



Welcome to the Soil News

February 2020

Issue #1 -Vol #68

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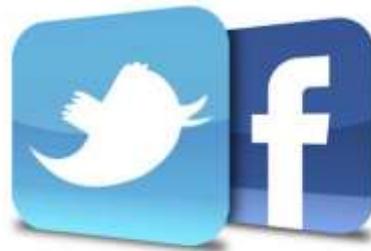
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Your contributions are required - New Zealand Soil News is your newsletter

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Officers of the NZSSS 2019-2020

President: Megan Balks, University of Waikato

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

President's message

Nga mihi

A highlight of 2020 will be the joint Australia/NZ Soil Science Society Conference in Cairns in December (see notice elsewhere in this issue). I hope I will see you there! The Aussies are planning to put on an excellent meeting and have some exciting fieldtrip options giving a chance for us to see some interesting country that is a little different from home (not to mention possibilities of a visit to the Great Barrier Reef if you can take a day or two extra on either side of the conference). The Global Soil Partnership (GSP) is being represented by a plenary speaker at Cairns and we are hoping to be able to encourage some Pacific delegates to the meeting to support the initiatives of the Pacific Soil Partnership which includes Australia, NZ, and some 22 Pacific Island countries.

The council of the NZSSS is always interested in trying to make the society work better for our members. To that end we will be running a survey of all members coming up in a month or two, to give you a chance to tell us what you would like to see the society doing. So please keep an eye out for that and take a few minutes to complete it and share your ideas and insights.

I am told that there is good progress happening on the NPS for highly productive soils with over 2/3 of submissions generally supportive of the initiative. Keep an eye out for that over the next few months.

Best wishes for all your soil science endeavours in 2020, remember that your work is important for contributing to sustainable management of our precious soils and that is an important service to humanity!

Dr Megan Balks
NZSSS President.

Obituary

Graham Will - the father of radiata pine nutrition

By Bill Dyck

Early life Graham Melville Will (BSc, MSc, DSc) passed away aged 92 on 25 February 2019 in Rotorua, where he lived most of his life. Born in Hastings on 17 November 1927, he used to recount his early memories of living through the big Napier earthquake. Graham completed his BSc and MSc over a four-year period in

Wellington at what was then the University of New Zealand. One can only assume that jobs for chemistry graduates were few and far between in the late 1940s because after graduation he became a drain digger for the Hastings City Council. This was probably the time when he dug his first soil profile, although he probably had no inkling as to what it was about to lead to.

Excerpt from the *New Zealand Journal of Forestry* (2019) **64(1)**: 42-43

For the full article go to:

http://www.nzjf.org.nz/abstract.php?volume_issue=j64_1&first_page=42

Society News

New Zealand Society of Soil Science Awards 2020

Nominations for the following awards open **1 March 2020** (with the exception of the US/NZ Exchange Award, for which nominations open 25 January). Key details regarding nomination requirements are provided in the table below. Please contact the NZSSS Awards Convenor for full award details (Brendon.Malcolm@plantandfood.co.nz).

Award	Presented	Nominations close	Nominee eligibility	Nominator eligibility
<i>NZSSS Fellowship</i>	Annually	31 July 2020	Nominees must be active members of the Society at the time of nomination.	Nominations must be made by two Full Members, or Life Members of the Society.
<i>The Grange Medal</i>	Biennially (conference year)	31 July 2020	Open to both non-members of the Society as well as members, fellows, or life members of the NZSSS.	Nominations must be made by two or more active members of the Society.
<i>The Blakemore Award</i>	Biennially (conference year)	31 July 2020	Open to technicians/support staff who have been employed in the field of science for at least three years.	Any two active members of the NZSSS can nominate an eligible candidate from a university, CRI, or other organisation (e.g. a Regional Council).
<i>The Leamy Award</i>	Biennially (conference year)	31 July 2020	Open to the author or authors of the most meritorious New Zealand contribution to soil science, published in the previous three calendar years.	Any two active members of the NZSSS can nominate an eligible candidate(s) from a university, CRI, or other organisation (e.g. a Regional Council).
<i>The Fertiliser Association Award</i>	Annually	31 July 2020	Open to postgraduate (PhD) students in soil science about to enter their third year of study. Candidates must be either student or full members of the NZSSS and should not be on the academic or technical staff of the department that nominates them.	Nominations must be received in writing from the Head of the Soil or Earth Science Department/Group at a New Zealand University. Only one nomination will be accepted from each University Department/Group.

<i>The Morice Fieldes Award</i>	Annually	31 July 2020	A PhD thesis submitted within the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate the best PhD thesis from their department/group.
<i>The Rigg Award</i>	Annually	31 July 2020	A Masterate thesis submitted within the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate the best Masterate thesis from their department/group.
<i>Undergraduate Prizes</i>	Annually	31 December 2020	A third-year student in Soil or Earth Sciences.	The Head of the Soil or Earth Science Department/Group at Massey, Lincoln, and Waikato University may each nominate the best third-year student from their department/group.
<i>The US/NZ Exchange Award</i>	Annually	15 April 2020 for initial submission (18 April for final submission)	Nominees are required to have at least seven years of membership in SSSA or the NZSSS. Former recipients of this Award are not eligible.	This award allows self-nominations.

Nominations and requests for further information regarding NZSSS awards should be addressed to:

Dr Brendon Malcolm

NZSSS Awards Convenor

C/O Plant & Food Research

Private Bag 4704, Christchurch Mail Centre, Christchurch 8140 (normal post), or
Canterbury Agriculture & Science Centre, Gerald St, Lincoln 7608 (courier)

New Zealand

Email: Brendon.Malcolm@plantandfood.co.nz

Report on Inaugural South Island Soils (SIS) 2019 Forum, Lincoln University, Canterbury

Brendon Malcolm, Plant and Food Research, NZSSS Awards Convenor

The 5th December 2019 was not only an important day in our professional calendars ('World Soil Day'), but marked the launch of our new initiative 'South Island Soils' forum, similar to the very successful Wai-BOP event run each year by Prof. David Lowe and his team at the University of Waikato. This was run on behalf of the New Zealand Society of Soil Science (NZSSS) with sponsorship from Lincoln University, and was initiated with an intention to highlight the importance of soil science through providing an opportunity for up-and-coming researchers to share their work and connect with others in the NZ soil community.

The name and theme of the forum was **South Island Soils 2019: Connecting Horizons**, and was organised and run by a small sub-committee, consisting of members from Plant and Food Research and AgResearch (Diana Selbie, Brendon Malcolm, Carmen Medina and Sam McNally). Approximately 30-40 people attended the forum throughout the day, which concluded with a very excellent Norman Taylor lecture by Marta Camps, “A biogeochemical view of major soil orders/groups”.

This was also a fantastic opportunity to announce the recipient of the NZSSS Morice Fieldes Memorial award (for best PhD theses from the previous calendar year) for 2019 - Camilla Gardiner, Lincoln University. Camilla was unable to attend the forum, but was presented with the award the previous week, and her supervisor Prof. Tim Clough formally received the award on her behalf at the forum. For details on the recipients of the other NZSSS awards for 2019, refer to David Lowe’s report - ‘Report on Wai-BoP Soils 2019 regional soils conference, University of Waikato, Hamilton’ (below).

Positive feedback following the event suggested that this would be a great event to continue running in the years between the NZSSS conferences (i.e. biennially in Dec), and we welcome any further thoughts from NZSSS members about how this might look in future.



Prof. Marta Camps, recipient of the Norman Taylor Memorial award for 2019, delivering her lecture at SIS2019 (left), and presentation of the NT award by NZSSS awards convenor Brendon Malcolm (right).



Camilla Gardiner (Lincoln University), recipient for the NZSSS Morice Fieldes Memorial award for 2019 (left), and her supervisor Prof. Tim Clough accepting the award on her behalf at the SIS2019 forum (right), presented by NZSSS awards convenor Brendon Malcolm.



Diana Selbie addressing delegates at SIS2019 about the significance and importance of World Soil Day (left), and cutting of the World Soil Day cake (right); Diana Selbie, Leo Condron, Brendon Malcolm and Carol Smith.

Convenors: Diana Selbie (AgResearch), Brendon Malcom (Plant and Food Research), Carmen Medina (Lincoln University) & Sam McNally (Plant and Food Research)

Sponsors: NZ Society of Soil Science (NZSSS) & Lincoln University

Report on Wai-BoP Soils regional soils conference, and society awards, 2019

David J. Lowe, School of Science, University of Waikato, Hamilton
david.lowe@waikato.ac.nz

On behalf of the New Zealand Society of Soil Science (NZSSS), the School of Science of the University of Waikato (Hamilton) hosted the 5th biennial Wai-BoP Soils conference on Friday 29 November, 2019. The one-day regional soils meeting, convened by David Lowe and Anne Wecking, attracted over 70 people who came from as far away as Northland and Canterbury (Prof. Thomas Schmid, on leave at Waikato University, came all the way from Spain). The conference was generously sponsored by NZSSS, the University of Waikato, the Waikato Regional Council, Manaaki Whenua Landcare Research, and AgResearch. Its theme was 'Commemorating Mendeleev', with 2019 being the 150th anniversary of the publication of the Periodic Table by Dmitri Mendeleev (1834-1907) in 1869 (Fig. 1).

