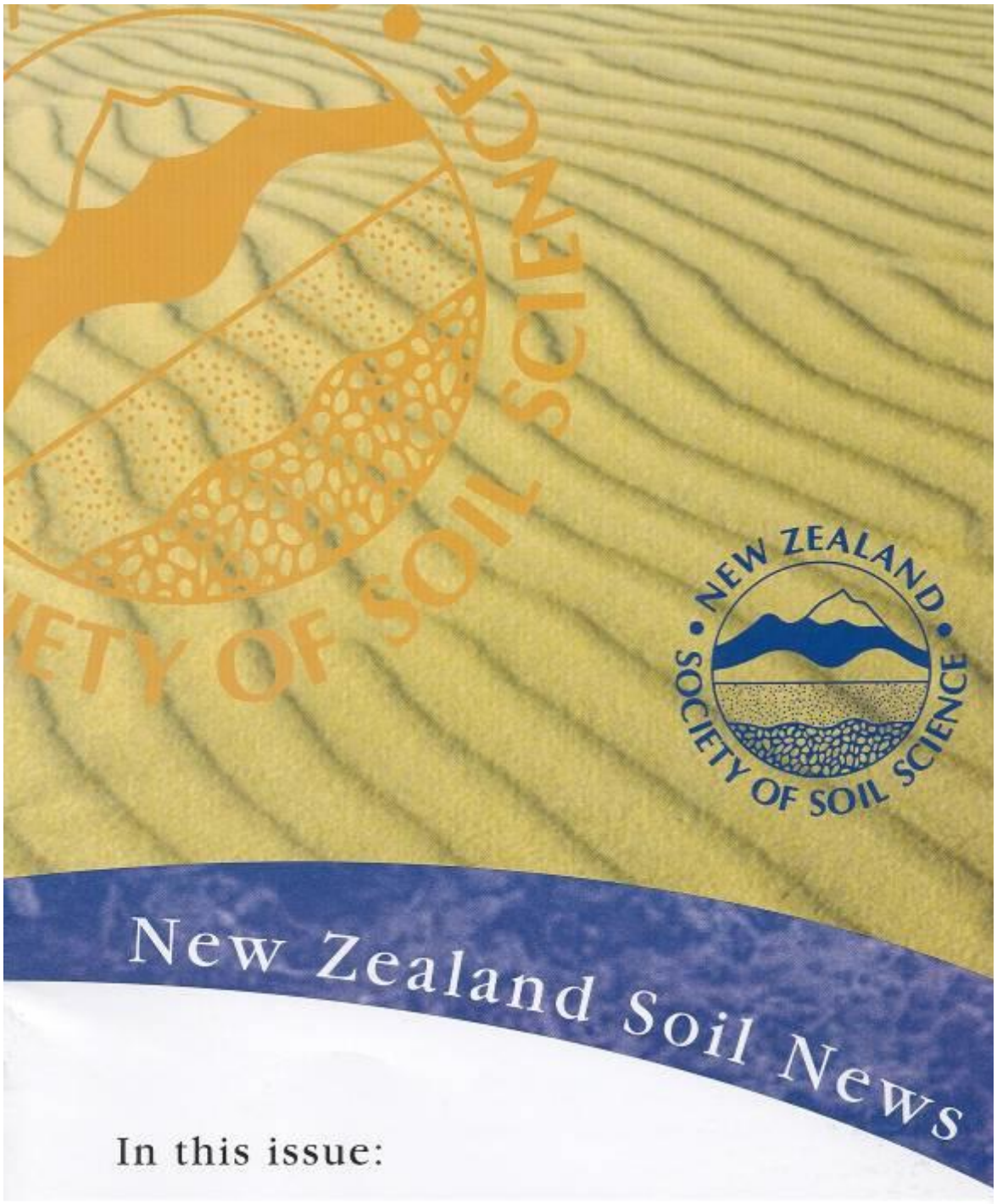

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Your contributions are required - New Zealand Soil News is your newsletter

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Deadline..... for the **August** issue of Soil News is **Friday 19th August 2016**

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New Zealand Soil News

New Zealand Society of Soil Science Officers 2014–2016

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Editorial: Where have our soils gone? By Hamish Lowe

What are the chances that in 10 years' time we will be asking where our high class soils have gone? Should the Auckland political football be used to encourage land sprawl it may be a question facing Aucklanders in less than 10 years. Hot on their heels maybe Hamilton, Tauranga, Christchurch and other growing centres. The rest of us may be asking this question in 30 years' time.

The conundrum that exists with the growth of urban areas and the utilisation of high class soils is often overlooked, and only debated in small gatherings of nostalgic earthlings. It is ironic that the ability to house a growing community comes at the price of losing the land which may best produce the very food that is needed to sustain that growing community; from the perspective of fertility, resilience and proximity.

Soil scientists have a role in presenting facts, and also pointing out the reality that urban sprawl comes at a cost; one that means many areas of high class soils will be lost to roads, pavements, concrete floors and backyard sandpit. While many of us sympathise with the balancing act required to enable cities to grow in a sustainable manner, how many of us contribute to the policies and dialogue?

Urbanisation is regulated in New Zealand through a number of legal statutes, with the key one being the Resource Management Act (RMA). While observers are critical of its many flaws, it also creates opportunities to bring up issues that may not have been adequately examined by consent applicants and regulatory authorities. These opportunities provide stakeholders, being the community, technical specialists (us) and NZ Inc, to have a say on the viability of any proposed land use change.

Soil scientists are often faced with the challenge of separating the emotional loss of an abundant and productive ecosystem (that many may have spent a lifetime observing and understanding) from the ability of using their technical expertise to challenge the thinking of politicians. How many have and continue to offer their views?

The NZSSS' Council have observed a passion about the loss of high class soils and a reluctance to get involved in the debate about the consequence of this loss. As soil scientists, at best we can encourage and promote technically factual debate surrounding the loss of high class soils, and at worst sit silently and do nothing. Decisions will be made and we can at least ensure we contribute to them being informed decisions.

To assist decision makers, the NZSSS Executive Council have prepared a generic submission that members (and others) can use during an application for a land use change consenting process. This submission is generic and not intended to recommend a position; but rather to highlight the need to have a well-informed debate on the consequence of potentially losing high class soils during the processing of that land use consent application.

NZSSS members are encouraged to look at the submission and if appropriate incorporate it into personal or organisational submissions with the obvious modifications. It SHOULD NOT be submitted on behalf of the NZSSS, unless it has been approved by the Exec Council.

Check out the submission on the 'new' website - http://nzsss.science.org.nz/

Hamish Lowe

Obituary – Robin James McPherson – 6/8/37 – 15/4/16

Robin (Rob) was a long serving member of the Department of Soil Science at Lincoln University, spending all 38 years of his working life at the University.

Rob was a Christchurch lad having been educated at Fendalton Open Air primary, Heaton Intermediate in its foundation years and St Andrews College where he was a drummer in the pipe band. As with many of his generation he was called up for compulsory military training (CMT), after which he elected to join the Armoured Corps of the Scottish Regiment as a territorial. He also played the side drum in the Regiment's Pipe Band.

Rob's interest in chemistry evolved from earlier in his youth when, encouraged by his father, he set up a small chemistry lab in their garage. This early interest led to Rob being appointed in 1960 as a soil chemistry technician at Lincoln. As a technician Rob's diverse range of skills were exceptional. He was a very humble person who never seemed to grasp how talented and capable he was. He could turn his hand to any practical task, be it operating a lathe, glass-blowing, welding, repairing electronic equipment and making sophisticated equipment for use in the laboratory and in the field. To quote Neil Smith, "When I was a new technician, not understanding a lot about how to get things done at Lincoln College as it was then, I found Rob very amenable; almost any query I had for him he could answer and point me in the right direction. He knew the administrative side, which he was also involved in as well as the technical side. I remember being impressed one time when wanting to arrange the purchase of some goods and approaching Rob, I found that he knew the charge codes from memory. Rob seemed to be able to solve any problem put to him and the solution would be nigh on perfect for the project at hand. This happened in spite of having very limited resources." Rob's ability to problem solve adapting items to the technical task at hand became legendary.

When Associate Professor Robert Sherlock was beginning a new aspect of soil research studying the release of gases from grazed pastures and soils into the atmosphere, Rob followed on from some ground breaking research by Dr John Freney in CSIRO Australia. Rob visited Dr Freney's lab and learnt how to make the required atmospheric sampling devices, which he subsequently made at Lincoln. These devices had the ability to trap ammonia in relation to the wind speed going through them, so essentially they were wind speed X ammonia concentration integrators as illustrated. Rob was very supportive of new technicians and their training through the Christchurch Polytechnic and as a representative on the Technicians Union. As an example Leanne Hassall who worked with Rob from 1983 to 1998 remembered "when I first started he was very supportive and initially found me some short term part-time work so I could continue to study at the CPIT. I really appreciated this start that Rob gave me".

