and mentoring of students. He has co-supervised Masters and PhD students and acted as a thesis examiner.

Allan's contributions to the science literature through various journal papers, books and websites promoting soils and soil science (Hewitt 1998; Hewitt 2016; International Union of Soil Science, 2015) are significant resources for New Zealand's soil science students and the proceeding generations of pedologists.

Allan's lifelong contribution to soil science has been fundamental for progressing the sustainable use of New Zealand's soil and land resources. It has been estimated that around 17% of New Zealand's GDP depends directly on our soils. Allan's knowledge of, and ability, to communicate the importance of soils and soil classification has been critical to the success of:

- Multi-institutional research programmes, including those focused on defining and valuing soil natural capital to enable land managers to identify vulnerabilities and target mitigations for nitrate leaching, and soil structural degradation.
- Development, testing and implementation of national and regional scale soil quality indicators with regional and central government for environmental reporting and performance evaluation.

Other honours and awards held by Allan include:

2010-2012	President, New Zealand Soil Science Society
2009	Oceania Science Coordinator/Oceania Representative, on the <i>DigitalSoilMap.net</i> International Science Committee
2008	Keynote Speaker, International Digital Soil Mapping Workshop, Utah, USA
2001	Invited Keynote Speaker, European Commission Conference on Volcanic Soils, Azores
1999	Invited Keynote Speaker, Manaaki Whenua Conference, Wellington
1996	Norman Taylor Lecturer Award, New Zealand Soil Science Society
1994	Leamy Award (for “most meritorious New Zealand contribution to soil science in 1993-1994”)
1992	Soil Science Society Award, Australian Soil Science Congress
1992	Invited Keynote Speaker, Australian Soil Science Congress
1979-1982	National Research Advisory Committee Post-Graduate Fellowship
1974	Member, New Zealand Soil Science Society/International Union of Soil Sciences

Allan has also contributed prominently within the wider community and he is highly regarded for his integrity and as a mentor. With his quiet manner, Allan listens carefully and is always willing to offer valuable advice. Allan is very personable and is highly regarded by his colleagues and friends. Since moving to Rolleston in 2001 he has spent most of his free time developing a large garden from a bare stony paddock (classic Lismore shallow and stony soils). Allan is a skilled landscape painter and has often used soil as a medium for his art. Some of his paintings were on display at the New Zealand Soil Science Society Meetings in Hamilton in 2014 and in Napier in 2018.

*Nomination prepared by Jackie Aislabie, Ian Lynn, Peter Almond*



*Allan Hewitt and wife Liz, proud recipient of the Lincoln University Bledisloe Medal.  
Photo Ian Lynn*

Dr Hewitt's citation:



## Lincoln University Bledisloe Medal Dr Allan Hewitt

'To be a successful farmer, one must first know the nature of the soil,' wrote Greek philosopher Xenophon around the 4th century BC.

The importance of 'knowing the nature of the soil' has been axiomatic in the life's work of pedologist and Lincoln University alumnus Dr Allan Edward Hewitt.

Dr Hewitt has made an outstanding scientific contribution to soil classification, land evaluation and soil mapping in New Zealand and also overseas.

He is the sole author of the New Zealand Soil Classification, the accepted source for naming, characterising, mapping, sampling and reporting for the national inventory of soils in New Zealand.

The publication of the New Zealand Soil Classification in 1992 was acknowledged as a 'major milestone in New Zealand soil science'. It was the culmination of some 10 years of work by Dr Hewitt and others.

To meet the demands today for digitally available descriptions of soil characteristics, Dr Hewitt pioneered the extension of his opus into New Zealand's spatial soil information system S-map.

Dr Hewitt's lifetime contribution to soil classification has provided the foundation for training an entire generation of undergraduates, emerging scientists and farmers with the critical skills needed for soil and land management across New Zealand.

International recognition for the New Zealand Soil Classification is evidenced by its translation into Spanish and the adoption of many of its features by China for its own national classification system.

The wide use of Dr Hewitt's soil classification has enhanced New Zealand's reputation for teaching and research in soil science.

Dr Hewitt is a past President of the New Zealand Soil Science Society and former Senior Pedologist and Research Leader at Landcare Research. After studying at Lincoln, he later completed a PhD in Agronomy at Cornell University.