During the conference opening, David Lowe noted that Mendeleev was instrumental in establishing a multidisciplinary committee in St Petersburg in 1874 to study soils, especially the Chernozems (Mollisols), and that Mendeleev, crucially, appointed geologist/mineralogist Dr Vasilii Dokuchaev (1846-1903) as the committee's chair (Tandarich and Sprecher 1994) (Fig. 2). Dokuchaev, along with Eugene W. Hilgard (USA) (1833-1916), is considered to be one of the twin founders of pedology (e.g. Brevik and Hartemink, 2009; Landa and Brevik, 2015). A special mug, provided to conference participants, was commissioned to celebrate the Wai-BoP Soils 2019 meeting and the role played by Mendeleev in soil science and chemistry (Fig. 3). For an article explaining why Mendeleev (unfortunately) never received a Nobel Prize, read Giunta (2018).

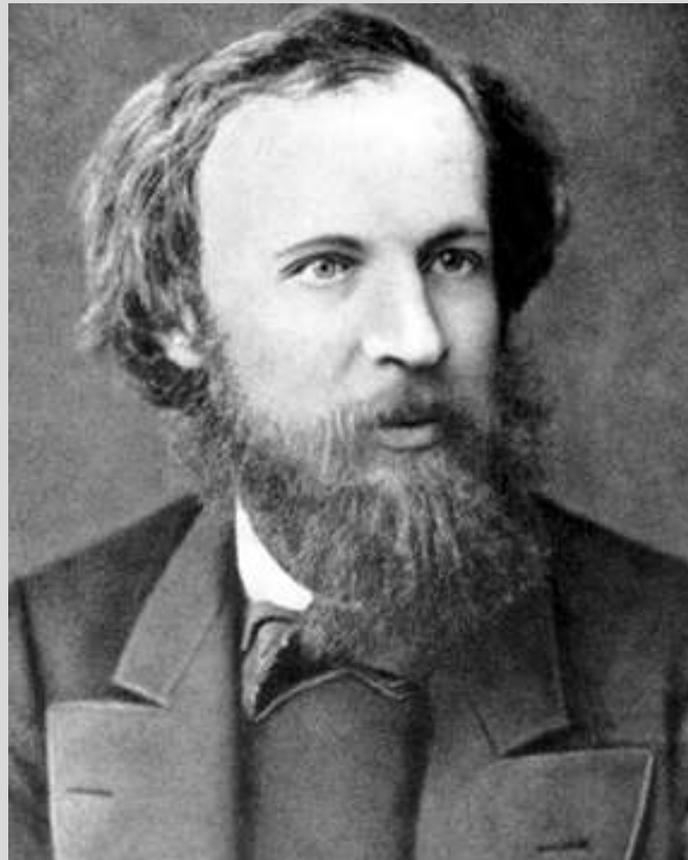


Fig. 1. Dmitri Mendeleev (from Sutton, 2019)



Fig. 2. Vasilii Dokuchaev (from Tandarich and Sprecher, 1994)



Fig. 3. Special commemorative Mendeleev mug prepared for the Wai-BoP Soils 2019 meeting (all participants received one - if you missed out, please email David Lowe and he can arrange for one to be sent). Photos: D.J. Lowe

Highlights for the day included the opening keynote talk by Dr Peter Hodder (Victoria University of Wellington), “The periodic table for Earth sciences” (a written version is being published by Hodder, 2020), an invited talk by Hamilton-based archaeologist Warren Gumbley, “Māori-made soils and gardens in central Waikato”, and this year’s N.H. Taylor Memorial Lecture by Prof. Marta Camps (Massey University), “A biogeochemical view of major soil orders/groups”. Another 18 talks (12 minutes each) were given during the day including five by students (all of which were excellent). Peter Singleton was entertaining and informative, as always, with his talk “Some useful field tools”, and Malcolm McLeod provided a useful update on progress in “Revising the Soil Description Handbook” of Milne et al. (1995).

During a special general meeting of the society, four awards were made as follows.

Emily Kitchen was awarded the NZSSS Undergraduate Prize (University of Waikato) for best final-year student in soil science completing a BSc degree (Fig. 3). Emily is currently the holder of the AECOM David A. Burns Award in Engineering Geology (University of Waikato) and is working for AECOM in Hamilton over the summer before enrolling in a masterate programme at Waikato in 2020.

Jamie Millar was awarded the Sir Theodore Rigg Award in recognition of the exceptional merit of her masterate thesis (University of Waikato), “The effects of irrigation on soil carbon and nitrogen stocks of Pumice Soils” (Fig. 4). Jamie is a research associate working for Pioneer Brand Products at Genetic Technologies in Hamilton.

Anne Wecking (University of Waikato) received the Fertiliser Association Postgraduate Bursary for 2019 for the best PhD student entering, or about to enter, his/her third year of study (Fig. 5). Anne is working with Prof. Louis Schipper towards her PhD.

Dr Bert Quin was awarded a Life Membership of NZSSS in recognition of his exceptional contribution to soil science in New Zealand through his generous sponsorship for more than 20 years of a postgraduate bursary to doctoral students in soil science entering their third year (Fig. 6).



Fig. 3. Emily Kitchen (left) receiving the NZSSS Undergraduate Prize in Soil Science (Waikato University) for 2019 from Prof. Tim Clough (vice-president of NZSSS). Photo: D.J. Lowe



Fig. 4. Jamie Millar (right) receiving the Sir Theodore Rigg Award for 2019 from Prof. Tim Clough. Photo: D.J. Lowe



Fig. 5. Anne Wecking (left) being presented with the Fertiliser Association Postgraduate Bursary for 2019 by Dr Ants Roberts (Ravensdown Chief Scientific Officer). Photo: D.J. Lowe



Fig. 6. Dr Bert Quin (right) after being presented with his Life Membership of NZSSS by Prof. Tim Clough. Photo: D.J. Lowe

Finally, at the end of the day, **Prof. Marta Camps** (Massey University) was awarded the N.H. Taylor Memorial Lecture Award (Fig. 7), and the special Taylor Auger (Fig. 8), by NZSSS president Dr Megan Balks at the conclusion of Marta's masterly lecture.



Fig. 7. Prof. Marta Camps (right) receiving the N.H. Taylor Memorial Lecture Award for 2019 by Dr Megan Balks (president of NZSSS). Photo: D.J. Lowe



Fig. 8. Prof. Marta Camps (left) and Dr Megan Balks with the famous Taylor Auger mounted on timber from the (now demolished) Hamilton Office of Soil Bureau, DSIR. Photo: D.J. Lowe.

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News from the Regions

Manawatu Plant & Food

Between 5-9 December 2019, **Brent Clothier** visited Professor Yuqing Huang, the Head of the Key Laboratory of Beibu Gulf Environment Change and Resource Use of Nanning University in Guangxi Province. Brent gave a talk at an international symposium at Nanning University, and then held a workshop with graduate students on how to write a paper in English for an international journal.



Brent also gave a talk at the Guangxi Institute of Botany in Guilin, and then met with some of the Institute's staff (above). Professor Huang is on Brent's right in the photo above



Brent also visited Yuqing's experimental field site at Baise, north of Nanning, where she and her students are carrying out micrometeorological and soil-water studies on the water use and growth of mangoes (above).

Manaaki Whenua - Landcare Research

Carolyn Hedley's retirement and farewell

Carolyn Hedley's last day at Manaaki Whenua - Landcare Research (MWLR), Palmerston North, was 6 December 2019. The following is adapted slightly for Soil News from a speech by Jackie Aislabie, Carolyn's Science Team Leader, given at Carolyn's farewell function:

A special thanks to our colleagues from Massey University who have joined us today. Massey University has been integral to Carolyn's involvement in Soil Science in New Zealand since 1977 when she came here to do her M.Phil. degree in soil erosion in the Southern Ruahine Ranges, with supervisors Vince Neall and Jim

Pollok, She also met her husband, Mike, studying for his PhD in the Massey University Soil Science Dept. at that same time.

Carolyn started working at MWLR on 28th March 1994, nearly 26 years ago. She worked with Surinder Saggar on agricultural greenhouse gas research and in the Environmental Chemistry laboratory. Craig Ross, her then Science Team Leader, must have been impressed as although it was a full-time role Carolyn negotiated a 9 to 3 job with school holidays off. At the time Carolyn had three children between 5 and 11, and as many of us know Carolyn and Mike are now enjoying time with their grandchildren.

Carolyn started working at the Aokautere site and spent her first six months helping to set up and use a temporary chemistry laboratory before moving to our present site.

After about 10 years Carolyn began to work full-time as she no longer needed to be home in the school holidays, and in 2004 moved to a Scientist role.

With encouragement and support from Peter Stephens, Carolyn got involved in electromagnetic (EM) mapping of soils to quantify soil variability using equipment used by Warren Woodgyer of the Massey University Soil Science Department. Graham Shephard had done some detailed work on soil texture at paddock scale at the Aorangi AgResearch cropping site and Carolyn questioned whether she could relate EM signal to soil texture. She presented her results at an Australian soils conference in Perth, and subsequently wrote a paper for Soil Research. So began Carolyn's work on application of soil sensor technologies. At the same time, she was working closely with Surinder to develop new methods and to measure greenhouse gas fluxes in agricultural soils.