Both within and outside of the University Rob took a wide interest in science education and helped organize and adjudicate the Canterbury School Science Fairs, made a clever model to illustrate the movement of water from soils into plants and designed simple soil pH kits which were made available at field days. In the late 1970's following the retirement of Arthur Adams, Prof Walker came to depend on Rob for much of the day-to-day organization of the Department, and for overseeing the management of technical needs. This continued for many years and Rob was a major contributor to the Department's continuing development and successes.

Over the years, Rob's contribution to Soil Science at Lincoln was recognized by promotion to Senior Technical Officer. Following his retirement in 1998, Rob and his wife Margaret maintained a working connection with the University as examination supervisors, a role that continued up until 2015 when Rob became unwell. A further interest in retirement was a family history that morphed over 15 years into a treatise on the history and ecology of Lake Ellesmere and of Selwyn District. He was a founder member and past Chair of the Waihora Ellesmere Trust. Rob and Margaret met as Technicians at Lincoln, he in Soil Science and she in Entomology and earlier this year this year had celebrated their Golden Wedding Anniversary.

Philip Tonkin, John Adams and Kirsty McPherson

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Obituary – Noel Anthony Trustrum 1950-2016

Noel Trustrum passed away on 21 April 2016 after a five year battle with cancer, which he confronted with unrelenting determination and positivity. His career as a pre-eminent New Zealand geomorphologist was characterised by excellent science, leadership and friendship, and featured travel and wine – good wine.

Noel was born in Wellington on 27 November 1950. He attended Wellington High School before going on to Victoria University of Wellington where he graduated with a BSc. in Geology in 1973. While still a student at Victoria University he was a member of one of Peter Barrett's expeditions to Antarctica.

Noel and wife Helen moved to Palmerston North in January 1973 where Noel was employed as a scientist by the Water and Soil Division of the Ministry of Works and Development. He was initially employed in a team led by Garth Eyles to work on the New Zealand Land Resource Inventory (NZLRI) - the nation-wide multi-factor inventory and land-use capability survey that forms New Zealand's main land-use planning tool. He began work on the East Coast north of Gisborne, an area he was to return to later in his career, and then worked in the Coromandel and Wellington regions. In those days, with long hair and a beard, Noel looked like a cross between a hippie and a hobbit - a potential Lord of the Rings character who was ahead of his time.

In 1977 Noel and Helen spent a year in Holland at the International Institute for Aerial Survey and Earth Sciences (ITC) where he received a Dip. Soil Science (Distn.). As part of the course he carried out field work in Spain, and it may have been here that he developed his taste for travel, good food and fine wine that he subsequently honed into an art form.

On his return to New Zealand he joined the Remote Sensing Group with Peter Stephens, Doug Hicks, Jonathon Cocks and Meryll White, at the Aokautere Soil Conservation Centre near Palmerston North, where John Hawley was Scientist-in-Charge. Here he researched using different film types for land resource assessment. This grew into a study of onsite impacts of

landslide erosion on pasture productivity in Wairarapa, Wairoa and Taranaki, where he worked with Paul Blaschke, Ron De Rose and Grant Douglas. This was a ground breaking piece of work, which for the first time quantified soil loss and recovery and enabled economic costs to be assigned to landslide erosion. At this time Prime Minister Rob Muldoon visited Aokautere, and Noel showed him the erosion-pasture productivity trial work. And this was at the time when Muldoon's government offered farmers subsidies to develop unproductive land (i.e. marginal and often erosion-prone).

Sam, Noel and Helen's son was born in 1980. During the 1980s and 1990s Noel began international consultancy work related to erosion and catchment management in places such as Hawaii, Solomon Islands, Fiji, Vietnam, Federated States of Micronesia, Japan and Indonesia. This foreshadowed his later role as International Business Development Manager at GNS Science.

In 1988 Noel was transferred to DSIR and then to Landcare Research in 1992. In the early 1990s Noel became leader of several programmes researching controls on sediment and nutrient fluxes, which took erosion research from onsite farm effects on annual and decadal time scales, to offsite cumulative catchment and landscape effects, and ultimately offshore marine effects at time scales of 100s to 1000s of years. This was big picture Source-to-Sink stuff. During this time Noel returned to the East Coast, first at Lake Tutira where, following Cyclone Bola, he worked with Mike Page, and later also Lionel Carter, Alan Orpin, and Hannah Brackley coring the lake bed to obtain a 7,000 year record of environmental change, and especially a record of storm magnitude/frequency. This was one of New Zealand's first truly high-resolution records constructed from lake sediments. It was at Lake Tutira that Noel introduced a young Brenda Rosser to geomorphology. Returning home from such field trips always involved visits to wineries to find the best Gisborne or Hawke's Bay wines.

As the work took on a more global focus, Noel's people and networking skills came to the fore. He developed collaborations with a wide range of overseas organisations and scientists, especially from USA (Basil Gomez, Leslie Reid, Steve Kuehl, Neal Blair, Lonnie Leithold), Japan (Tomomi Marutani, Mio Kasai), France (Herve Piegay), Australia (Gary Brierley), Austria (Thomas Glade), Russia (Aleksey Sidorchuk), all of whom came to work on the East Coast. There were also collaborations with eminent geomorphologists Mike Crozier (VUW) and Denys Brunsden (Kings College, London). The most prestigious of programmes was the MARGINS Source-to-Sink programme, where Noel helped convince US scientists that the Waipaoa catchment near Gisborne was the best place in the world to carry out research on processes and events that shape continental margins.

In 1999 Noel's achievements in erosion research were recognised by the conferment of a Doctor of Science from VUW. One of Noel's major achievements was being instrumental in keeping erosion research and geomorphology afloat during difficult times when redundancies were rife and research funding was even harder to come by than today. An example of this was Noel's leadership of the Erosion Carbon project (identifying the role erosion plays in soil carbon flux) at a time when carbon was sexy and erosion was not.

In 2003 Noel moved to GNS Science as Business Development Manager for Natural Hazards, with a focus on Asia and the Pacific. This was a natural fit, as he loved travel and meeting people. A big part of that work was in Indonesia, where he developed a great love, respect and admiration for the Indonesian people. This is manifest in his book "Aceh Revives" – a series of photographs and essays on the experiences of the people of Aceh during and following the 2004 Indian Ocean earthquake and tsunami, and then ten years later, which shows the remarkable

recovery and resilience of the people. Bali was also a special place for Noel and Helen. They visited regularly and it became Noel's spiritual home during his illness - they had only returned from a visit a few days before his death. One of Noel's lasting legacies is an MFAT-funded programme "Strengthened Indonesian Resilience: Reducing Risks from Disasters (StIRRRD), which he was instrumental in establishing. The goal is to build capacity in Disaster Risk Reduction in disadvantaged Indonesian communities.

Noel's career spanned MWD, DSIR, Landcare Research and GNS Science, a rare achievement. He did some ground-breaking science. His publications have been cited over 2000 times in the international literature. But his career was much more than just his scientific achievements. His work has also benefitted the environment and many communities, in New Zealand and the Asia-Pacific region, where he made many friends with his positive, enthusiastic and inclusive attitude. He was also an inspirational mentor for a number of young staff. More than anything Noel was a people person. Noel had style. He was a great schmoozer. He had the ability to take an idea, find the best people, bring them together in a team, and lead them.

It has been a long journey, but not long enough. Noel packed a lot into that journey. To Helen, Sam and family, we extend our deepest sympathy.

Mike Page, Hannah Brackley, Brenda Rosser

Signing copies of "Aceh Revives" at the book launch.

Article

Geology, landforms and soils of the Waipara and Waikari regions of North Canterbury with an emphasis on lands used for viticulture

Philip Tonkin[1*], Trevor Webb[2*], Peter Almond[1,3], Glen Creasy[1,4], Roland Harrison[1,4], Leanne Hassall[1,3], Carol Smith[1,3]

[1]Lincoln University, Canterbury, New Zealand,
[2]Landcare Research (New Zealand) Limited, Lincoln, New Zealand,
[3]Department of Soil and Physical Sciences,
[4]Centre for Viticulture and Oenology

2015

Looking across the Greystones vineyard to the Omihi Valley and beyond towards Moores Hill, Waipara North Canterbury.

LANDCARE RESEARCH MANAAKI WHENUA

Centre for Viticulture & Oenology

Lincoln University

* retired

Summary

Soils play and important role in grape growing and wine making. Soils anchor the vine and act as a reservoir of water and nutrients essential for growth. Soils influence the vine microclimate and therefore wine characteristics. While the history of winemaking in Waipara can be measured in decades, the soil's history goes back thousands of years, yet it still has a tangible influence on vine and wine. Adding to this is the input of vignerons, whose husbandry varies with place and person, leading to unique wines, expressing their terroir, or sense of place. The influence of soil on wine quality has been discussed and researched for many years, yet there is still much to be understood. This document forms a summary of information about a serendipitous nexus of soil and wine in Canterbury's Waipara and the neighboring Waikari regions. Here, geological processes have resulted in broad range of parent materials on which a wide variety of soils have formed within a relatively small area: a perfect place to start investigating the physical aspects of terroir on wine. From the mid 1980's in the Waipara region and the mid 1990's in the Waikari region of North Canterbury, there have been changes to and intensification of land use, most notably expressed by the development and expansion of viticulture and wine making. In a relatively short span of time, this area of North Canterbury has cemented a reputation for high quality wines, particularly for Pinot noir and Riesling. There are good reasons for this. The region has many soil and landform attributes that suit this land use, including the meso climate with the coastal hills sheltering the region from the cooler easterly winds. Since 1990 the region has been a focus of improved mapping and characterization of the soil resources (which can be accessed online through the Landcare Research digital information system S-mapOnline http://s-map.landcareresearch.co.nz/home) and some more detailed studies as a result of the interest in winegrowing.