Lincoln University's Bledisloe Medal recognises outstanding contributions 'advancing New Zealand's interests'. Dr Alan Hewitt's career in soil science readily fulfils this requirement.

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Professor Bruce McKenzie  
Vice-Chancellor

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Bruce Gemmill  
Chancellor

## **Dr Allan Hewitt, Acceptance Speech on the award of the Lincoln University Bledisloe Medal, 3 May 2019**

Thank you for this great honour that I humbly accept.

It is also an honour to soil science and its crucial importance to life. My rural background led me into this path as I came from generations of farmers and witnessed my father, most of my uncles and my grandparents at work. After completing a science degree at Canterbury University I came to Lincoln College (now Lincoln University) and did a Diploma in Agricultural Science and morphed from a geologist into a soil scientist. My year at Lincoln College was a seminal one, launching me into my lifetime career as a pedologist, and my first year of marriage. Lincoln College was the springboard into an extraordinary life that I could never have imagined.

As a boy of 10, being driven through Lincoln township and passing the DSIR, I had a sudden certain feeling that I would work there one day. That boyhood epiphany was fulfilled when, without a job interview, I was taken on by the DSIR as a pedologist. I was based in Otago for 24 years with my wife and two children sharing our life, then latterly I returned to Lincoln.

Throughout my career, and in everything I may have achieved, I have been helped and supported on the whole journey by my wife Liz, and for this I am most grateful.

The journey has been full of adventurous travel, driving and flying thousands of kilometres, from the Antarctic to Europe, Asia, Australia, the Pacific and South America, and then living in upstate New York, not to mention all the travel at home throughout New Zealand. I have worn out lots of boots walking and climbing many hills and valleys, and I have dug and augured thousands of holes in all weathers. I have pored over maps and been inspired and overawed by fieldwork in spectacular places. Fieldwork had its hazards, like the time I was run at by an over-protective landowner waving a gun.

Then there were farmers of the old school who saw science as government meddling on their land and were suspicious of any visitors. Permission had to be granted to go on their land and usually the wives answered the door. Most said "Yes" but the "No's", deferring to their husbands, meant there was possibly the odd gap on a soil map.

My wife once got a bit upset when I returned home from a day in the field and informed her that I had 'fallen in love'. She softened when I explained that a donkey had taken a liking to my company in the paddock and spent the day leaning on my arm.

Then there are still people today who regard my Cromwell Gorge mapping, prior to construction of the Clyde Dam, as part of a Government conspiracy to acquire their land.

I have spent a day digging out a bogged vehicle, and once I was saved on a slippery tussocky slope when my vehicle began to slide and was halted only by a providential boulder.

Many of my best ideas have come while soaking in the bath, or been jotted down in the middle of the night. These have often cast visions for the big picture and become foundational.

The 10-year journey of wrestling with the New Zealand Soil Classification was like catching a tiger by its tail, but it was very satisfying to turn it into a reasonable and useful beast. The seed for this work was sown in my Lincoln year while on a fieldtrip when I saw the limitations of the old system and began to imagine new ways.

As an Expert Witness I have stood in court and defended the appropriate use of high-class soils. I put in a lot of effort to see that there was funding for the science and tried hard to lift the national conscience towards the importance of soils, and the current respect heartens me. I have done many conference presentations, mentored young scientists and talked to sceptical politicians and farmers. I have huge respect for the keepers of the land who apply intelligent and up-to-date science in their husbandry. I have sat next to some dastardly characters in foreign countries, like the Chief of Police of Macau.

For my inspiring teachers at Lincoln, Tom Walker, Eddy Cutler, Phil Tonkin, Kuan Goh, Alistair Campbell and others, I am very thankful. In my career I have had a supportive and harmonious workplace which has produced excellent science and I have been sharpened by the finest of minds.

I know that history tells of nations which rose and fell on the stewardship of their soils. I am awed by soils and their Creator's genius, and I am thankful to God that I have been able to look into their mysteries and been given so many opportunities.

Dare I say, I have fallen madly, truly and deeply in love with soils. I look back on my life's work and say to myself, 'It's not bad for a country boy'.