Carolyn has been the key contact and editor of Soil Horizons, a Manaaki Whenua newsletter that began in 1997. The newsletter was established to communicate our soils-related research to the general public, stakeholders, customers and colleagues, and she was pleased to be able to hand over this role to John Drewry in 2019. <https://www.landcareresearch.co.nz/publications/newsletters/soil>

From 2006 to 2009 Carolyn did her PhD on "The development of proximal sensing methods for soil mapping and monitoring, and their application to precision irrigation". Her PhD was funded by AgMardt and a William Georgetti scholarship and she continued to work part-time for MWLR during this period.

Carolyn has provided leadership in precision agriculture and soil carbon research. She has worked with many people across multiple research domains including proximal sensing, soil spectroscopy and the mapping and monitoring of soil carbon. She has led Global Research Alliance Projects and a large MBIE Endeavour Programme "Maximising the Value of Irrigation".

Carolyn is quick to credit her colleagues and their contributions to her science achievements. Notably, Pierre Roudier for sharing a vision to develop proximal soil sensing and pedometrics in New Zealand, Jagath Ekanayake for his leading sensor technology, telemetry and engineering expertise, and John Drewry for ably taking over her soil-irrigation research projects. Focussing on precision agriculture, Carolyn and colleagues developed proximal sensing methods for rapid mapping and monitoring of soil variability at precision scales (< 10m) and then applied it to precision irrigation to enable farmers to use water more efficiently and minimise leaching losses.

For rapid soil mapping, Carolyn utilised vehicle mounted electromagnetic and gamma radiometric sensors linked to on-board GPS and dataloggers for rapid surveying. The maps were used to guide the positioning of sensor networks that wirelessly transmit soil moisture data in near real-time to remote end users. This work enabled high resolution spatio-temporal monitoring of dynamic soil processes and pioneered real-time tracking of soil drainage events.

Carolyn introduced new portable soil spectroscopy instruments to MWLR. They rapidly and non-destructively scan soils for predicting a number of soil attributes, including soil moisture, carbon and clay, providing a step change in our ability to acquire abundant soil data. Carolyn has developed new methods to scan soil cores in the field and lab and led the build of an automated soil core scanner, in collaboration with CSIRO, Australia. More recently she with others have been working on a national soil spectral data library.

Carolyn published 58 papers in peer-reviewed scientific journals, 16 as first author. Carolyn is also the author of 139 conference proceeding papers, 6 book chapters and 1 patent.

To finish up I have a few words from Craig Ross who is sorry he can't be with us today:

“Carolyn was always easy to get along with as a work colleague, an exemplary team person and mentored new staff who worked on her research topics. I appreciate and congratulate her on the way she adapted to working both in the lab and the field. She is a practical lady who doesn't mind getting her hands dirty, doing the hard yards and connecting well with farmers. I have fond memories of coring sandy soils with Carolyn, John Dando and Pierre out in the Rangitikei sand country. I am sure Carolyn will enjoy her retirement.”



Photo: Carolyn Hedley's farewell on 6 December 2019 at Manaaki Whenua, Palmerston North. From left to right are: Benny Theng, Pierre Roudier, Carolyn Hedley, Richard Gordon, Mike Hedley, Surinder Saggar and Jagath Ekanayake.

Other news

Craig Ross has completed the big task of going through 48 years of reports, books and paraphernalia from his office. Irreplaceable 'gems' have been placed into MWLR archives or passed onto colleagues that continue some of his work. This includes meticulously labelled slides and annotated reports from over 25 years as mine rehabilitation peer reviewer that plot progress of this science since its inception in New Zealand. Craig has been a Research Associate in recent years, after this official retirement in 2015. Craig joined DSIR Soil Bureau Lower Hutt in 1972 and moved to Palmerston North in 1994. Craig researched and contributed to a wide range of soil topics and locations with a focus on pragmatic soil management based on hands-on field work - soil structure, cropping practices, carbon and nutrient cycling, management practices to improve water quality, soil erosion, structural degradation, pedology and mining impacts and rehabilitation. He also helped pioneer 'hump and hollowing' and 'flipping' to improve pastoral productivity of poorly drained West Coast soils. Craig authored or contributed to well over 100 reports and over 50 journal papers, was generous in sharing his knowledge, especially when beside a soil profile excavation. Thanks Craig, for your contribution to our organisation and to soil science.

Massey University

Tribute to Lance Currie, our safe pair of hands

Text and photos: Mike Hedley, Chris Anderson and Christine Christensen (Massey University).

On the 18th December 2019 the Soils Group at Massey marked a major moment in its history - its longest serving member of staff retired from permanent employment

to take on part-time work for the next two years. The group held an extended lunch to celebrate **Lance Currie's** huge contribution to the Soils Group. Current staff and students and retired members of staff, all came to show their gratitude for the major contribution that Lance had made. This contribution was not only to soil science as a discipline but to the day to day management of the business model that has kept the Soils Group nicely afloat through the treacherous waters of past and present university financial storms. Following a long-standing tradition for soil science at Massey, HOD **Chris Anderson** presented Lance with a hat to mark his years of service. This 'home made' creation reflected on Lance's management and musical skills, with knitting needles prominently placed in lieu of conducting sticks. The cans around the brim of the hat were designed to keep pesky flies away as he spends his retirement time tending to his tomatoes and spuds.



Photo: Lance with the customised hat marking his years of service.

In Lance's speech he reminisced about his appointment by **Keith Syers** in 1973 to the DSIR funded project investigating the impact of nutrient run-off from agricultural land on stream and river water quality. It brought many a smile to the faces of those that remembered the cavalier days of weir building and stream sampling in the hill country catchments and the days, nights and weekends spent in the old wooden TVL laboratories, where all the water sample processing was conducted.



Photo: The Soils Dept. in 1978 with a young Lance Currie (back row, 4th from right).

By 1978, Lance's skills in the analysis of nitrogen and phosphorus in waters, was redirected into phosphate rock field trials and chemical characterisation as New Zealand and German partners tried to evaluate the fertiliser value of phosphate nodules dredged from the sea floor on the Chatham Rise. Establishing and servicing pasture field trials was a large part of Lance's work from 1978 - 1982. The demand for a large number and variety of analyses created the need for a semi-commercial analytical laboratory with both full time and casually employed technical staff. Lance's job description changed and he began to manage both the laboratory and the staff hours of work. When Professor **Robert White** took over the Head of Department role from Keith Syers in 1986, Lance's position of manager of the laboratory and technical staff became formalised under the umbrella of the Fertilizer and Lime Research Centre (FLRC). Lance was awarded the NZSSS Les Blakemore Award in 1998 for his outstanding contribution to New Zealand soil science. As the FLRC took on professional development teaching courses and hosting the annual technical workshop, Lance took on the key roles of course and workshop organiser. All rural professionals in New Zealand with a certificate nutrient management from Massey University, will appreciate Lance's effort that went into managing the courses, the submission and timely marking of assignments. Through six directors of FLRC, Lance has been the "safe pair of hands", as Technical Manager, that has kept the ship on course.

Of course life was not all work and "the family of soil scientists" knew how to enjoy themselves, whether it was the "boys fishing trip" organised by Keith Syers or regular participation of the "Diggers" in the twilight business cricket league.



Photo: Lance's Catch on a Keith Syer's fishing trip.

These events have generated many hilarious moments that provide the “icing” to long-term friendships. Lance was a very capable wicket keeper for the Diggers, taking over duties from Jim Pollock and then handing the role on to **Mike Tuohy**.

Lance has been a major figure for soil science at Massey. His humour, steady hands and commitment to staff and students across the university will be missed as he phases out to full retirement. Lance, Soil Science at Massey thanks you for your years of dedicated service.



Photo: The Diggers Cricket Team (circa 1987), Lance (5th from left, back row).

Golf has always played an important part in Lance's life and apart from the weekly game at Palmerston North Golf club, Lance, **Russ Tillman** and Mike Tuohy still enjoy a New Zealand tour each year, playing the more select golf courses and taverns. No social events were enjoyed more than the Soil Science Department's Christmas Parties, which involved the university tradition of annual reviews. In the first of these

reviews postgraduate students and technicians created skits and songs that rivalled the best of Morecombe and Wise. Lance a skilled piano player was a key lyricist in these compositions with his partner in crime Mike Hedley. In years that followed senior staff also joined in. **Vince Neall** and **Paul Gregg** created the hilarious “AsPro” (Associate Professor) awards for students who had caused the most pain during the year and loosely based on the “Two Ronnies”. Lance’s partial retirement lunch was a time to remember the fun had by all.

We all wish Lance well with the extra time he has over the next two years to spend with his wife Carol and family as he adjusts “his flasks to be all in line” ready for his full time retirement down the track.

Another year, another FLRC Workshop

The 33rd Annual FLRC Workshop was held by the Farmed Landscapes Research Centre (FLRC) on 11th-13th February 2020. The title of the workshop this year was ‘Nutrient Management in Farmed Landscapes’ and continued with the focus on sustainable farming from previous years.