The special character of North Canterbury is a reflection of its geological history. The topography of North Canterbury is dominated by a series of north-east trending hills and valleys. This landscape was formed by tectonic compression and faulting deforming the hard basement rocks and the softer cover rock sequence into asymmetrical anticlinal hills and synclinal valleys and basins. The greywacke basement rocks are exposed in the centre of most anticlinal hills and outcrop in the mountains to the west and north-east of this region. The younger Cretaceous to Tertiary cover rocks comprise a layered sequence listed from oldest to youngest, of quartz sandstones, glauconitic sediments, limestones, sandstones and interbedded sandy limestones and weathered conglomerates. These outcrop to form distinctive hilly landforms along the margins of the synclinal valleys and basins. From the late Quaternary to more recent times erosion infilled these valleys with sediments sourced from adjacent hills and the basins with greywacke alluvium eroded from the mountains to the west. Aeolian mantles of non-calcareous loess were regionally sourced and calcareous loess locally sourced from the aggrading floodplains. Detailed soil mapping of vineyards planted between 1980 and 2000 revealed a wide range of soils. New Zealand soil scientists group soils into classes using the specific terminology of the New Zealand soil classification. In summary - bedrock and colluvial hill slopes have Rendzic Melanic Soils developed on limestones and calcareous mudstones (marls), and Typic Immature and Typic Argillic Pallic Soils formed on clayey regoliths derived from glauconitic sediments. Downlands have deep Fragic and Argillic Pallic Soils, formed in non-calcareous loess and Orthic Melanic Soils formed in calcareous loess. On footslopes, fans and terraces there are Orthic Melanic Soils and Vertic Melanic Soils formed in clayey sediments. The terraces and fans have Argillic Pallic Soils formed in both clayey loess and alluvium. On the most extensive terrace gravelly Immature Pallic Soils and Weathered Recent Soils are formed in greywacke alluvium, and Typic Fluvial Recent Soils are formed in the alluvium on the younger terraces and fans.

From 1990, consultancy reports prepared by Drs Philip Tonkin, Peter Almond (Lincoln University) and Mr. Trevor Webb (Landcare Research) reviewed aspects of the geology, landscape history and soils in some North Canterbury vineyards. Hitherto these reports were not accessible to the public, but this document aims to combine this information with that of the former Soil Bureau of the Department of Scientific and Industrial Research and of Landcare Research New Zealand Limited. Hopefully this will increase the winegrowing industry's understanding of how the region's soils came to be and stimulate further research on soils, landscapes and an understanding of terroir as in applies to viticulture and wine production.

This report is organized into 16 chapters, and these can be grouped into three parts. The first part includes this introduction, and chapters on geological history, landform history and an overview of the soils within the Waipara and Waikari regions of North Canterbury. This last chapter includes a summary table listing the landforms, regolith, soils and their New Zealand Soil Classification and maps of the landforms and dominant soil series associated with wine growing in North Canterbury. The second part of the report is ordered using the landform relationships of the predominant soils established in the previous section. This is referred to as a *physiographic order* from the highest and steepest parts of the landscape to the youngest surfaces alongside streams and rivers and on recently active fans. There are eight sections in this part and all available information on the soils' morphology (description) and chemistry are included in this section up to the time of completion of this report. The third part of the report includes three chapters. The first section is a discussion of soil mapping and the definition of terms associated with soil mapping. These include field identification of soil profiles and soil profile description and the definition of soil horizon notation used in this report and field determination of soil texture, consistence and structure. A simple field method for determining the presence of primary and secondary calcium carbonate using a dilute acid is described. This chapter concludes with the New Zealand Soil Classification (Hewitt, 2010) relevant to the soils of North Canterbury described in this report. The next chapter is a discussion on the interpretation of soil chemistry data. The final chapter in this section comprises tables listing the vineyards of the Waipara and Waikari regions of North Canterbury grouped by the dominant soil or combinations of soils within vineyards. The location of Waipara vineyards are plotted on three maps, of the Omihi Valley, north of the Waipara River and the southern part of the Omihi valley, and south of the Waipara River. This information was last updated in January 2014.

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This report is available as PDF file from Associate Professor Roland Harrison, Centre for Viticulture and Oenology, Lincoln University. Email <roland.harrison@lincoln.ac.nz>
Article

Article – Curious Minds and the Science of the Spud

PFR Lincoln have been doing some work for this MBIE Curious Minds project for school children and Trish Fraser has been at the front of it here doing a fantastic job of getting science over to these kids.

Says Trish Children from the local 'Lincoln school cluster' (includes Lincoln, Ladbrooks, Springston, Tai tapu, Prebbleton and Broadfields schools) are visiting Plant & Food as part of an "MBIE Unlocking Curious Minds" project that we are carrying out at the moment.

One of the main aims of the project is to inspire children about science and give them a greater appreciation of the role and importance of science in their daily lives. We are going to use potatoes as a theme to show the children various aspects of research that we conduct at Plant & Food Research – covering science topics ranging from the paddock to the plate.

Curious minds and the science of the spud

The potato may not be the obvious choice as a means of inspiring young minds about science, but that's precisely the point for Plant & Food Research soil scientist Dr Trish Fraser.

Dr Fraser and colleagues recently hosted more than 300 primary and intermediate students from six Selwyn district schools at Plant & Food Research's Lincoln site, taking them on a scientific journey in sustainable production, crop protection, breeding and biotechnology, and food and nutrition, with the potato holding centre stage.

The visits were part of a project funded through the Unlocking Curious Minds programme – a Ministry of Business, Innovation and Employment (MBIE) initiative which aims at enhancing the role and awareness of science in the community through public engagement and participation. Researchers and research teams from across the country put proposals forward for funding approval under the scheme.

"The aim of our Unlocking Curious Minds project is to inspire children about science by giving them a greater appreciation of the important role it plays in their daily lives, and with things we can easily take for granted," says Dr Fraser.

"We tend to think science needs to have an obvious or dramatic 'gee whiz' aspect to be interesting, but we can miss the fascinating science that plays out around us every day, either through natural processes or the work of scientists themselves.

"We used the potato for the project because children can easily relate to them, especially through their love of chips. So this humble vegetable provides a great vehicle for explaining how plants are bred for different purposes, how we use scientific methods to fight pests and diseases, how growing plants can affect the environment, and the range of behind-the-scenes science that gets the crop from paddock to plate.

"We want to show the students that something that might seem mundane actually has a fascinating science story to tell. In so doing, they gain a better understanding of the properties and processes of the living world."

The programme was repeated over three sessions throughout the week, with the students receiving presentations and taken on a tour to research stations on Plant & Food Research's Lincoln site, where they then participated in science demonstrations.

Dr Fraser's Unlocking Curious Minds project also includes an upcoming workshop for teachers, which aims at identifying opportunities to better support their science teaching endeavours, thereby enhancing the engagement of students with the subject.

"Primary and intermediate teachers can be responsible for many subjects, but cannot be experts in everything. The school environment can make it tricky to juggle all of these teaching responsibilities, with science often perceived as time consuming and difficult to teach," says Dr Fraser.

"Research has shown that while children start school with enthusiasm, their motivation for subjects such as science can decrease as they progress into intermediate school. An important part of this programme is to explore ways of building the teacher's toolkit to help ensure students maintain an interest in science later in life."

The MBIE programme is a collaboration between Plant & Food Research and the Lincoln Ngā Mā tā puna o Ngā Pā kihi Learning Community Cluster with support from Potatoes New Zealand and Lincoln New World.

Trish Fraser describing what makes potatoes grow to Lincoln primary school children

Trish Fraser shows the root distribution of a potato plant and explains how differing soil types affect water holding capacity to Ladbrooks school children

Article

New and improved version of Landcare Research's Soils Portal launched

Landcare Research launched a new version of its well-used soils portal in May. A result of a busy 6 month's effort of requirements gathering, design and implementation, key features include a refresh of the content and a site designed to now work on desktop, tablet and mobile platforms. A major focus of the redevelopment has been to provide our users and stakeholders with a better launch pad to our soil information services.