## Related Society Notices

### International Union of Soil Sciences

The latest USS Alert (May 2019) can be found here:

[https://www.iuss.org/index.php?article\\_id=714](https://www.iuss.org/index.php?article_id=714)

## Abstracts

### Re-introduction of light grazing reduces soil erosion and soil respiration in a converted grassland on the Loess Plateau, China

Yu H, Li Y, Oshunsanya SO, Geng Y, Are KS, Saggar S, Liu W (2019) Agriculture Ecosystems & Environment 280: 43-49. <https://doi.org/10.1016/j.agee.2019.04.020>

Prohibition of grazing has significantly reduced soil erosion and enhanced soil organic carbon (SOC) stock on the Loess Plateau. However, this practice has reduced livestock production and consequently decreased herders' income in the region. In this study, light grazing was therefore re-introduced to investigate effects of converting cropland to grassland on soil erosion and CO<sub>2</sub> emission under light grazing practice. The light grazing trials (10 adult sheep grazing to 7-8 cm of the initial grass height in 1530 m<sup>2</sup> land area) were conducted, where soil loss, SOC erosion and CO<sub>2</sub> emission were measured using <sup>7</sup>Be technique and Li-COR Automated Soil CO<sub>2</sub> Flux System. Soil and SOC erosion were 60% and 56% lower in the light grazed grassland and 46% and 29% lower in the un-grazed grassland when compared with cropland, respectively. Light grazing and un-grazing practices increased soil CO<sub>2</sub> emission by 15% and 33% respectively, relative to cropland. The mechanisms to control soil erosion by light grazing and un-grazing practices were similar, and governed by grass root biomass and near surface vegetation coverage. However, light grazing had higher potential than un-grazing practices in reducing Soil and SOC erosion and CO<sub>2</sub> emission. Our results highlight the potential of light grazing in reducing soil erosion in the "Grain for Green" grassland ecosystems to achieve the dual goals of ecological and economic gains, and sustainability in China and elsewhere.

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## Root hairs and cortex contribute to soil loss due to root crop harvesting

Oshunsanya SO, Yu H, Li Y, Saggar S (2019). *Catena* 174: 514-523.  
<https://doi.org/10.1016/j.catena.2018.11.016>

Soil loss during crop harvest (SLCH) has been increasingly recognized as an important soil degradation process. Root hairs can impact SLCH apart from playing nutrient uptake role in the soil. In order to better understand the role of root hairs in inducing SLCH, a two years field experiment was conducted in Nigeria to assess the impacts of root hairs on soil loss due to yam harvesting in response to organic fertiliser application. Two yam cultivars (Tropical *Dioscorea alata* 00/00194 - Cultivar<sup>A</sup>) and (Tropical *Dioscorea alata* 00/00006- Cultivar<sup>B</sup>) were planted using three different fertilizer placements i) ring placement, ii) side placement and iii) control (no fertilizer). SLCH was measured by removing the soil adhering to the harvested root crops. Then root-hairs were trimmed and weighed to determine root hair density. Fertilizer application was found to significantly ( $p < 0.05$ ) induce SLCH by increasing root yield and associated root hairs. Soil loss per unit root mass (SLCH<sub>spec</sub>) was by 70.8% and 68.7% higher in ring and side fertilized plots, respectively than unfertilized plots. Changes in SLCH vary mainly with yam cultivar due to difference in root hair density per unit crop yield. Soil loss due to crop harvest (SLCH<sub>crop</sub>) from cultivar<sup>A</sup> was significantly ( $p < 0.05$ ) higher compared to cultivar<sup>B</sup> by 11.2% and 36.3%, respectively for years 1 and 2. Root hair density, root cortex, clay and organic matter significantly ( $p < 0.0001$ ) contributed 97% of SLCH<sub>spec</sub> variation. The contribution of determining factors decreases in the order of root hair density (40%) > clay (28%) > organic matter (18%) > root cortex (14%). Our results suggest that root hair density and root cortex as well as soil factors should be considered together in evaluating SLCH induced land degradation and associated influencing mechanism.