The Primary Sector Climate Change Commitment (He Waka Eke Noa) was presented by **Andrew Kempson** on the first morning and outlined the big challenges and opportunities for the whole of the NZ primary sector in the coming months.

The first day had a big focus on GHG, with keynote speaker Professor **Bob Rees** from Scotland Rural College in the UK kicking off Session 1. This was followed by presentations from other international researchers in this space, from Ireland and Australia.

A session dedicated to carbon sequestration was also a feature on the first day and included keynote speaker Dr **Axel Don** from Thünen Institute of Climate-Smart Agriculture in Germany, followed by NZ speakers who have been collaborating in research on full inversion tillage.

Day two started with an edge-of-field mitigation focus and included keynote speaker Dr **Laura Christianson** from University of Illinois, USA, on denitrifying bioreactors. Following this was Australian and NZ perspectives for edge-of-field mitigation options.

With the proposed National Policy Statements in consultation presently and many regulatory challenges being bestowed upon NZ agriculture, the content of the workshop was well received with much discussion and opportunities explored.

In all there were 92 oral and poster presentations over the 3 days and more than 230 delegates in attendance. These delegates represented universities, CRI’s, fertiliser industry, regional councils, industry-good bodies, government agencies, and private consultancies.

Proceedings of this very successful workshop will be available online in the near future, at <http://flrc.massey.ac.nz>.

Axel Don (Thünen Institute, Germany) visit to New Zealand

Axel Don (Thünen Institute of Climate-Smart Agriculture, Germany), visited New Zealand during 7 days in February 2020. Axel was an invited speaker at this year’s

FLRC Workshop, in a session dedicated to sequestering C in soils to offset GHG emissions. The session covered multiple aspects of a GPLER-funded project assessing how pasture renewal using full inversion tillage could increase soil C storage. A set of oral presentations dealt with a wide range of topics, from field measurement of soil carbon stock changes to pasture performance and nutrient cycling, covering also how renewal impacts nitrous oxide emissions, as well as what modelling can tell us about the long-term potential for increasing carbon stocks following these practices. Axel's presentation on "Deep tillage effects on soil carbon stocks - Evidence from long term experiments" provided a perfect introduction to the topic.



*Meeting at FLRC, left to right: **Mike Hedley** (Massey University), **Miko Kirschbaum** (Manaaki Whenua-Landcare Research), **Axel Don** (Thünen Institute of Climate-Smart Agriculture, Germany), **Mike Beare** (Plant & Food Research) and **Roberto Calvelo** (Massey University), part of the team at FLRC presenting and discussing details on pasture renewal using full inversion tillage to increase soil carbon storage; **Erin Lawrence-Smith** and **Sam McNally** (Plant & Food Research) contributed presentations on the session of this topic. Photo courtesy of Roberto Calvelo, thanks to **Mike Bretherton** for the good angle.*

Axel spent some time meeting with delegates during the FLRC Workshop at Palmerston North. The focus of his visit was discussing the progress of the GPLER-funded project led by **Mike Beare** (Plant & Food Research, Lincoln) about pasture renewal using full inversion tillage, in the wider context of soil carbon storage in an age of Climate Change. Axel's expertise on topics relating to carbon and nitrogen dynamics in soils, greenhouse gas emission and carbon sequestration are well acknowledged. Axel's smile and good nature is also a must-see! Axel enjoyed and joined in the convivial discussions held at the FLRC Workshop, barbeque and the Workshop dinner. Axel and Mike Beare also made some time for a short road trip to

see some of the North Island summer landscape before Axel returned home, to the Northern Hemisphere winter.

Activities in the Manawatu

Assessing carbon storage after pasture renewal including full inversion tillage

In late November 2019 the team at Massey University formed by Mike Hedley, Roberto Calvelo, Quang Mai and Ian Furkert were sampling soils at Massey Dairy No4. This particular experimental site (established in October 2016) is part of the GPLER-funded set of trials set up between 2016 and 2018 in the North and South Island to assess the potential of pasture renewal using full inversion tillage to increase soil C storage compared to other renewal practices.



Combining efforts, Mike Hedley, Quang Mai and Ian Furkert achieved a remarkable coring performance, 72 cores in approx. 3 hours (processing included!); accumulation of carbon in the subsoil (red arrow) can be visually assessed, three years after full inversion tillage, in the Pallic soil surrounding Massey. Photo: Roberto Calvelo.

The Massey team had a busy morning coring the well-known Tokomaru silt loam under a scorching sun. Soils taken will provide information on the short-term changes in soil carbon stocks, particularly at 20-30 cm depth after pasture renewal using full inversion tillage. Intense monitoring done at this and other benchmark trials around New Zealand has provided key information allowing the evaluation of agronomic and environmental benefits and risks caused by pasture renewal using full inversion tillage; further monitoring of these sites will evaluate effect on long-term soil C storage.

Shelterbelts on grazed pastures

Team here at Massey University Palmerston SAE is working on a Sustainable Farming Funded project aiming to investigate the environmental benefits of planting shelterbelts on various grazed pastures across New Zealand. This multidisciplinary project consists of team members from Massey University Soil Science: **Prof. Marta Camps-Arbestain**, **Dr Neha Jha**, **Dr Peter Bishop**, **Dr Lucy Burkitt**; Pasture Science: **Dr Ignacio Lopez**, Animal Science: **Dr Ina Draganova**, Plant and Food Research: **Dr Ian McIvor**. The project plans to conduct measurements on soil carbon sequestration, nitrate leaching, nitrous oxide emissions, above-ground biomass, pasture composition, and animal behaviour monitoring on various dairy and sheep

and beef farm across New Zealand. The project started in July 2019, and Post-Doc Dr Neha Jha started managing the work, since then we have number of additions (students and interns) in the group. A PhD student **Jacques Carvalho** from animal science group joined in October 2019, we had a summer intern, **Brooke Maddison** (SAE 3rd year undergrad student), helping with field and laboratory work during summer semester. A master's student, **Nandar Yee** from SAE, is starting her research on nitrate leaching and nitrous oxide measurements from March 2020. We also have a PhD student funded through CLIFF-GRADs scholarship starting his research on nitrate leaching and nitrous oxide measurements for six months from July 2020.



Ph.D Student Jacques Carvalho collecting a soil core (Photo: Neha Jha).



Summer student intern Brooke Maddison processing soil for carbon analysis (Photo: Neha Jha).

Great news from Lombok, Indonesia

On Tuesday 4th Feb, **Dr. Bambang Kusumo**, who completed his PhD in Soil Science at Massey University in 2009, was promoted to Professor of Soil Science in the Faculty of Agriculture at the University of Mataram, in Lombok, Indonesia. **Chris Anderson** (Head of Department for Soil Science at Massey - now called Environmental Sciences, and Director of FLRC) was fortunate to be present for Bambang's inaugural professorial address and the award of his professorial status. Chris was made an Adjunct Professor in Soil Science at the University of Mataram in 2015 in recognition of his ongoing efforts to support staff and students at this Indonesian Institution. Chris currently leads a MFAT-funded agricultural development project in East Indonesia working in collaboration with the University of Mataram.

As a result of his professorial status Chris was able to wear the professorial robes of the University of Mataram, and he was able to congratulate Bambang on behalf of Massey University and the New Zealand Soil Science Society on this occasion of his promotion to professor.



Photo (courtesy of Chris Anderson), left to right: Prof. Komang Damar Jaya - Director of Postgraduate Studies, Dr (Prof.) Bambang Kusumo, Prof. Chris Anderson, and Prof Taufik Fauzi of the University of Mataram prior to award of Bambang professorial address and promotion. The yellow scarf signifies the rank of professor. Bambang was presented with his scarf after his speech by the Rector of the University of Mataram.

Student's initiative: Spotlight on a Soil Scientist

A year ago, a maverick group of students and staff at Massey University supported a new initiative called "Spotlight on a Soil Scientist" to forget (a little bit) on pure science and highlight instead the philosophy and the people behind the hard work. The following is a personal reflection from **Brian Levine**, PhD student at Massey (not for long, he is doing well, about to complete his doctorate) after one year of coordinating this great space of communication about life and science.

February's 'Spotlight on a Soil Scientist' will be its ninth instalment of the program. 'Spotlight' is a chance for a member of the Soils Group at Massey University to tell their story of how they got to where they are and what they are doing, with the only

rule being 'No Data!'. Following the guest's 30-minute presentation, there is a 30-minute Q&A led by the host and 'Spotlight' creator, Brian Levine.

Previous guests have been a mix of PhD students at various stages of their research, PhD student advisors and researchers from the soil lab, with diverse international backgrounds and a wide variety of work experiences. "As a presenter, I found it really interesting to think about my journey through soil science and to think about what drives and interests me," **Lucy Burkitt**, Levine's primary research advisor, and assistant 'Spotlight' producer said. "From an audience perspective, some of the discussions about the challenges of being a student or academic have been particularly interesting and having a forum to have these discussions has been really useful."