The site continues to provide information on the wide variety of soils information collected and managed by Landcare Research. This includes national mapping datasets of soil and land resources such as the New Zealand Land Resource Inventory (NZLRI), nationally significant databases such as the National Soils Database (NSD), regional soil mapping for a number of regions with S-MAP, soil quality indicators for regions and soil orders in the form of SINDI as well as a multitude of legacy (older) soil surveys predating these datasets. Downloadable datasets are also available from the LRIS portal.

The new site provides the soils and informatics teams at Landcare Research with a great platform for further iterations of the soils portal, developing richer content to better deliver to the needs of our users. Whilst the development team has engaged with a number of users internal and external in the design of the new site, we'd love to hear the experiences of society members, how they find the user experience of the soils portal and if the site was able to deliver the content they required.

You can find the new Landcare Research soils portal at
https://soils.landcareresearch.co.nz/
We'd also encourage you to check out our new National Soils Data Repository site, the place to go to access the National Soils Database, and a new version of the soil map viewer. You can find links to these sites on the portal or go directly to the sites using the links below.

https://viewer-nsdr.landcareresearch.co.nz/search
https://soils-maps.landcareresearch.co.nz/

Any feedback, positive and negative, would be greatly appreciated by contacting the team through Jim Payne at payneje@landcareresearch.co.nz.

Robert White & Brian Davidson

Myths about Carbon Storage in Soil

Goals of sequestering carbon in agricultural soil ignore the law of diminishing returns.

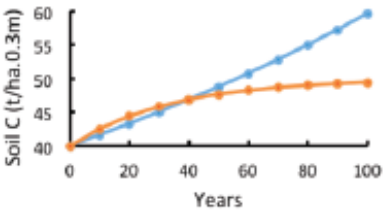
Direct-drilling through cereal stubble will not achieve much net carbon abatement that can be set against Australia's greenhouse gas emissions. Credit: CSIRYT/Defreese

The idea that an increase in the carbon content of the world's soils could substantially offset greenhouse gas emissions has been enthusiastically promoted by politicians and environmental groups. It arises because the amount of organic carbon in the world's soils is impressive – some 1500 billion tonnes to a depth of 1 metre, which is about twice the amount of carbon in atmospheric carbon dioxide.

This carbon is stored in soil primarily as organic matter, comprising the residues of plant material, animal excreta and dead organisms. Although it's also present in insoluble carbonates, these are much more stable than soil organic matter and not very amenable to human manipulation.

A prominent example of this idea is the "4 per 1000 Initiative" launched by the French Ministry of Agriculture at the COP21 meeting in Paris last December (www.4p1000.org). The thinking is that even a small annual increase of 0.4% in soil carbon, averaged over all soils, would not only improve soil fertility and agricultural production but would also help to limit the global temperature increase to 1.5–2°C, as advocated by the Intergovernmental Panel on Climate Change.

While this may be a laudable aspiration, the concept is flawed. It implies that soil carbon will increase by a slightly bigger increment each year as the amount of carbon in the soil increases, in an analogous way to the effect of compound interest on money in a bank.



As shown by the blue line in the figure, the effect can be approximated by an exponential model. However, we know from many field studies of soil carbon changes that, following the addition of extra organic residues, the soil carbon content rises asymptotically to a new steady-state maximum according to the "law of diminishing returns" (as illustrated by the orange line in the figure). Although the result of this behaviour is little different to the "4 per 1000" model over the first few decades, the end result after 100 years (when the change is deemed "permanent") is very different.

A similar flaw occurs in the Australian government's methodology for estimating carbon sequestration in soil as part of the Carbon Farming Initiative (http://tinyurl.com/gmf4vgl). In this methodology, a linear increase in soil carbon is calculated according to prescribed land management actions and site location for a period as long as 100 years. Again, although the assumption of a linear increase in soil carbon is reasonable for 25 years or so, it does not hold for longer periods up to 100 years.

Although "sustainable intensification" (e.g. nutrient management, new irrigation, managing soil acidity and pasture renovation) and stubble retention (where plant residue is left on top of the soil after harvest) are desirable from an agronomic viewpoint, we have reported that this will not achieve much net carbon abatement that can be set against Australia's greenhouse gas emissions (www.tinyurl.com/hzh825q). The main reason for this is that at a carbon price of $12–14 per tonne of CO_2-equivalent there is no financial incentive for a farmer to make the change, except in the case of liming acid soils and stubble retention.

With regard to stubble retention, national uptake is also limited because many cereal farmers in southern Australia are already retaining stubble and hence would be ineligible under the Carbon Farming Initiative. Furthermore, when stubble is retained, a new crop needs to be seeded by direct drilling (commonly called "no-till"). A recent review in *Nature Climate Change* of no-till globally has shown that the benefits of no-till for carbon accumulation, and hence carbon abatement, have been overstated (www.tinyurl.com/zy7algk).

We conclude that although actions to build up soil carbon as organic matter are desirable to improve soil fertility and agricultural productivity, sequestering carbon in agricultural soils will not provide a major offset for greenhouse gas emissions. A focus on these actions should not distract policy-makers from more direct methods of reducing emissions in agriculture and other industries.

Robert White is Emeritus Professor and Brian Davidson is Associate Professor in The University of Melbourne's Department of Agriculture and Food Systems.

A New Look

The NZSSS has weathered on the outside; and I am not referring to the people. The way you see and interact with the NZSSS' through written, electronic and social media is changing. We have just been through an overhaul to revamp how things look, and you can expect to see changes to the branding and imagery of the Society's communications and publications rolled out over the next few months".

We have been very fortunate to have the assistance of **Marianne Coleman of iDesign** who has helped with a spruce up of our branding and how things look. This includes a complete revamp of our website. All of the resources are still available, but we've upgraded things in the background to be more modern, and it's now even mobile friendly.

We'd love to hear what you think about the rebranding and website. Please let us know if you have any suggestions for further improvements, or ideas for other material we could include. Please send any comments to nzsss@groundworkassociates.co.nz or hamish@lei.co.nz

Have you liked us on Facebook?

Unless you've been living under a lump of greywacke, you will already be aware of the importance of social media, and the benefits of having an active presence. The NZSSS has a Facebook page and Twitter handle (@NZ_Soil_Soc). If you are already a user, please follow us. If you are new to social media, or not sure about getting involved, you can now keep an eye out for new NZSSS posts by checking the feed from our website:

http://nzsss.science.org.nz/

New Zealand Soil Science Society Awards 2016

Award	Presented	Nomination Deadline	Eligibility	Conditions
Bert Quin Award	Annual	31 July 2016	Advanced level in PhD study (not yet completed)	Head of the Soil and Earth Science Groups at New Zealand Universities can nominate one student who is an active member of NZSSS.
The Grange Medal	Bi-annual (conference year)	31 July 2016	Open to non-members, members, fellows, or life members of NZSSS	Any active member of NZSSS can nominate non-members, members, fellows, or life members of NZSSS.
Morice Fieldes Memorial Award	Annual	31 July 2016	PhD thesis submitted within the previous calendar year	Head of the Soil and Earth Science Groups at New Zealand Universities can nominate one thesis from their group.
Sir Theodore Rigg Award	Annual	31 July 2016	MSc thesis submitted within the previous calendar year	Head of the Soil and Earth Science Groups at New Zealand Universities can nominate one thesis from their group.
Undergraduate award	Annual	21 Nov 2016	Best 3rd year student in Soil and Earth Sciences	Head of the Soil and Earth Science Groups from Massey, Lincoln and Waikato Universities should nominate one student.
Leamy award	Bi-annual (conference year)	31 July 2016	Author(s) of most meritorious publications in the last three years	Any active member of NZSSS can nominate active members from Universities, CRIs and other organizations (e.g. Regional Councils).
Blakemore award	Bi-annual (conference year)	31 July 2016	Technician/ support staff	Head of the Soil and Earth Science Groups at New Zealand Universities, CRIs, and other organizations (e.g. Regional Councils) can nominate one active member from their group.

Bert Quin Award

1. The award recognises the efforts and present or likely contribution to New Zealand soil science arising from a Doctorate study.
2. Eligibility: - A postgraduate (Ph.D) student working on the properties, productivity or sustainability of New Zealand's soil and land resources who is about to enter their third year of study.
3. The annual award shall be known as the Bert Quin Award and shall carry a stipend of $5000 for one year.
4. Nominations must be received in writing from the Head of Department or Group, or delegated academic staff member with two other signatories by the **31st of July**. Nominations should include a CV and a supporting statement of not more than two pages. Only one nomination will be accepted from each University Department/Group.
5. The award shall be judged by a subcommittee designated by Council.
6. To be eligible, 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.
7. The Award shall be presented or announced at a General Meeting of the Society.

The Grange Medal

The L.I. Grange Medal for Outstanding Service to New Zealand Soil Science
(Short title: The Grange Medal)

Description

The Grange Medal is for outstanding service to New Zealand soil science. It commemorates Dr Leslie I. Grange's extraordinary leadership and service to New Zealand soil science through his pioneering pedology, his far-sighted and constructive administration, and for his pivotal role in helping establish the discipline in New Zealand*. The Grange Medal is normally made every two years to one or two individuals who have made an extraordinary contribution to the promotion or advocacy of soil science (in its broadest sense) including for the following reasons:

- through outstanding use of the media,
- through outstanding administration or management,
- through outstanding publications including outreach/extension and other ('non-academic') material (e.g. development of a DVD or CDR),
- through outstanding advocacy of soil conservation or sustainable land-use practises,
- through outstanding mentoring.