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## Wetting-induced layer contraction in illite and mica-family relatives

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<sup>a</sup> Technical University Delft, The Netherlands (deceased)

<sup>b</sup> Royal Netherlands Institute for Sea Research (NIOZ), Den Burg, The Netherlands (retired)

<sup>c</sup> Geological Survey of Norway (NGU), Trondheim, Norway

<sup>d</sup> Landcare Research, Palmerston North, New Zealand

### Abstract

When dry illite is wetted, its layer structure contracts along the *c*-axis by up to 0.2 Å. This behavior contrasts with that of smectite which shows interlayer swelling on wetting. Layer contraction has also been found to occur in glauconite and celadonite that are structurally more disordered than illite, as well as with phengite and artificially degraded hydromuscovite. In contrast, muscovite proper does not show contraction. The contraction is ascribed to the deprotonation of hydronium ions ( $\text{H}_3\text{O}^+ \rightarrow \text{H}_2\text{O} + \text{H}^+$ ) occupying interlayer  $\text{K}^+$  positions. The hydronium ion is approximately 5% larger than the neutral water molecule. This difference in size is proportional to the magnitude of contraction. The change in molecular volume and interlayer separation of illite particles may explain the anomalous decrease in density after dehydration under pressure. This paper reports on wetting-induced contraction in illite and related layer silicates, using humidity-controlled X-ray diffraction.

*Applied Clay Science*, 135: 226-233, 2017

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## Pyrolysis temperature-dependent changes in the characteristics of biochar-borne dissolved organic matter and its copper binding properties

Jing Wei<sup>1,2</sup>, Chen Tu<sup>1,2</sup>, Guodong Yuan<sup>3</sup>, Dongxue Bi<sup>1,2</sup>, Hailong Wang<sup>4</sup>, Lijuan Zhang<sup>5</sup>, Benny K.G. Theng<sup>6</sup>

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### Abstract

The dissolved organic matter (DOM) samples from biochars produced from Jerusalem artichoke stalks by pyrolysis at 300, 500, and 700 °C were characterized using a combination of spectroscopic techniques. Additionally, the

binding affinities (long KM) and the complexation capacities (CL) of the DOM samples with Cu(II) were calculated to assess their Cu binding properties. The biochar-borne DOM contained mainly humic-like components (C1-C3) with a small amount of a protein-like component (C4). As the charring temperature increased, the concentrations of released DOM decreased. The low temperature biochar-borne DOM was found to have more carboxyl groups than its high temperature counterparts, and thus it had larger CL values. In contrast, the high temperature biochar-borne DOM had larger long KM values. Low temperature biochars, if applied in a large quantity, would alter copper mobility in the environment because of their high DOM contents and large copper binding capacities.

*Bulletin of Environmental Contamination and Toxicology* <https://doi.org/10.1007/s00128-018-2392-7>

## Geochemical characteristics of heavy metal contamination induced by a sudden wastewater discharge from a smelter

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<sup>c</sup> Landcare Research, Private Bag 11052, Palmerston North 4442, New Zealand

### Abstract

Metal contaminations from smelting have been widely reported, however, the study on metal mobility or transfer characteristics in soil profiles after a sudden wastewater overflow is far limited. This study was undertaken to investigate distribution and potential mobility of heavy metals in soils flooded by smelting wastewater in Hechi, China. Total heavy metal/metalloid levels were measured in topsoil, profile and profile pore-water taken in-situ. Enrichment factor (EF) and nemero synthesis index ( $P_N$ ) were used to detect the contribution of anthropogenic emissions to trace element fluxes and pollution levels, respectively. Soil-water partition coefficient ( $K_d$ ) was used to reflect the fate and the mobility of elements. Results showed topsoil were seriously contaminated with Sb (289-3100 mg kg<sup>-1</sup>), Pb (444-6388 mg kg<sup>-1</sup>), Zn (294-923 mg kg<sup>-1</sup>), Cu (59-192 mg kg<sup>-1</sup>), Cd (12-34 mg kg<sup>-1</sup>), and As (32-405 mg kg<sup>-1</sup>), and  $P_N$  values indicated this area was in severe or strongly pollution level. Higher EF values of Sb, Zn, Cd and As were found in the flooded soils, and  $P_N$  in flooded area was 5 times of that in the unflooded sites, indicating wastewater flooding aggregated pollution in the low-lying area. The Sb, Pb, and Cd concentrations declined drastically with profile but dropped to constant levels below a depth of about 20 cm. In contrast, Zn and Cu in flooding soils declined rst and then increased to another extreme value even at depth of 50 cm. Pore-water profiles exhibited the similar declining trends of vertical metal/metalloid distribution pattern. The  $K_d$  values ranged from 102-106 L kg<sup>-1</sup>, and the mobility and bioavailability of the six elements in the profiles declined in the following order: Sb > Zn > Cu > Cd > As > Pb. The relatively low  $K_d$  values for some depth intervals may reflect adsorption decrease or migration increase of metal/metalloid. However, it is worth to further study and assess their potential risk to environment in longer period.