The 'Spotlight on a Soil Scientist' audience enjoying a feast that accompanied Dr. Paramsothy (Jeya) Jeyakumar guest presentation. No data! they say; tasty international food is welcome. Photo credit: Brian Levine.

This month's instalment of the 'Spotlight on a Soil Scientist' program will mark the end of its opening chapter and start of a new. Brian Levine, is finishing his PhD thesis and moving on from Massey and is passing the hosting torch, or soil corer, along to fellow PhD student **Thomas Mackay-Smith**.

"It's really been fun to develop and run this program, and the support from the soils group community has been really enthusiastic." Levine said he proposed the idea at a Soils Group social meeting that he felt was all too rare. "Feeling like I'm part of a community is important to me. I like hearing people's stories and I wanted to hone

my interviewing skills. The research work environment can be so isolating, and the idea just clicked.”

Thomas Mackay-Smith echoes Brian’s sentiments about the solitude of PhD research and desire to build a sense of community. “It is very important there are regular occasions to meet with peers to exchange ideas, and learn about other’s research,” Mackay-Smith said.

Burkitt thinks the program has been really important to develop a sense of collegiality within the Soils Group and has opened lines to interact socially and discuss important issues facing students and academics. Levine agrees. “‘Spotlight’ has achieved what I hoped it would” Levine said. “The stories told, and conversations with the group have really garnered a closer sense of community. I appreciate the support from all of the participants and am excited to know I’m leaving the ‘Spotlight’ in good hands.”

The Soils Group at Massey University looks forward to further support this great initiative strengthening the sense of community, also helping Tom to hold the torch, I mean, the corer, when needed.

Graduation week at Massey

One last note to congratulate all recent Massey University PhD graduates, enjoying a celebration day last November during the Graduation Week. They represent a great example of work well done. All the best for their careers.



Massey-bred new scientists smiling to the cameras: (left to right) Ahmed Elwan, Kamal Adhikari, Grace Chibuike and Sasikunya Cheuyglintase (May). Photo courtesy of Grace Chibuike.

Canterbury Lincoln University



Professor Keith Cameron “I was fortunate to get to talk with Prince Charles as he was leaving. He recognised the medal and asked what I received it for. When I told him it was for research to reduce the impact of agriculture on the environment he encouraged us to “Keep up the good work!”

On the 22 November, and after much anticipation, Lincoln University were honoured to host His Royal Highness, the Prince of Wales on campus. Just on 300 people, including Lincoln students, staff, and representatives from the University’s partner organisations, were invited to the Stewart building for His Royal Highness’ State of the Environment address. Afterwards over a cup of tea, The Prince of Wales chatted to postdocs who presented posters of their research, including current Soil Science PhD students Camille Rousset and William Talbot.

In December, Sephrah Rayner successfully defended her PhD thesis “entitled “The Potential for Nitrate Attenuation from Paddock to Stream using Dual Nitrate Isotopes.” Sephrah’ s supervisors were Prof Tim Clough, Prof Troy Baisden (GNS/Waikato Uni) and Assoc Prof Jim Moir.

In January, we welcomed Ali Duncan, From Ladbrooks School, who is joining us as part of the Royal Society Te Apārangi Science Teaching Leadership Programme for 6 months. This is an opportunity for Ali to work alongside scientists and seeing science in action. Ali is working with Tim Clough on aspects of greenhouse gas fluxes from soil, using both laboratory studies and field studies.

In February, Leo Condrón organised an international research symposium: “Phosphorus Cycling and Management in Terrestrial Systems” with speakers from Canada (U. Guelph), Australia (CSIRO, U Western Australia, U Queensland), AgResearch and Lincoln University. This was an opportunity for current PhD students to present their research, and for all participants to discuss current advances in both new techniques such as molecular tools to investigate P cycling in soils (Kari Dunfield, Guelph); P fluxes in surface water; P dynamics in cropping systems and P mechanisms in the rhizosphere. We welcomed back ex-Lincoln soil

science PhD graduates Gustavo Boitt, now a Post Doc at U Western Australia, and BSc graduate Bianca Das, now studying for a PhD at U Queensland.

<https://www.lincoln.ac.nz/News-and-Events/Phosphorus-focused-symposium-on-campus>

At the start of the new academic year, the Department presented prizes to the 2019 top achieving students who achieved the highest marks in soil science courses in 2019; at 200, 200 and 300 level. The prizes were sponsored by the Centre for Soil and Environmental Research; thank you to Keith Cameron and Hong Di for their continued support of these prizes to recognize excellence in undergraduate soil science studies.



Students from left Amy Wells, Fiona Anderson, Imogen Brankin, Penelope Chapman, Zoe Holcroft, Kaitlin Watson, Hamish Dunbar, Absent: Sam Earl-Goulet and Jack Dixon.

Staff from left: Dr Nik Lehto, Roger McLenaghan, Dr Carol Smith, Prof Tim Clough, Prof Keith Cameron, Assoc Prof Peter Almond, Dr Henry Chau, Josh Nelson, Assoc Prof Jim Moir, Dr Janet Bertram, Louisa Hall and Prof Hong Di.

Manaaki Whenua - Landcare Research

South Island Stony Soil Sampling for National Soil Carbon Monitoring - by Nina Koele

The week of 10-14 February an interisland team of Manaaki Whenua Landcare Research (MWLR) pedologists set out to sample the first stony sites for the [National Soil Carbon Monitoring programme for agricultural soils led by Paul Mudge \(MWLR Hamilton\)](#).

As soils on the North Island were still too dry and hard to sample, we used the opportunity to train North Islanders in the stony pit technique in scenic South Island locations. We worked in two teams: Thomas Caspari (MWLR Lincoln) and Jonno Rau (MWLR Hamilton), and Nina Koele (MWLR Lincoln) training Sam Brinkworth (MWLR Hamilton, Waikato Uni BSc (Tech) student). After the usual initial hick-ups of missing keys and gear and rental cars with flat batteries, we started the 5-day South Island tour to excavate stones.

The biggest misconception about stony pits is that they are dug. Although we use spades and shovels, the actions required to get to 60cm through gravel or saprolite include knife carving, loosening cemented gravel pans with the “wonderweeder”, dislodging smaller sections of bedrock with screwdrivers, and scraping in millimetre increments through dense clayey gravel layers. All this is done in the typical pedologist’s introspective posture: on the knees with the nose close to the ground. During the week we encountered all sorts of stony soils, which was beneficial to show the variety of techniques and associated challenges. The first soil had schist saprolite in the last 20 cm. The second soil was a dense loamy clay with river gravel, never relenting and forcing us to abandon pit #2 at 30 cm in order to have a meal before midnight, while the others encountered bedrock at 40cm. The third soil was a pleasant loose loam interspersed with sandstone blocks of all sizes. The final soil consisted of dry sand and pebbles. Some pits got smaller and smaller as we tunnelled deeper, others got bigger and bigger as the walls caved in.

This sampling is the first phase of the project to have soil carbon stock measurements at 110 nationally representative sites each year for the next four years. Sixty sites in hill country drystock pastures were already sampled in 2018 and make up the remainder of the 500 total sites. The intention is to resample sites using a 4-5 year rolling scheme to determine if and how soil carbon stocks are changing under agricultural land in New Zealand.

An overview of the project is in this [Soil Horizons article](#).



When you hit bedrock at 40cm (Photo T Caspari)



A rare sight, two pedologists not looking down (Photo T Caspari)



Prima example of a site that may be too steep to use the stony pit method (Photo J Rau)



Sam at work on a beautiful site near Tekapo, slightly rocky (Photo N Koele)

Related Society Notices

SouthCOP - the first International Permafrost Association (IPA) Southern Hemisphere Conference on Permafrost celebrated world soils day

The SouthCOP conference, convened by Megan Balks, was held in Queenstown from 4-14 December 2019 and attracted 115 delegates from 18 countries. The IPA has held regional conferences for about 20 years, along with their major four yearly International Conference on Permafrost. However this is the first time such a meeting was held in the Southern hemisphere.

The pre- and post-conference fieldtrips led by Peter Almond, supported by Megan and Errol Balks and Andre Eger, travelled from Christchurch to Queenstown and return investigating landscapes, and the geological and glacial history of the region. Highlights included a visit to Antarctica New Zealand, glacial landforms in the Rakaia Gorge, and a day was spent at the Aoraki/Mt Cook National Park. World Soils day was celebrated by indulging in eating some unusual soil fauna while viewing a soil profile on the lateral moraine adjacent to Lake Pukaki (Fig 1). Some ventured forth on the rapidly forming pro-glacial Lake Tasman (Fig.2) to get a closer view of the current terminus of the Tasman Glacier while others viewed the moraines associated with both the Tasman and Hooker Glaciers.



Fig 1. SouthCOP preconference fieldtrip participants celebrated world soils day with “wriggly-worm” lollies at a soil profile near Lake Pukaki. Photo: Errol Balks

Due to heavy rain on the west coast of the South Island, many roads were closed by landslides and flooding. As a result, the post conference fieldtrip was not able to access the Fox and Franz Joseph glaciers. However, the participants made the most of the opportunity and travelled through Haast Pass to view the trace of the Alpine Fault, and the dune sequence associated with fault movement events, and with loess from the Haast River, in South Westland. They returned to Christchurch via the east coast with a trip up the Nevis Road, to the highest public road point in NZ, to look for evidence of periglacial action and admire the schist tor landscape.