Nominations are open to both non-members of the Society as well as members, fellows, or life members of NZSSS.

Nominations

Nominations every two years are made by two or more active members of the Society in the form of a statement up to two pages in length that summarises the extraordinary contribution the nominees have made to the promotion of soil science in New Zealand. Nominations are due by **31 July** in the year of the award. The awards are decided by the president, vice-president, and immediate past president on advice from Council. The medal is normally awarded at the Society's biennial conference or at the four-yearly Australia-New Zealand joint soils conference. In special circumstances and at the discretion of the Council the medal may be awarded more frequently.

*A summary of Grange's career is given in *New Zealand Soil News* 55, p.177-180 (2007)

Postgraduate awards (Morice Fieldes Memorial Award and Sir Theodore Rigg Award)

1. To be eligible for the awards, theses must have been presented for a degree which was awarded by a university council in the calendar year immediately prior to its submission to the Society (for the purposes of these rules, "awarding of the degree" implies approval in the previous year, not necessarily actual conferring of the degree at a graduation ceremony).
2. The awards are open to all degree candidates irrespective of their status as full or part-time postgraduate students or as university or research institute staff members.
3. The awards will be judged by a committee of three persons appointed annually by the Council of the New Zealand Society of Soil Science. The committee shall have the power to seek the opinion of others to help decide whether a thesis is of outstanding merit, provided that opinion is not sought from the supervisors or examiners of the thesis.
4. The committee shall normally recommend one award in each category each year, but in exceptional circumstances the committee may recommend up to two awards in each category.

M.L. Leamy Award

This award commemorates the outstanding ability and contributions to New Zealand Soil Science of Mike Leamy, and is made to the author or authors of the most meritorious New Zealand contribution to soil science, published in the last three years. A single paper, a series of papers on a theme, a scientific paper, a map or a lecture series may qualify a person for the award. The results of joint authorship will be considered where the candidate is senior author and has other eligible publications.
Nominations must be received in writing accompanied by a statement of not more than two pages listing the candidate's achievements and publication(s) etc that are to be considered for the award. Nominations must carry signatures. No self-nominations will be accepted. The candidate and both Nominators must be fully paid members of NZSSS.

L.C. Blakemore Award

This award honours the outstanding ability and contributions to New Zealand Soil Science of Les Blakemore and is awarded to the outstanding New Zealand Soil Science Technician or support staff member of the past two years. Eligibility is open to all aspects of technical and support work that assist soil science, for example analyses, field trials, cartography, computing, data storage and manipulation, archiving etc. Candidates shall have been employed in the field of soil science for at least three years, have shown marked ability in their field of employment and have made a notable contribution to the work of their institution, field team etc.
Nominations must be received in writing accompanied by a statement of not more than two pages detailing the candidate's achievements and worthiness for the award. Nominations must carry signatures. No self-nominations will be accepted. The candidate and both Nominators must be fully paid up members of NZSSS.

Nominations should be sent to:

Dr Haydon Jones
Land and Soil Scientist
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
Hamilton 3240
New Zealand
Haydon.Jones@waikatoregion.govt.nz

Fellowship of the New Zealand Society of Soil Science

Fellowship of the Society is an honour conferred for distinction in any or all of the following areas; research, technology, teaching, extension and/or the advancement of soil science. **Nominations close on 31 July each year**.

FELLOWSHIP RULES

Rule 1. Nominees must be active members of the Society at the time of nomination.

Rule 2. Nominations must be made by two Full Members, or Life Members of the Society. Nominations cannot be made by members of the Fellowships Committee of Council.

Rule 3. Nominations for the Fellowship must be submitted to the **NZSSS Secretary by 31 July** each year, and should be accompanied by the following documents:

* Fellowship Nomination Form (available from http://nzsss.science.org.nz/awards.html);
* Three copies of the Fellowship Nomination Summary Form (available from the Secretary);
* Three copies of the nominee's curriculum vitae;
* Three copies of the nomination statement prepared by the nominators of up to 500 words, stating why, in the view of the nominators, the candidate is worthy of becoming a Fellow;
* Where applicable, three copies each of up to five of the nominee's most significant publications or other works.

Rule 4. Fellowship nominations will be judged by the Fellowships Committee of Council, consisting of the President, Vice-President, and Past-President. Fellowships will be endorsed by Council.

Rule 5. Normally up to two Fellowships may be awarded in any one year, except in the first two years when up to a total of twelve Fellowships may be awarded.

Rule 6. Fellowships will be announced at an Annual General Meeting of the Society.

Rule 7. Nominations will remain valid for 2 years.

Rule 8. Fellows will be permitted to use the letters FNZSSS after their name and will receive a certificate.

Soil Science Australia

SOIL SCIENCE AUSTRALIA

Dear Members,

It with is with jubilation that I extend the message received acknowledging the election of prominent Australian Soil Scientist Professor Alex McBratney CPSS as a Fellow of the Australian Academy of Science. https://www.science.org.au/fellowship/fellows.

On behalf of Soil Science Australia, I extend our congratulations to Alex for this outstanding achievement - an acknowledgement for his leadership in the disciplines of Soil Science and Precision Agriculture with his conceiving and development of pedometrics, digital soil mapping and soil security.

Professor Alex McBratney CPSS joins other distinguished Soil Science Australia members as Academy Fellows, including CPSS Board Chair and Soil Science Australia member, Professor Michael McLaughlin CPSS (elected in 2015), South Australian members Professor Andrew Smith, Professor Sally Smith and Western Australia member Professor Jim Quirk .

Another notable to join Australian Academy of Science Fellows (elected in 2016) with an interest is soil science is Dr John Kirkegaard - an outstanding agricultural scientist who has made major contributions towards improving agricultural productivity through among many resources including soil management, both nationally and internationally.

Not only is this a great achievement for Alex but I am sure it will raise the overall profile of soil science.

Yours Sincerely,

Tim Overheu CPSS

President Soil Science Australia

ASA-CSSA-SSSA – Science News

Links to science news that may interest you:

Mechanisms of early microbial establishment on growing root surfaces
Bacteria in the soil play a major role in cycling nutrients, breaking down
Read More >>

U.S. companies make case for keeping Cuba organic
Cuban farms could one day help to feed Americans' burgeoning appetite
Read More >>

2016 Global Food Policy Report: How we feed the world is unsustainable
The International Food Policy Research Institute today released its flagship
Read More >>

Companies begin embracing GMO labeling
More food companies are voluntarily disclosing if their products contain
Read More >>

Carbon farming is a zero-risk strategy for curbing climate change
Now that 195 nations, including the U.S., have agreed to ambitious greenhouse
Read More >>

One crop breeding cycle from starvation
In the race against world hunger, we're running out of time. By 2050, the
Read More >>

How Japan is combatting a decline in farming
The earthquake, tsunami, and resulting nuclear disaster that rocked Japan's
Read More >>

~Asia's insatiable lentil lust means farms switch to pulses
The humble pea is taking over. With vegetarians in Asia hungry for lentils
Read More >>

Half the world to face severe water stress by 2030
Without altering current levels of water consumption and pollution, almost
Read More >>

Meet a tractor that can plow fields and talk to the cloud
At the trendy South by Southwest conference in mid-March, there was buzz
Read More >>

Waikato/Bay of Plenty

AgResearch Ruakura

Stewart Ledgard and **Natalie Watkins** have been working with a group of 25 Tatua dairy farms in an SFF project examining the environmental effects of increased use of brought-in feeds on farm. OVERSEER and Life Cycle Assessment models were used to examine nitrogen and phosphorus losses as well as wider environmental indicators. A recent field day on one of the case farmers drew over 40 farmers to learn of the relatively small on-farm impacts but increased effects when all off-farm contributors were included.

Gina Lucci, **Dave Houlbrooke**, and **Scott Fraser** (Landcare Research), along with representatives from DairyNZ, Waikato Regional Council, and Ballance AgriNutrients a are all working together with a group of farmers on Peat as part of a three year SFF project looking at the sustainable management of Peat soils in the Waikato. A field day was held in April at Orini Downs to report on spring N response trials, progress on the classification of peat soils, and general information on effluent and fertiliser use on peat soils (Pictured, right). In addition, two farmers from the project team also gave presentations about their innovative was of managing peat on their own farms.

Stewart Ledgard and **Jiafa Luo** hosted a visit by several researchers from the Chinese Academy of Science (Pictured below) to progress a joint China-NZ project on dairying effects on water quality and water footprinting. They visited a dairy farm and attended the SFF field day and kept commenting on our beautiful green rolling countryside (we forget about this until we visit intensive crop-based Chinese farms!).