## Carbon-coated montmorillonite nanocomposite for the removal of chromium(VI) from aqueous solutions

Jing Wei<sup>a</sup>, Chen Tu<sup>a</sup>, Guodong Yuan<sup>b</sup>, Dongxue Bi<sup>a</sup>, Liang Xiao<sup>a</sup>, Benny K.G. Theng<sup>c</sup>, Hailong Wang<sup>d,e</sup>, Yong Sik Ok<sup>f</sup>

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<sup>e</sup> Key laboratory of Soil Contamination Bioremediation of Zhejiang Province, School of Environmental and Resource Sciences, Zhejiang A7F University, Hangzhou 311300, China

<sup>f</sup> Korea Biochar Research Center & Division of Environmental Science and Ecological Engineering, Seoul 02841, Republic of Korea

### Abstract

A carbon-coated montmorillonite nanocomposite (CMt), obtained by hydrothermal carbonization of montmorillonite suspension in glucose, was used to remove Cr(VI) from aqueous solutions. The distribution and speciation of Cr immobilized by CMt were assessed by transmission electron microscopy with energy-dispersive X-ray analysis, X-ray absorption near edge structure (XANES), and scanning transmission soft X-ray microscopy (STXM). The variation in the functional groups and molecular structures of CMt was also investigated. The capacity of CMt for adsorbing Cr(VI) was markedly superior to that of the parent montmorillonite, showing maximum uptake of 100 and 12.4 mg.g<sup>-1</sup> at pH 2 and 8, respectively. The Cr K-edge XANES and STXM analyses indicated that Cr(VI) was reduced to Cr(III) under both acidic and alkaline conditions, while a Cr(OH)<sub>3</sub> precipitate and Cr(III)-acetate complex were the predominant species present on the CMt surface. Fourier transform infrared spectroscopy and C K-edge XANES further suggested that the phenolic groups in CMt serve as electron donors, facilitating Cr(VI) reduction. The combined results indicate that electrostatic attraction, Cr(VI) reduction, complexation, and precipitation are involved in the removal of Cr(VI) by CMt.

*Journal of Hazardous Materials* 368: 541-549, 2019

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## The influence of unsaturated zone drainage status on denitrification and the redox succession in shallow groundwater

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b GNS Science, PO Box 30368, Lower Hutt, New Zealand

### Abstract

Since nitrate is a major agricultural freshwater contaminant, denitrification is the environmentally most important step in the ecological succession of redox processes that can occur in groundwater. Understanding where and to what extent denitrification occurs would enable spatially differentiated land management and regulation.

We investigated in a dairy farming catchment in the North Island of New Zealand the influence of the unsaturated zone's drainage status on the redox succession in shallow groundwater along a well transect spanning drainage conditions from well drained to very poorly drained. Groundwater samples were analysed for a variety of parameters including nitrate, tritium, dinitrogen, argon, methane and nitrous oxide.

The redox classification based on measured redox-sensitive parameters broadly matched the a priori assessed drainage status of the overlying unsaturated zone. Only the groundwater underlying the well-drained soil was oxic and reflected the N losses from the intensive pastoral land use, with nitrate nitrogen concentrations up to 9.6 mg L<sup>-1</sup>. All other sites had mildly to strongly reduced groundwater and concomitantly decreasing or low nitrate concentrations, even at the water table. The tritium-derived mean residence time (MRT) estimates for the oxic groundwater (12 and 14 y) were within the range found in mildly reduced groundwater from the imperfectly drained sites (6-24 y), with the exception of one sample from below an aquitard (105 y). In contrast, the strongly reduced groundwater observed at the poorly and very poorly drained sites was relatively immobile (55 to N110 y).