Fig. 2. Pre conference fieldtrip: boat trip on Tasman pro-glacial lake. Photos: Megan Balks.

The conference opened with an address from the IPA president, Hanne Hvidtfeldt Christiansen from Svalbard, Norway. The Opening plenary address entitled “The Impermanence of Permafrost” was given by IPA Immediate Past President, Antoni Lewkowicz from Canada. Over the course of the conference other plenary speakers included: Fiona Shanahun (NZs Antarctic Science programme) and Vicky Singleton (engineering considerations in Scott Base redevelopment) from Antarctica New Zealand (a major sponsor of the conference); reviews of Antarctic soil and permafrost research from Drs Tanya O’Neill (NZ), Alexey Lupachev (Russia) and Thomas Schmid (Spain); and aspects related to permafrost engineering from Michael Krautblatter (Germany) and Fujin Niu (China). A combined plenary and public session (which attracted a number of Queenstown local people) was presented by David Barrell (GNS) which gave an overview of the geological history

of the Southern Alps and Queenstown/central Otago area as a lead-in to the mid-conference fieldtrips. A total of 16 concurrent sessions were held over three days covering the full range of topics of interest to the permafrost community.

Two mid-conference fieldtrips were undertaken, one with local tour guides, to Doubtful Sound, and the other to see the geology and landforms of the Wakatipu Basin and Central Otago led by David Barrell.

We are pleased to note that our Chilean colleagues are hoping to organise the second southern hemisphere conference on permafrost.

Thanks 😊 to Antarctica NZ for sponsorship and to Lea Boodee and all the team from “On Cue” who ensured that everything ran smoothly.

Abstracts

Improved prediction of water retention curves for fine texture soils using an intergranular mixing particle size distribution model

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Abstract

Laboratory measurements to derive the soil water retention curve, $\theta(\psi)$, are time consuming and expensive. We present a cost-effective alternative using particle size distribution (PSD) and saturated water content. We propose a novel physical conceptual intergranular mixing PSD model, (IMP model), which derives $\theta(\psi)$ from PSD, exploiting the relation between particle size and pore size distributions and the intergranular arrangement of the soil particles. The IMP model successfully predicts $\theta(\psi)$ for fine texture soil, which is the most challenging soil texture to be modelled. With our novel model, reliable $\theta(\psi)$ can be obtained using only three general fitting parameters without needing to assume any particular type of soil particle packing, with mean Nash-Sutcliffe efficiency coefficient of 0.92 for 259 soils.

The IMP model can accurately predict $\theta(\psi)$ for fine texture soils because: a) it implements an intergranular mixing function that accounts for soil pores not all being perfectly spherical and takes into consideration the intergranular rearrangement (mixing) of the particles, which allows neighbouring particles to have different sizes resulting in variations in pore radius and pore shape of the corresponding pore fraction; b) it overcomes the absence of PSD data below the clay fraction by developing a normalised form of the Young-Laplace capillary equation; and c) the residual pore volume accounting for water strongly bound to solid particles or in very small pores is incorporated as a function of the clay fraction.

Keywords: Particle size distribution; Pore size distribution; Water retention curve; Intergranular mixing; Kosugi model

Pollacco, J.A.P., Fernández-Gálvez, J., Carrick, S., 2020. Improved prediction of water retention curves for fine texture soils using an intergranular mixing particle size distribution model. *Journal of Hydrology* 124597. <https://doi.org/10.1016/j.jhydrol.2020.124597>

Chronic impact of an accidental wastewater spill from a smelter, China: A study of health risk of heavy metal(loid)s via vegetable intake

Yongqiang Yuan, Meng Xiang, Congqiang Liu, Benny K.G. Theng

Chronic impact will last from a sudden pollution accident, however, potential adverse effects of heavy metal(loid)s are overlooked when pollution decreased during years of equilibration. Here, we assessed the potential health risks of heavy metal(loid)s via intake of vegetables from fields affected by the smelting wastewater spill eight years later, basing on site-specific target hazard quotient (STHQ) and cancer risk (SCR) models. Results showed kohlrabi, lettuce and garlic had significant high concentrations of Sb (10.4 mg kg^{-1}), Pb (21.0 mg kg^{-1}), Cd (6.49 mg kg^{-1}), and Zn (441 mg kg^{-1}), and sweet potato and garlic enriched high levels of As (19.6 mg kg^{-1}) and Cu (14.1 mg kg^{-1}), respectively. Transfer factors of metal(loid)s from soil to plants were enhanced by high soluble metal(loid) concentrations, and Sb, As, Pb and Cd in most edible tissues exceeded the contamination limitations for food in China and FAO/WHO. Chinese cabbage had significant high STHQ of As (adult 9.31 and child 19.8) and Sb (adult 0.76 and child 1.61) ($p < 0.05$), and the highest STHQ of Cd (adult 1.41 and child 3.02) was in lettuce, whereas the highest STHQ of other elements from vegetables were below 1. However, the non-carcinogenic risks based on total STHQ values of these vegetables were several times higher than the acceptable level of 1. In addition, the total SCR values at 5% were hundreds times of safety level of 5.0×10^{-5} set by International Commission on Radiological Protection. Considering food frequency and metal(loid) levels, long-term consumption of local vegetables, especially lettuce and Chinese cabbage, are likely to increase noncarcinogenic and carcinogenic (e.g. As and Cd) health risks. Child's health risk of toxic elements was far greater than adult. This study might serve as a case study of long-term adverse impact for other pollutant incidents. People should pay attention to human health through food chain, and the government should solve the outstanding environmental problems that harm the health of the masses.

Ecotoxicology and Environmental Safety 182 (2019) 109401

Fate of engineered nanomaterials in urban and work environments

Guodong Yuan, Benny K.G. Theng, Lirong Feng, Dongxue Bi

The increasing production and wide use of engineered nanomaterials (ENMs) make their release into the urban environment inevitable. In this chapter, we review the exposure risks associated with the production of ENMs at the workplace and during

their life cycle in the urban environment. We then describe the transformation processes controlling the fate of ENMs in the urban environment, with emphasis on photochemical degradation, aggregation, and dissolution together with the intrinsic and external physicochemical factors affecting the transformation of ENMs, such as UV light, particles size, surface charge, surfactant, humic substance, and pH. We then touch on the release, behavior, and fate of ENMs in the urban atmosphere, water, soil, and sediment. Finally, human exposure to ENMs via inhalation, dermal, and ingestion routes is discussed albeit our understanding of the health aspects of ENMs is still at the infant stage.

In: N. Marmiroli, J.C. White, and Jing Song (Editors), 2019. Exposure to Engineered Nanomaterials in the Environment, Chapter 5, pp. 143-163, Elsevier, Amsterdam

Modelling 3D urine patch spread in grazed pasture soils to determine potential inhibitor effectiveness

Donna Giltrap, Ben Jolly, Peter Bishop, Jiafa Luo, Geoff Bates, Stuart Lindsey, Peter Berben, Thilak Palmada, SurinderSaggar

Urine patches represent hot-spots of nitrogen (N) loss in dairy-grazed soils. Targeted application of urease and nitrification inhibitors that slow down certain N transformations in the urine patches is a potential method to reduce N losses. However, for optimum effectiveness the inhibitors need to be in close physical contact with the urine in the soil under urine patches. In practice, there will always be some time delay between urine deposition and application of inhibitors. It is therefore important to understand how the urine is transported in the soil following deposition. In this study, we developed an empirical model of urine patch area from thermal images of urine patches applied on two different soil types, at two different initial moisture contents, and with three different applied urine volumes. Spatial measurements using Spikey®-R (a mobile device that measures soil surface layer electrical conductivity) were used to test the model. A linear regression model of the ratio (urine volume)/(patch area) against the soil air-filled pore space explained 45 % of the variation in the ratio and had a Nash-Sutcliffe efficiency of +0.74 in predicting the mean patch area. This regression model was then used to define the boundary conditions for HYDRUS2D/3D simulations of urine movement through the soil after application. These simulations reasonably predicted the amount of urine-N in the top 50 and 100 mm of the soil 4 h after application (model efficiencies +0.38 and +0.42, respectively), but the model efficiencies were only -0.18 and +0.14 after 24 h. The measurements also had a high degree of spatial variability. After 24 h 44-78 % of the urine-N measured in the profile was within 50 mm of the surface. This represents a limit on the proportion of urine-N that could be physically intercepted by a post-grazing inhibitor application.