Dave Houlbrooke, **Jiafa Luo** and **Seth Laurenson** visited China in early March to help close off a collaboration with the Chinese Academy of Science, Tsinghua University, Fonterra, MFE and the Chinese Ministry of Environmental Protection. A two year trial has now been completed looking at land application of dairy effluents and solids and has demonstrated its suitability as a fertiliser source for agronomic benefits while decreasing the loss of N leached compared to a more traditional fertiliser regime. The successful collaboration was officially marked by the presentation of a plaque (Pictured above) by Prime Minister John Key during his April visit to China.

Lincoln Agritech

Compiled by Roland Stenger

NEW RESEARCH

TRANSFER PATHWAYS PROGRAMME (TPP) – NEW RESEARCH TO DETERMINE PATHWAY-SPECIFIC CONTAMINANT TRANSFERS FROM THE LAND TO WATER BODIES

It has been well established that land use (source) can only be defensibly linked to an effect on a receiving water body (receptor) if the critical transfer pathways and the hydrological and biogeochemical processes that occur along them are understood. Depending on the natural setting of the catchment and the contaminant concerned, surface runoff, interflow, artificial drainage, shallow and deep groundwater may be critical pathways. Accordingly, the Transfer Pathways Programme (TPP), which was successful in the MBIE 2015 investment round, has been developed to quantify pathway-specific transfers of nitrogen (N) and phosphorus (P) that take lag times (Fig. 1) and attenuation potentials (Fig. 2) of the different pathways into account.

The multi-disciplinary research team, comprising scientists from Lincoln Agritech, Aqualinc Research, Environmental Science and Research, Plant and Food Research, Lincoln University and Landcare Research, has started working closely with industry partner DairyNZ and council partners (Waikato Regional Council, Environment Canterbury, Marlborough District Council), as well as iwi on achieving the programme's aims. By 2018, we aim to have established how N and P transfer is partitioned across the pathways relevant in four case study areas.

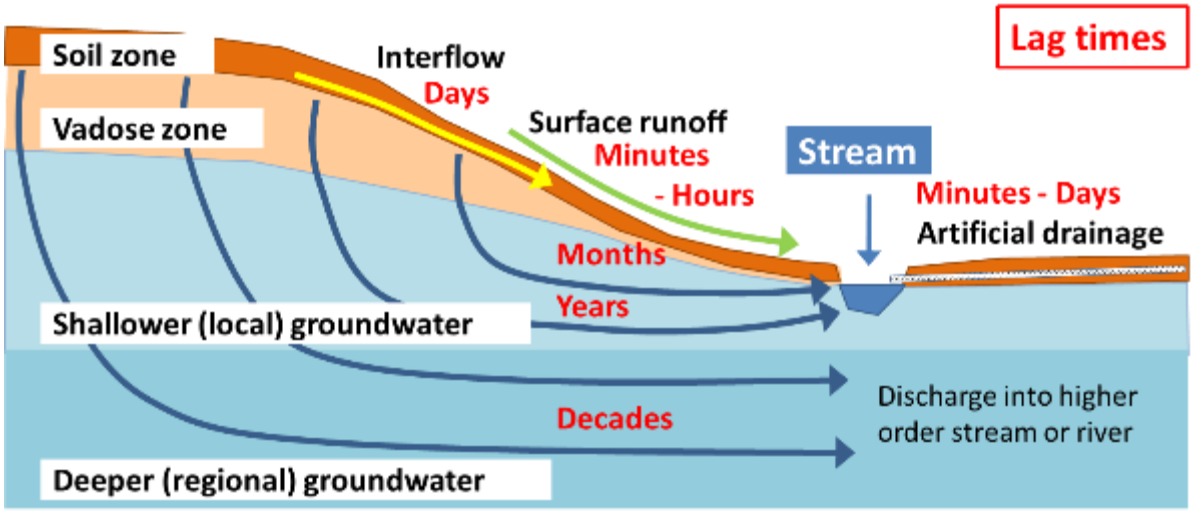


Fig. 1: Schematic of typical lag times associated with different transfer pathways.

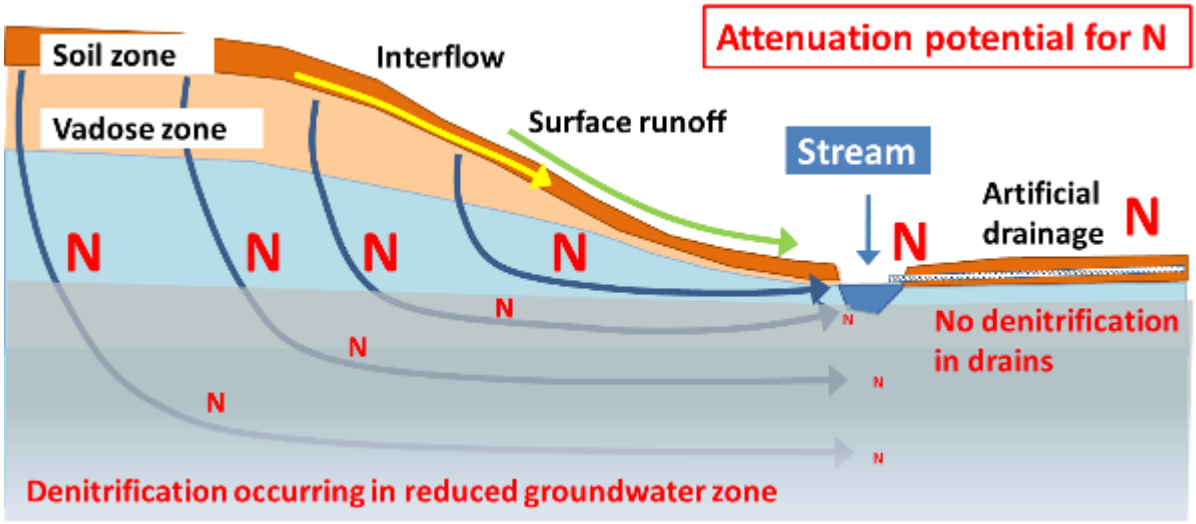


Fig. 2: Schematic of nitrogen attenuation potential in reduced groundwater zone (left) vs. by-passing of that potential in artificially drained land (right).

The temporal and spatial variation of pathways feeding spring-fed streams, particularly Spring Creek, will initially be our focus on the Wairau Aquifer case study. Groundwater modelling for this area is already at an advanced stage due to earlier work carried out by team members. Building on a conceptual groundwater model developed by ECan, we will investigate in the Ashley-Waimakariri case study how the different pathways, combined with the geochemical environments, control the contaminant transfers to terminal groundwater discharge locations (springs, estuaries, or off-shore). We will determine the vertical variation of nitrate in groundwater near the water table and use a continuous nitrate sensor giving high resolution data to distinguish different sources and pathways. The relationships between land uses, soil types, anoxic groundwater and sediments, and the concentrations of P in shallow groundwater and

receiving waters in the coastal zone (shallow lakes, estuary and streams) will also be investigated.

Quantifying water, N and P fluxes leaving artificially drained land is the focus of the Hauraki case study (field sites near Tatuanui and Waharoa). This work includes quantifying the episodic transfer of contaminants via near-surface lateral pathways (subsurface and surface drains) to local streams, as well as vertical recharge into the underlying groundwater system.

Initially, research in the Upper Waikato case study area is focussing on the five sub-catchments (Waiotapu, Otamakokore, Tahunaatara, Mangakino, Pokaiwhenua) for which long-term surface water flow and chemistry time series exist (from WRC, NIWA, Mighty River Power). Upon analysis of this data using a range of data stratification and hydrograph analysis techniques we will select two contrasting sub-catchment for more in-depth field studies and modelling (incl. spatially distributed groundwater models).

The development of a catchment typology scheme will facilitate the application of our new transfer pathway understanding in other, less well studied catchments. Concurrently, we will apply an iterative modelling framework to integrate existing data of different types and quality, identify knowledge gaps, characterise and quantify fluxes, analyse uncertainty, and ultimately derive simplified models for management purposes.

For more detail on TPP please contact Roland.Stenger@lincolnagritech.co.nz or see http://www.massey.ac.nz/~flrc/workshops/16/Manuscripts/Paper_Stenger_2016.pdf

PERSONNEL CHANGES

Blair Miller joined LAL in October 2015 as new Group Manager for LAL's Environmental Group and is based in our head office on the Lincoln University campus.

Blair grew up on a mixed cropping and dairy farm on the Taieri Plains south of Dunedin. His academic background includes a Bachelor of Science majoring in Physical Geography from the University of Otago, focussing on hill slope hydrological processes; and a PhD in Environmental Physics, based in the Soil and Physical Sciences Department at Lincoln University, where he developed water balance models for agro-forestry farming systems. In 2009, he completed his MBA degree at Canterbury University to complement his scientific training.

Blair brings to Lincoln Agritech 20 years of industry experience. He has solved environmental management issues for a wide range of areas including the mining, forestry, agriculture and tourism sectors. Blair has managed his own consultancy firm and has worked in a number of large corporate businesses.