Science of the Total Environment 660 (2019) 1232-1244

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## **A general Beerkan Estimation of Soil Transfer parameters method predicting hydraulic parameters of any unimodal water retention and hydraulic conductivity curves: Application to the Kosugi soil hydraulic model without using particle size distribution data.**

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Soil hydraulic characterization is crucial to describe the retention and transport of water in soil, but current methodologies limit its spatial applicability. This paper presents a cost-effective general Beerkan Estimation of Soil Transfer parameters (BEST) methodology using single ring infiltration experiments to derive soil hydraulic parameters for any unimodal water retention and hydraulic conductivity functions. The proposed method relies on the BEST approach. The novelty lies in the use of Kosugi hydraulic parameters without need for textural information. In addition, the method uses a quasi-exact formulation that is valid for all times, which

avoids the use of approximate expansions and related inaccuracy. The new BEST methods were tested against numerically generated data for several contrasting synthetic soils, and the results show that these methods provide consistent hydraulic functions close to the target functions. The new BEST method is accurate and can use any water retention and hydraulic conductivity functions.

Adv. Water Resour. 129, 118-130. <https://doi.org/10.1016/j.advwatres.2019.05.005>

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## Towards a preliminary assessment of the soil security dimensions in Aotearoa/New Zealand

Pierre Roudier<sup>1</sup>, Linda Lilburne<sup>2</sup>, Anne-Gaëlle Ausseil<sup>3</sup>, Gerard Grealish<sup>1</sup>, Bryan Stevenson<sup>4</sup>, Sam Carrick<sup>2</sup>, Andrew Manderson<sup>1</sup>, Suzie Greenhalgh<sup>5</sup>, Garth Harmsworth<sup>1</sup>, Elektra Kalaugher<sup>4</sup>

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Similar to most countries around the world, the soil resource in Aotearoa/New Zealand is under stress. Soil scientists need to engage with policy makers to perpetuate the availability of this key resource now and in the future. Soil security is a holistic framework that acknowledges the central place of soils in a wide range of challenges facing humanity, and the multi-faceted problems faced when attempting to protect and enhance it. In order to facilitate its implementation, it has been suggested to distinguish five different dimensions within the soil security concept: capability, condition, capital, connectivity, and codification.

We review and discuss the progress that has been made to date to evaluate the five dimensions in Aotearoa/New Zealand, how well they align to existing work streams, where there are gaps and uncertainty that can focus future work. The capability dimension has been mapped by soil scientists from the 1940's; progress has been made on soil capital assessment, whilst the connectivity dimension is seen in research on ecosystem services and integrating Te Ao Māori. Ongoing soil health monitoring and research is developing insights into soil condition, whereas the pertinence of issues of water quality degradation and versatile land loss indicate that more work is needed in the codification dimension. As these dimensions are inherently spatial, the mapping of soil security is also discussed, to better deliver policy outcomes that address the multi-dimensional nature of the soil resource.

Presented during the [Soil Security and Planetary Health Conference](#), Sydney, 4-6 December 2018.

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The Land Resource Circle

Linda Lilburne<sup>1</sup>, Andre Eger<sup>1</sup>, Paul Mudge<sup>1</sup>, Anne-Gaelle Ausseil<sup>1</sup>, Bryan Stevenson<sup>1</sup>, Alexander Herzig<sup>1</sup>, Mike Beare<sup>2</sup>

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<sup>2</sup> Plant & Food Research, Gerald St, Lincoln, Canterbury, New Zealand