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Modelling the effects of pasture renewal on the carbon balance of grazed pastures

Liyin L.Liang, Miko U.F.Kirschbaum, Donna L.Giltrap, Aaron M.Wall, David I.Campbell

In New Zealand, pasture renewal is a routine management method for maintaining pasture productivity. However, knowledge of the renewal effects on soil organic carbon (SOC) stocks is still limited. Here we use a process-based model, CenW, to comprehensively assess the effects of pasture renewal on the carbon balance of a temperate pasture in the Waikato region of New Zealand. We investigated the effects of renewal frequency, length of fallow period, renewal timing, and the importance and quantification of age-related reductions in productivity. Our results suggest that SOC change depends on the combined effects of renewal on gross primary productivity (GPP), autotrophic and heterotrophic respiration, carbon removal by grazing and carbon allocation to roots. Pasture renewal reduces grazing removal proportionately more than GPP because newly established plants need to allocate more carbon to re-build their root system following renewal which limits foliage production. That lengthens the time before above-ground biomass has grown sufficiently to be grazed again. New plants have a lower ratio of autotrophic respiration to GPP, however, which partly compensates for the GPP loss during renewal. Our simulations suggested an average SOC loss of 0.16 tC ha⁻¹ yr⁻¹ if pastures were renewed every 25 years, but could gain an average of 0.3 tC ha⁻¹ yr⁻¹ if pastures were renewed every year. For maximizing pasture production, the optimal renewal frequency depends on the rate of pasture deterioration with more rapid deterioration rates favouring more frequent renewal. Additionally, the length of the fallow period, renewal timing, and associated environmental conditions are important factors that can affect SOC temporally, but the importance of those effects diminishes at the annual or longer time scales. Major uncertainties for a full understanding of the renewal effect on SOC lie in the rate of pasture deterioration with time since previous renewal.

Science of Total Environment 2020 in press. 136917.
<https://doi.org/10.1016/j.scitotenv.2020.136917>

Development of a national-scale framework to characterise transfers of N, P and Escherichia coli from land to water

M. S. Srinivasan, Richard W. Muirhead, Shailesh K. Singh, Ross M. Monaghan, Roland Stenger, Murray E. Close, Andrew Manderson, John J. Drewry, Leo Christopher Smith, Diana Selbie and Roger Hodson

A hydrological framework encompassing nitrogen (N), phosphorus (P) and microbial (*E. coli*) transfer from land to water was developed to provide a consistent and rapid approach for assessing the potential impacts of land activity on water quality in New Zealand. A flow partition approach was used to route precipitation via surface and subsurface pathways from land to water. The framework included a typology-based inventory that estimates annual yields of transportable N and P from land, a regional-

scale spatial layer that attenuates N in groundwater, and literature-based estimates of *E. coli* concentrations in surface runoff and artificial drainage. Application of the framework in four catchments highlighted the importance of local catchment knowledge of dominant hydrological processes that was needed to ensure flow partitions derived were a realistic representation of transport processes. While the approach was promising, additional refinements are needed to improve process representation (e.g. effects of groundwater lags) and ensure input data (e.g. soil attributes) have appropriate resolution to describe hydrological pathways. We contend that such a framework would provide a consistent and relatively rapid approach for identifying contaminant transfer pathways from land to water that can inform assessments of the potential consequences of land use change and intensification.

New Zealand Journal of Agricultural Research. 2020. On-line early.
<https://doi.org/10.1080/00288233.2020.1713822>

Soil horizon variation: a review

Soil horizons reflect soil processes and convey information about past and present soil conditions. The identification and delineation of soil horizons are affected by lateral and vertical variation in soil properties. Early studies focused on the variation of horizon thickness and the waviness of horizon boundaries, but did not consider within-horizon lateral and vertical variation. Here we review studies that investigated variation in the master horizons O, A, E, B, and C. We summarize what is known about soil horizon variation, quantify the variation in different horizons, and investigate whether the variation increases or decreases with depth. The variation within horizons differs among soils, and the magnitude of the variation varies for different soil properties. Variation within soil horizons or laterally within a few square meters may be considerable, and the within-horizon variation changes with depth. Horizon thickness does not seem to be related to the variation of soil chemical and physical properties within the horizon, i.e., thicker horizons do not necessarily have higher variation in their soil properties. Three case studies are presented: Spodosols and Histosols (Russia), Alfisol and Mollisol (USA), and Oxisol (Brazil). Factors that affect the within-horizon variations include landscape position, parent material, vegetation, fertilization, tillage, drainage, and time. The vertical distribution of soil properties can be quantified using soil depth functions. Digital soil morphometrics techniques can assist in the quantification of two-dimensional soil profile properties and variations.

Hartemink, A.E., Zhang, Y., Bockheim, J.G., Curi, N., Silva, S.H.G., Grauer-Gray, J., Lowe, D.J., Krasilnikov, P. 2020. Soil horizon variation: a review. *Advances in Agronomy* 160, 125-185. (<https://doi.org/10.1016/bs.agron.2019.10.003>) (Free open access until 18 March 2020 at <https://authors.elsevier.com/b/1aTsuEqynXRFV>)

Wiggle-match radiocarbon dating of the Taupo eruption

R.N. Holdaway et al.'s (2018) proposal (*Nature Communications* 9, 4110) that the Taupo eruption is decades to centuries younger than 232 ± 10 CE is unsound. Although ^{14}C -depleted materials are associated with magmatic degassing, the context and consistency of any radiocarbon dates indicate whether a robust and accurate age estimate has been attained. The 250-year ^{14}C wiggle-match against SHCal13 presented here reinforces the view that 232 ± 10 CE remains the most accurate and precise age estimate for the Taupo eruption, and we conclude there is no evidence for anomalously older ages near the Taupo volcano. We re-assert that radiocarbon wiggle matching to refine volcanic event chronologies, especially where sequential ^{14}C dates and Bayesian modelling form the basis of the event timing, remains an accurate and invaluable dating tool.

Hogg, A.G., Wilson, C.J.N., Lowe, D.J., Turney, C.S.M., White, P., Lorrey, A.M., Manning, S.W., Palmer, J.G., Bury, S., Brown, J., Southon, J., Petchey, F. 2019. Wiggle-match radiocarbon dating of the Taupo eruption. *Nature Communications* 10, 4669. (Permanent free open access: <https://doi.org/10.1038/s41467-019-12532-8>)

Rainfall threshold for initiating effective stress decrease and failure in weathered tephra slopes

Rainfall is one of the most important triggers of slope failure. Weathered pyroclastic (tephra) deposits are especially vulnerable to slope failure because they commonly form slopes of high porosity and high clay content. Empirically derived thresholds for the triggering of landslides are commonly based on rainfall conditions and have been widely applied in volcanic soils. However, so far only few researchers utilized pore water pressure in the slope as additional variable for the threshold calibration. Here, we derived a new rainfall threshold for initiating the decrease in effective stress in the slope by analyzing a long-term record of rainfall and piezometer data from a slide-prone coastal area in northern New Zealand that consists of clayey, halloysitic tephra deposits. The level of effective stress decrease increased with rainfall intensity and duration. We observed highest effective stress decrease of up to 36% during rainfall events that triggered landslides in our study area. The effective stress threshold exhibits a satisfactory predictive capability. The probability of correctly predicting a decrease in effective stress is 53%. The effective stress threshold contributes towards the implementation of the decrease in effective stress into rainfall thresholds for the occurrence of landslides.

Kluger, M.O., Jorat, M.E., Moon, V.G., Kreiter, S., de Lange, W.P., Mörz, T., Robertson, T., Lowe, D.J. 2019. Rainfall threshold for initiating effective stress decrease and failure in weathered tephra slopes. *Landslides* (2019) (<https://doi.org.ezproxy.waikato.ac.nz/10.1007/s10346-019-01289-2>)

Peat humification records from Restionaceae bogs in northern New Zealand as potential indicators of Holocene precipitation, seasonality, and ENSO

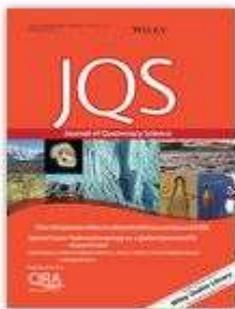
In comparison with temperature reconstructions, New Zealand proxy records for paleo-precipitation are rare, despite the importance of precipitation in contemporary climate variability and for projected climate impacts. In this study, records of mid-late Holocene palaeomoisture variation were derived for two hydrologically separate ombrotrophic Restionaceae bogs in northern New Zealand, based on peat humification analysis. At each site, three cores were analysed for peat humification, facilitating both intra- and inter-site comparisons. Age models for the six sequences were developed using radiocarbon dating and tephrochronology. Twelve tephras (including six cryptotephras) were recognised, four of which were used to precisely link the two sites and to define start and end points for the records at 7027 ± 170 (Tuhua tephra) and 1718 ± 10 cal yr BP (Taupo tephra) (2s-age ranges), respectively. We find individual differences between the six peat humification records at short-term timescales that are presumably due to local site factors, in particular changing vegetation and microtopography, or to changes in the composition of the material analysed. Stronger longer-term coherence is observed between all six records but is attributed to slow anaerobic decay over time because the implied trend towards wetter summers in the late Holocene cannot be corroborated by independent climate proxies. Despite these confounding factors, centennial scale shifts in bog surface wetness are a pervasive feature of all six records with varying degrees of overlap in time that show strong correspondence with El Niño-Southern Oscillation reconstructions from the eastern equatorial Pacific. These results indicate the potential for peat humification records from New Zealand's ombrotrophic bogs to elucidate past climate variability and also demonstrate the importance of developing multiple well-dated profiles from more than one site.