Tasman McKelvey joined LAL in February as an Environmental Monitoring Technician and is based in our Hamilton office.
Tasman is a graduate from the University of Waikato and has a background in Earth and Ocean Sciences. Before joining LAL, Tasman worked with science and environmental monitoring teams at Auckland Regional Council, Bay of Plenty Regional Council and eCoast in Raglan. At LAL, Tasman will focus on environmental monitoring and groundwater management.

Manawatu/Hawke's Bay

Landcare Research

Scott Fraser has been mapping peat lake catchments in the Waikato as part of the Living Waters programme (a partnership between DOC and Fonterra). Farm-scale soil maps have been produced that allow end users to access soil information from the S-map database for all farms within four Waikato peat lake catchments. The soil maps were developed from field observations, but also drew on existing 1:30,000 soil survey maps dating back to the 1930's as well as from knowledge developed during current 1:50,000 mapping in the Waipa catchment for S-map. This new soil information will help inform catchment nutrient models.

Photo 1: Road cutting near Lake Areare showing soil parent materials of the surrounding hills – Hamilton ash over Kauroa ash over Walton Subgroup (pumiceous alluvium). The pale layer mid-photo is the Rangitawa tephra which forms the base of the Hamilton ash (Photo provided by Scott).

Malcolm McLeod and **Danny Thornburrow** have been busy taking topsoil samples for near-saturated hydraulic conductivity cores; which they do annually in the same paddock. But this year they were unlucky enough to find the water supply line at only 4 cm deep which required a bit of emergency plumbing work.

Photo 2: Danny trying not to get too wet (Photo provided by Malcolm).

Malcolm also met with the Governor General **Sir Jerry Mateparae** at the farm of **Mike and Sharon Barton** farm at Tihoi, near Lake Taupo, where they have established a large scale lysimeter facility. Malcolm discussed how his work with the lysimeters has shown that the long-term N leaching from cut-and-carry lucerne is similar to that from ungrazed ryegrass/clover pasture. There is a spike in N leaching under the lucerne from cultivation. **Malcolm** has also recently received an award for Outstanding Services to the NZ Land Treatment Collective.

Photo 3: Malcolm (check shirt on right) with the Governor General and other visitors at the Tihoi lysimeter facility (Photo provided by Government House).

Michael Marden (Landcare Research Gisborne) and **Suzanne Lambie** have been scaling the hill country around Lake Tutira and Owetea (north of Gisborne) to assess the above and below ground characteristics of mānuka planted for honey production. They have been concentrating on the effect of landform terrain on mānuka growth performance and its relationship to erosion control on marginal land. This year they have excavated 27 trees from the Owetea site and 12 from Lake Tutira hillslopes, with the help of Hawkes Bay Regional Council and Gisborne District Council, to assess if landform influences root growth.

Photo 4: Root system of a three year old mānuka tree excavated from Owetea showing that one "tree" may actually be made up of several (Photo provided by Suzanne).

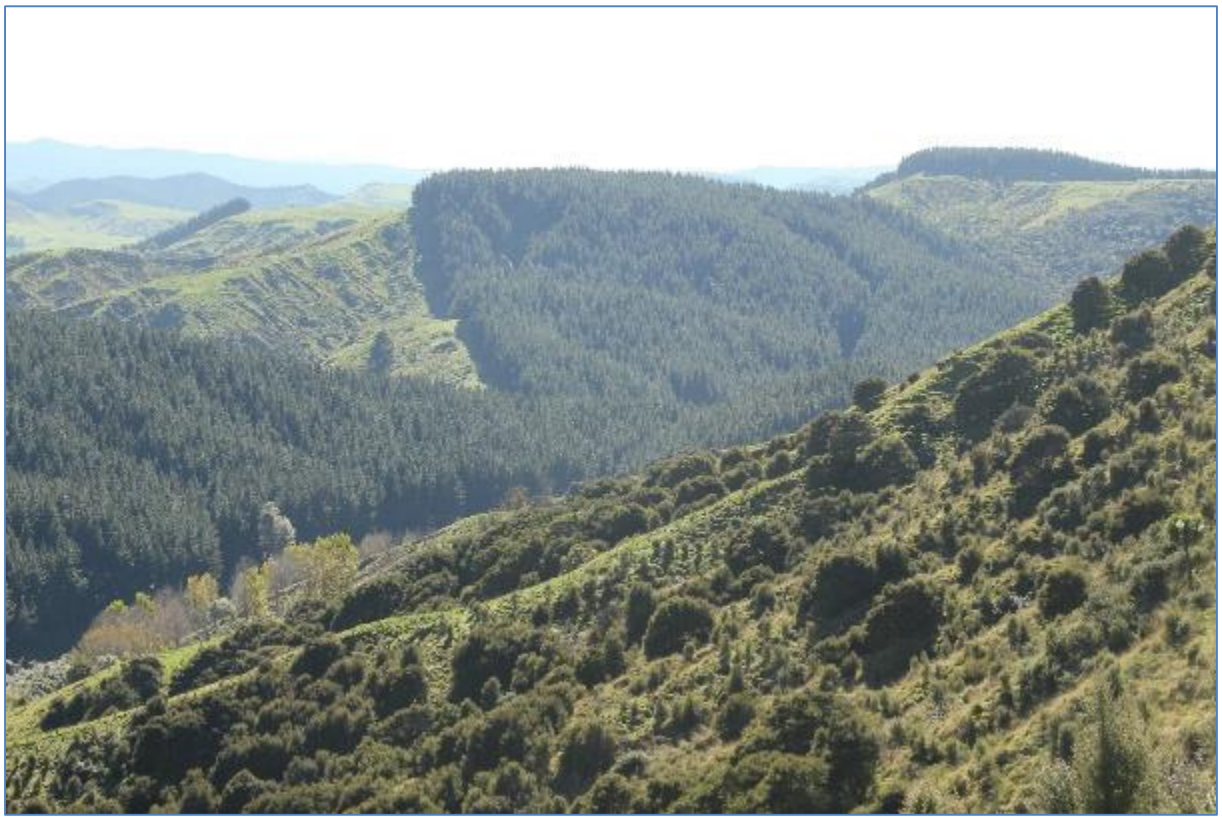


Photo 5: Plantings of four year old mānuka trees (foreground) on the hill slopes surrounding Lake Tutira; the height of the planted trees ranged from 2.0-3.5 m tall (Photo provided by Chris Phillips, Landcare Research Lincoln, who contributed to field work (including his photographic skill) at Lake Tutira).

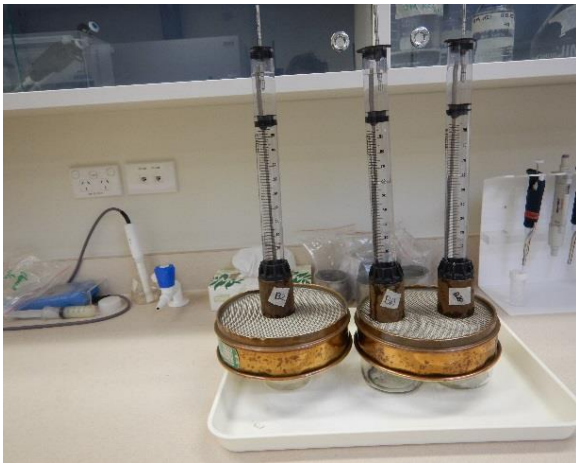
Paul Mudge, in association with collaborators from Landcare Research, AgResearch and the University of Waikato, recently submitted a paper entitled: *"Irrigating grazed pasture decreases soil carbon and nitrogen stocks"*, which is currently under review in Global Change Biology. Soils were sampled from 34 paired, irrigated and unirrigated pasture sites across New Zealand (Photo 6). On average, irrigated pastures had significantly (P<0.05) less soil carbon and nitrogen than adjacent unirrigated pastures with differences of 6.99 t C ha^{-1} and 0.58 t N ha^{-1} in the uppermost 0.3 m.

Photo 6: Example of the placement of irrigated and unirrigated sampling sites (Photo provided by Paul).

Plant & Food Research – Palmerston North

Eva van Dijk and **Myke Koopmans** from Wageningen University in the Netherlands, have been working for three months with **Ian McIvor** and **Trevor Jones**, doing project work for their BSc theses. Eva has undertaken a survey of farmers in the Manawatu-Whanganui and Hawke's Bay regions, on their experiences of poplar and willow trees on farms, and Myke has been evaluating the effect of tree spacing on soil properties in poplar Nelder trials. Soil cores have been sampled from different tree spacings and open pasture in two Nelder trials on different soil types, and mini-disc infiltrometers used in the laboratory with ethanol solutions to measure the water infiltration rates of the soil. Closer tree spacings have shown lower soil bulk density and higher water infiltration rates, consistent with the formation of macropores by the poplar tree roots.

Soil core sampling in the poplar Nelder trial at Ongaonga in Hawke's Bay.



Soil core measurements of water infiltration using mini-disc infiltrometers in the laboratory.