Over the decades soil mapping has progressed from mapping of soil types to digital mapping of soil properties and now to a more interpretative mapping of soil functions. In other research work, the contribution of soil functions to ecosystem services has been established. Our extension to this work has been to develop a new framework called “The Land Resource Circle” (LRC) which aims to provide comprehensive land resource information to support decision-making on a wide range of issues relating to environmental outcomes as well as sustainable use of land. It is intended to be used for multiple purposes including spatial planning, land assessment, informing trade-offs between ecosystem services, and increasing awareness of soil related constraints to sustainable use of land. The core soil functions include storage/filtering/transformation of nutrients and water, carbon storage and cycling, biomass production, biodiversity support, physical platform, raw material and historical archive. In addition, the LRC acknowledges that soils differ in their capacity for resisting the various pressures due to land use and/or climate by including four functions characterising resistance to degradation of soil structure, fertility, biodiversity and erosion. It also recognises that the surrounding landscape also provides functionality that can impact on the delivery of ecosystem services from a land parcel and its suitability for different land uses. Four additional landscape functions describe the connectivity of the land to flood zones, water bodies, infrastructure and attenuation. This paper describes early progress with representation of the functions and how they interact with land use pressures.

Abstract accepted for presentation at the [2019 Wageningen Soil Conference](#).

## Books

### **DSIR Soil Bureau legacy reports now available online**

Manaaki Whenua - Landcare Research is now providing free online access to all major publication series of the DSIR Soil Bureau (1946-1990) and of DSIR Land Resources (1990-1992). This also includes some +/- 100 soil maps that were produced for the NZ Soil Survey Reports.

Access is via this link:

<https://soils.landcareresearch.co.nz/index.php/soils-at-manaaki-whenua/key-documents-and-publications-newsletter-multimedia/key-documents-and-publications/explore-list-of-publication-by-title/>

Any [feedback](#) is welcome!

## Conferences and Training

### **Wageningen Soil Conference: Understanding soil functions**

27-30th August 2019, Wageningen, Netherlands

Wageningen University & Research is delighted to invite you to join us at the fourth edition of the Wageningen Soil Conference. As in previous editions, the aim is to discuss the importance of soils. In the 2019 edition, the focus will be on "Understanding soil functions: from ped to planet". To do this we will adopt a new style of conference, with traditional conference talks in the mornings, followed by a range of scientific and interactive topic masterclasses in the afternoons.

<https://wageningensoilconference.eu/2019/>

### **International Interdisciplinary Conference on Land Use and Water Quality' - Agriculture and the Environment**

3-6 June 2019, Aarhus, Denmark

LuWQ2019 is conference on the cutting edge of science, management and policy to minimise effects of agriculture and land use changes on the quality of groundwater and surface waters. The conference is aimed at scientists, land and water managers and policy makers involved in water quality improvement. If you consider attending and would like to have a conversation with a local member of the Scientific Advisory Committee, please feel free to contact

[Roland.Stenger@lincolnagritech.co.nz](mailto:Roland.Stenger@lincolnagritech.co.nz).

More information: [www.luwq2019.dk](http://www.luwq2019.dk)

### **7th International Symposium on Soil Organic Matter: Soil Organic Matter in a Stressed World**

6 - 11 October 2019, Adelaide, South Australia

It is of course this amorphous substance, SOM, that draws our interests together and affords us the privilege to invite you to the wonderful city of Adelaide, South Australia, where the 7th iteration of the International SOM Symposium Series will be held from 6th -11th October 2019. The conference follows the amazingly successful editions at Rothamsted Research, UK (2017), Georg-August-Universität Göttingen, Germany (2015), and their four predecessors stretching back to the initiation of the series at Potiers, France, in 2007. It draws together a vibrant mix of established world experts, early and mid-career researchers, and students in order to share knowledge, make new connections, and advance the field of SOM research.

More information: [www.som2019.org](http://www.som2019.org)

### **Australian and New Zealand Soils Conference: Soils, investing in our future**

30 November to 5 December 2020 in Cairns, QLD

The Queensland branch will be hosting the 2020 joint Australian and New Zealand Soil Science conference in Cairns. As the organising committee begins the detailed planning for the conference, we'd love to hear your ideas of what you'd like to see at the conference. Whether its events, topics, speakers, training, panel discussions, technical tours or anything else. We would love to hear from the national membership. The organising committee is keen to make this one of the

most successful conferences ever and your ideas can help make that happen. If you'd like to contribute please submit your ideas in the form located in the link below.