Newnham, R.M., Hazell, Z.J., Charman, D.J., Lowe, D.J., Rees, A.B.H., Amesbury, M.J., Roland, T.P., Gehrels, M.J., van den Bos, V., Jara, I.A. 2019. Peat humification records from Restionaceae bogs in northern New Zealand as potential indicators of Holocene precipitation, seasonality, and ENSO. *Quaternary Science Reviews* **218**, 378-394. (<https://doi.org/10.1016/j.quascirev.2019.06.036>)

Crossing new frontiers: extending tephrochronology as a global geoscientific research tool

A special issue of *Journal of Quaternary Science (JQS)* on tephra studies (the first such collective issue to be published by *JQS* on this topic) has arisen from the work of the International Focus Group on Tephrochronology and Volcanism (INTAV), and the most recent INTAV field conference on tephrochronology held in Romania from 24 June-1 July 2018. The central theme of the issue is 'Crossing new frontiers: extending tephrochronology as a global geoscientific research tool,' which was chosen for three reasons. (1) INTAV, the field conferences and the conference

sessions it helps to organise, encourage both established and emerging tephrochronologists from many countries to cross borders to experience and learn from multiple points of view, and to network with the global community. (2) The geographical frontiers of tephrochronology are constantly being extended, in part by modern, systematic cryptotephra studies. Such studies are continually highlighting the revelation that tephras can be traced over much larger areas than previously demonstrated, elevating tephrochronology from a local- or regional-scale to a hemispheric-scale tool. (3) The ever-increasing number of research studies using tephrochronology, the variety of differing applications, and the new studies in this special issue allow us to cross new frontiers in knowledge and understanding. The special issue [Abbott, P.M., Jensen, B.J.L., Lowe, D.J., Suzuki, T., Veres, D. (editors) 2020. "Tephrochronology as a global geoscientific research tool", *JQS Vol. 35 (1/2)*, pp. 1-379; <https://onlinelibrary.wiley.com/toc/10991417/2020/35/1-2>] comprises 27 articles dealing with varied aspects and applications of tephrochronology along with an editorial (cited below) and an obituary (free open access) for Dr Richard J. Payne (York University), one of the British climbers killed in May 2019 while attempting to climb Peak 6477, a previously unclimbed subsidiary peak of one of India's highest mountains, Nanda Devi. The special issue is dedicated to the memory of Dr Payne, who was a highly regarded tephrochronologist and peatland researcher.



Volume 35, Issue 1-2

Special Issue: Tephrochronology as a global geoscientific research tool

Pages: i-iii, 1-379

January-February 2020

Issue Edited by: Peter M. Abbott, Britta J.L. Jensen, David J. Lowe, Takehiko Suzuki, Daniel Veres

Three key themes are identified and have been used to arrange the articles. Firstly, an initial set of three papers provides perspectives and reviews of differing aspects of tephrochronology. Secondly, three further papers outline the development of new analytical tools and approaches to data analysis that can be added to the tephrochronological toolbox. Thirdly, the final set of 21 papers provides a global tour of research sites and volcanoes, presenting examples of a diverse range of applications of tephrochronology in a variety of depositional settings. The articles in this special issue (Jan/Feb 2020) are to be made available as free open access for 12 months.

Abbott, P.M., Jensen, B.J.L., Lowe, D.J., Suzuki, T., Veres, D. 2020. Crossing new frontiers: extending tephrochronology as a global geoscientific research tool. *Journal of Quaternary Science* 35 (1/2), 1-8. (Free open access for 12 months: <https://doi.org/10.1002/jqs.3184>)

Removal of vanadium from aquatic environment using phosphoric acid modified rice straw

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Bioremediation Journal, DOI: 10.1080/10889868.2020.1724073

Vanadium (V) is a toxic metal, which dominantly exists as V⁵⁺ in an aquatic environment. Rice straw, which is an abundant agricultural by-product throughout China was used to treat V⁵⁺ containing wastewater as an adsorbent after phosphoric acid treatment. The effects of initial V⁵⁺ concentration, solution temperature, pH and reaction time on V removal by phosphoric acid modified rice straw (AcM) were systematically assessed. A pH range of 2.0-3.0 was favorable for V removal and the adsorption capacity of V by AcM increased with elevated solution temperature. The maximum adsorption capacity for water containing 500 mg V⁵⁺ L⁻¹ was 24.70 mg V g⁻¹ dry matter under the optimum operation (3.33 g L⁻¹ AcM, pH = 2.0, 50 °C, and 200 rpm for 4 h). Adsorption experiment data fitted well to pseudo-second-order kinetic and Langmuir adsorption isotherm models. In the presence of coexisting ions, Na⁺, Cu²⁺, NO³⁻ and Cl⁻ had no significant (P > 0.05) effect on V removal. These results indicated that AcM derived from agricultural waste was effective to remove V⁵⁺ from aqueous solution.

He W, Liao W, Yang J, Jeyakumar P, and Anderson C (2020): Removal of vanadium from aquatic environment using phosphoric acid modified rice straw, Bioremediation Journal, DOI: 10.1080/10889868.2020.1724073

Biochar effects on crop yields with and without fertilizer: A meta-analysis of field studies using separate controls

Ye L^{ab}, Camps-Arbestain M^a, Shen Q^a, Lehmann J^{cde}, Singh B^f, Sabir M^g

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Soil Use and Management 36, 2-18

The added value of biochar when applied along with fertilizers, beyond that of the fertilizers themselves, has not been summarized. Focusing on direct comparisons between biochar additions ($\leq 20 \text{ t ha}^{-1}$) - separately considering the addition or not of inorganic fertilizers (IF) and/or organic amendments (OA) along with biochar - and two different controls (with and without the addition of IF and/or OA), we carried out a meta-analysis to explain short-term (1-year) field responses in crop yield across different climates, soils, biochars and management practices worldwide. Compared with the non-fertilized control, a 26% (CI: 15%-40%) increase in yield was observed with the use of IF only, whereas that of biochar along with IF caused a 48% (CI: 30%-70%) increase. Compared with the use of IF only, the addition of biochar along with IF caused a 15% (CI: 11%-19%) increase in yield, indicating that biochar was as effective as fertilizers in increasing crop yields when added in combination. The use of biochar alone did not increase crop yield regardless of the control considered. Whereas in the short term, liming may have partly contributed to the beneficial effect of biochar (>90% was plant-derived) when added along with IF, a separate meta-analysis - using those studies that reported crop yields for different years after a single biochar application - showed a 31% (CI: 17%-49%) increase in crop yield over time (≥ 3 years), which denotes the influence of biochar properties other than liming (i.e. an increase in CEC). Our results also suggest that biochar application rates $> 10 \text{ t ha}^{-1}$ do not contribute to greater crop yield (at least in the short term). Data limitations precluded identification of the influence of feedstock, production conditions or climatic conditions without bias. As the response of crop yield to biochar addition was less a result of climatic zones or soil type than fertilizer use (chiefly N additions), the choice of nutrient addition along with biochar should be priorities for future research and development regardless of the region.

Ye L, Camps-Arbestain M, Shen Q, Lehmann J, Singh B, Sabir M, 2019. Biochar effects on crop yields with and without fertilizer: A meta-analysis of field studies using separate controls. Soil Use and Management 36, 2-18.

Conferences and Training

Eurosoil 2020 - 20th anniversary of the European Confederation of Soil Science Societies

Eurosoil 2020 will take place in Geneva (Switzerland) in 24-28 August 2020. As the conference of the European Confederation of Soil Science Societies (ECSSS), Eurosoil is the soil voice of Europe. Eurosoil 2020 aims at tackling among others the environmental, social, economic and public policy goals related to / impacting soil use and services. In line with the Eurosoil2020 theme "Connecting People and Soil", the conference program will be structured around selected Sustainable Development Goals (SDGs) of the United Nations.

<https://eurosoil2020.com/>

INI2020: 8th Global Nitrogen Conference

The conference will take place on 3-7 May 2020 in Berlin, Germany. The 8th Global Nitrogen Conference of the International Nitrogen Initiative will follow on from the previous conferences held since 1998. This time, the overall framework will be "Nitrogen and the UN Sustainable Development Goals (SDG)". Most of the SDGs are closely interlinked with the nitrogen cycle. Sustainable nitrogen management is therefore a key element in tackling environmental and societal issues on a global scale.

<https://ini2020.com/>

Global Symposium on Soil Biodiversity

10-12 March 2020 - FAO HQ, Rome, Italy

#SoilBiodiversity

Soils host a tremendous diversity of organisms that are fundamental to terrestrial ecosystems. Soil biodiversity drives many ecological processes, including soil formation, nutrient and water cycling, climate regulation, production of food, medicine and fibre, disease and pest control. In the presence of a changing change, land degradation and biodiversity loss, soils have become one of the most vulnerable resources in the world.

For more information check the GSOBI20 website:

[العربية](#) | [中文](#) | [English](#) | [Français](#) | [Русский](#) | [Español](#)

EGU General Assembly 2020

Vienna, Austria, 3-8 May 2020

www.egu2020.eu

Deadline for abstracts submission: 15 January 2020.

Deadline..... For the May 2020 issue of Soil News is Friday 22nd May 2020.

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