<https://forms.gle/BHLQuQv55me6LAEr9>

## **British Society of Soil Science Conference: Managing Soil Resources to Secure Our Future**

4 to 5 September 2019

The multi-functionality of soils puts ever greater pressure on how and what expert advice is provided to manage our soils and the time that remains until we must reduce Greenhouse gas emission gets ever shorter. Are soils in the natural environment likely to be affected by the same drivers of change? Certainly, we have to be concerned about science, policy and practices in all these aspects of management. Innovative research and research applications from all areas in soil science will be required to tackle these challenges.

We are delighted to announce that Professor John Crawford, Rothamsted Research, will deliver the Presidential Lecture "Linking Soil and Human Health" at this two day conference and we also invite you to present your latest research at this meeting. Contribute to having soil science make a difference - there will be opportunities for oral and poster presentations.

Abstracts for the conference should be submitted via

<https://submissions.atanto.com/?eventId=88> .

## **MSc and PhD research in trace element cycling, uptake and toxicity**

The SWAMP lab facility is seeking highly motivated students to undertake research related to trace element concentration and speciation in the dissolved (size-based speciation, < 450 nm) and particulate fractions (chemical reactivity, > 450 nm) of surface waters, and in soils and soil solutions. Two PhD positions are available, in the following research areas: 1) Assessing the uptake of trace elements into aquatic and riparian plants, and associated relationships with concentration, size, and speciation, and; 2) Assessing the uptake of trace elements by invertebrates and fish, associated toxicity, and relationships with trace element concentrations, size and speciation. The MSc position will focus on the assessment of soil properties, including trace element concentrations and speciation, and the impacts of these soils on surface runoff. Soil solutions will also be collected and characterized using ultraclean soil lysimeters. This research will occur in the context of an experimental engineered landscape in the Athabasca Oil Sands Region that is designed to treat and reclaim waste streams.

To apply for one or more of these positions, please send a letter of application, CV, and the names of two references to Ms. Tracy Gartner ([tgartner@ualberta.ca](mailto:tgartner@ualberta.ca)) or Dr. Chad W. Cuss ([cuss@ualberta.ca](mailto:cuss@ualberta.ca)).

## **Postdoctoral Associate - Nutrient Management Spear Program - Cornell University**

The work of the Postdoctoral Associate will be a component of the Cornell Nutrient Management Spear Program (<http://nm-sp.cals.cornell.edu>), which is the applied research and extension program in field crops nutrient management for New York

dairy and cash grain operations led by Dr. Quirine Ketterings, Professor in the Department of Animal Science. The sustainability of animal feeding operations in New York State depends greatly on their ability to increase nutrient recycling on the farm, reduce N and P losses to the environment, reduce cost of production and increase yield and milk sales.

Please apply via Academic Jobs On-line (AJO):

<https://academicjobsonline.org/ajo/jobs/13666>.

Applications will be reviewed as received, continuing until a suitable applicant is identified. For more information, please contact Dr. Quirine Ketterings at [gmk2@cornell.edu](mailto:gmk2@cornell.edu).

## **Charles Fleming Award for Environmental Achievement – Call for Nominations**

The award honours those who have achieved distinction in the protection, maintenance, management, improvement or understanding of the environment, in particular the sustainable management of the New Zealand environment. This award is made every three years.

Closing date: 30 June 2019

<https://royalsociety.org.nz/what-we-do/medals-and-awards/charles-fleming-award-for-environmental-achievement/>

## **Kudos Science Trust calling for nominations**

The Kudos Science Trust (Hamilton Science Awards Trust) is currently seeking nominations for its annual Kudos awards that recognise top scientists from Hamilton and the Waikato region. The trust seeks to inspire communities to recognise the value of science and how it impacts and empowers lives.

Nominations close: 20 June 2019

<http://www.thekudos.org.nz/nominations/>

## **Expressions of interest for Catalyst Fund Reviewers**

Calling for Expressions of Interest (EOI) from experienced individuals wishing to assist with the assessment of proposals submitted to Catalyst: Leaders and Catalyst: Seeding.

<https://royalsociety.org.nz/whats-happening/opportunities/expressions-of-interest-for-catalyst-fund-reviewers/>