Brent Clothier and **Steve Green** completed the first of their 2016 visits to the Central Highlands of Kenya on their NZ Aid project there. Plant & Food are working in a public-private partnership with the company Olivado who press oil from the avocados grown by the small holder farmers in the Highlands. The project goal is to alleviate poverty amongst the small-holder farmers.

One task they carried out was to install 2 m long TDR rods to measure the deep root-water uptake by the trees during the droughts that precede both the Short and Long Rainy Seasons. Previously, monitoring had only been carried out down to 1 m.

Steve Green (right) and Michael Gitahi from Olivado (second from right) installing 2 m long TDR rods on the farm of Mr Thomas Njui (second from left) under the watchful gaze of Sarah Murigi from Olivado (left). The tree in the middle is instrumented with our heat-pulse sap flow gear.

One task in this project is to develop a decision support tool (DST) to provide information for Olivado and farmers on drought avoidance measures and tree nutrition guidance. A key input will be rainfall, and manual raingauges were installed across the Highlands. The farmers will text in the rainfall values to Olivado for use in the DST that PFR are developing.

Mary Kosgey from Olivado installing the bracket for a manual raingauge on a farmer's property under the 'stink eye' guidance of Steve Green.

While Brent and Steve were in the field, they were visited by the New Zealand High Commissioner to Kenya (who is based in Addis Ababa), Bruce Shepherd; Stewart Henderson, the Honorary NZ Consul to Kenya; and Peter Zwart, NZ Aid.

Brent Clothier, Steve Green (right), and Michael Gitahi from Olivado (left) discuss the baseline monitoring programme on Mr Thomas's farm in the Central Highlands of Kenya, with the New Zealand High Commissioner, Bruce Shepherd (second from left). Peter Zwart of NZ Aid is in the background.

Massey University, Palmerston North

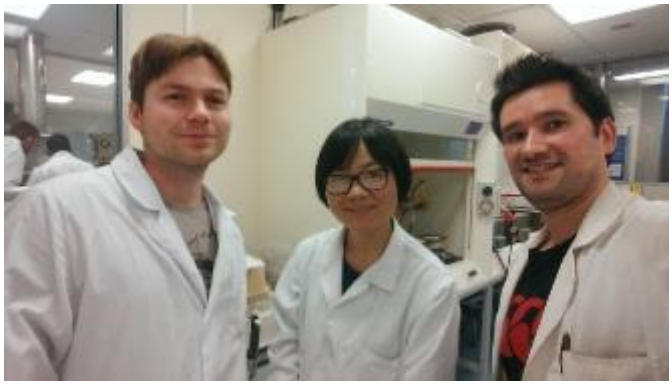
Taylor Leabourn is the NZSSS Massey University Undergraduate Student Prize winner for 2015.

Taylor Leabourn – winner of the NZSSS Undergraduate Student Prize for 2015 -receives the award from Mike Hedley.

Taylor completed undergraduate studies in 2015 and worked on a research project over the summer of 2015/16. In this project he looked at the effect Cross Slot no-tillage had on soil carbon content when compared to conventional cultivation. The project was funded by the New Zealand No-Tillage Association and involved the collection of soil core samples across a range of different farms throughout the Manawatu, Wairarapa and Canterbury. Taylor will report the data collected as part of his honours dissertation which he plans to complete before the end of 2016.

The NZ Biochar Research Centre recently hosted three visitors who are each exploring collaborative opportunities with Assoc. Prof. Marta Camps Arbestain and staff at the Centre.

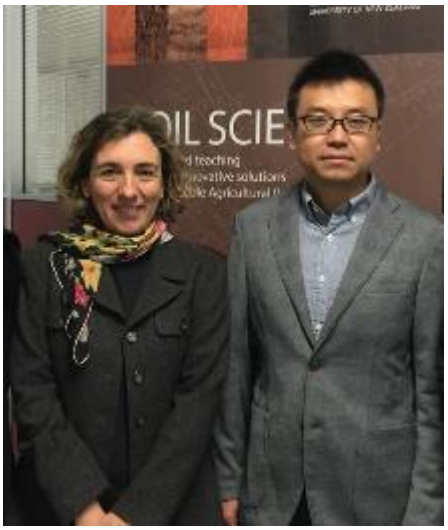
Mr Stanislav Garbuz, from the Dokuchaev Soil Science Institute (Moscow, Russia) has a Master's degree from the Lomonosow Moscow State University (2009) and is collaborating with Dr R. Calvelo Pereira, Ms Q. Shen and other members of the team in experiments related to carbon sequestration in soil, with special attention to the fractionation of soil C in pastoral soils and the response of soils to management practices in pastoral Allophanic soils of New Zealand.



Stanislav Garbuz (left) with Qinhau Shen and Roberto Calvelo Pereira in laboratories at Massey University

Mrs Paloma Cabecas Segura from Polytech Clermont Ferrand in France has a bachelor in Biology and is currently in second year of Master in Biological Engineering. During her three-month visit, she will be collaborating in experiments related to the availability of dissolved organic carbon that could be used for denitrification, in both surface and subsurface soils following a shift from pasture to cropping.

Associate Professor Liam Fei from the Agro-Environmental Protection Institute, Ministry of Agriculture (China), based at the Hi-Tech Industrial Park of Tianjian, visited the Centre during May and also met with other staff in the Soil & Earth Sciences Group at Massey University. Valuable discussions were held that could result in an agreement for the establishment of a China-New Zealand Platform for Agriculture and Environment Development and Innovation which will enhance the exchange and cooperation in biochar and agro-environmental research between New Zealand and China.



Marta Camps with Associate Professor Liam Fei

The month of May – and another week of Graduation Ceremonies in Palmerston North, with many students and their families celebrating their achievements. This year saw a Doctorate in Soil Science conferred on **Qinhua Shen** with her thesis titled **"Can Biochar Ameliorate Phosphorus Deficiency and Aluminium Phytotoxicity in Acid Soils?".** Qinhau Shen was supervised by A/Prof Marta Camps-Arbestain, Prof Mike Hedley (Massey University) and Dr Miko Kirschbaum (Landcare Research) and the following is a summary of her work:

"Biochar" is a potential technology to mitigate climate change by reducing atmospheric carbon dioxide concentration. Implementation is currently constrained by the manufacturing costs. During her study, Qinhua Shen investigated the possibilities of using certain tailored-made biochars from local forest waste (e.g., willow woodchips and pine woodchips) to increase phosphorus (P) availability to plant in acidic soils in New Zealand. Biochar produced from willow woodchip at 550^{o}C had a considerable amount of available P and liming value and this was found to alleviate P deficiency and aluminium toxicity to root in an acid soil low in P thus increasing crop yield; while biochar made from pine woodchips at 450^{o}C was shown to enhance P uptake by stimulating arbuscular mycorrhizal fungi growth in a high P patch soil of a low P soil. Therefore, willow woodchips can be selected to produce biochar to be added to promote use by farmers, particular those faming acid soils.

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Also in attendance at the Graduation Ceremony for the conferring of the prestigious 'Doctorate of Science' was **Professor Ravi Naidu**, Global Innovation Chair and Director of the Global Centre for Environmental Remediation at the University of Newcastle, Australia. Ravi has forged an outstanding career since completing his PhD at Massey University in 1985. He was the Founding Director, Centre for Environmental Risk Assessment and Remediation, University of South Australia and the Chief Executive Officer and Managing Director of CRC CARE – a centre that he initiated at that University. There was a recent shift of the entire research group (75 researchers) to the University of Newcastle where Ravi's work continues to focus on the remediation of contaminated soil, water and air, and the potential impacts of contaminants upon environmental and human health at local, national and global levels. He has helped revolutionise contamination science by leading the move to a risk-based approach to managing contaminated sites.

By demonstrating that contaminants only pose a risk if they can be taken up by humans, animals, plants and other biota with adverse effects, he has helped pioneer a more rational, effective and affordable approach to contamination science and actual clean-up, which has been adopted in Australia. He has also been a leader in the shift to *in situ* remediation – cleaning up contamination where it lies, rather than the traditional 'dig and dump' approach. Together, these approaches potentially save industry millions, if not billions, of dollars annually and make clean-up far more feasible and attractive. At the University of Newcastle, Ravi leads the Global Centre for Environmental Remediation (GCER), where he continues to implement his vision to safeguard the environment for future generations.

Ravi's staff profile at the University of Newcastle, and his contact details can be found at: https://www.newcastle.edu.au/profile/ravi-naidu.

"Where's my old desk?" Ravi may be asking – during a visit to the now refurbished laboratories in the Soil & Earth Sciences at Massey University, where he completed his PhD in 1985.

'Professors All' – following the Graduation Ceremony where Ravi Naidu was conferred DSc. Left to right: Mike Hedley, Bob Stewart, Ravi Naidu and Russ Tillman.

Ex-colleagues and friends of Ravi and Shamila Naidu gathered for an evening of reminiscing during their visit to Palmerston North

Canterbury

Lincoln University

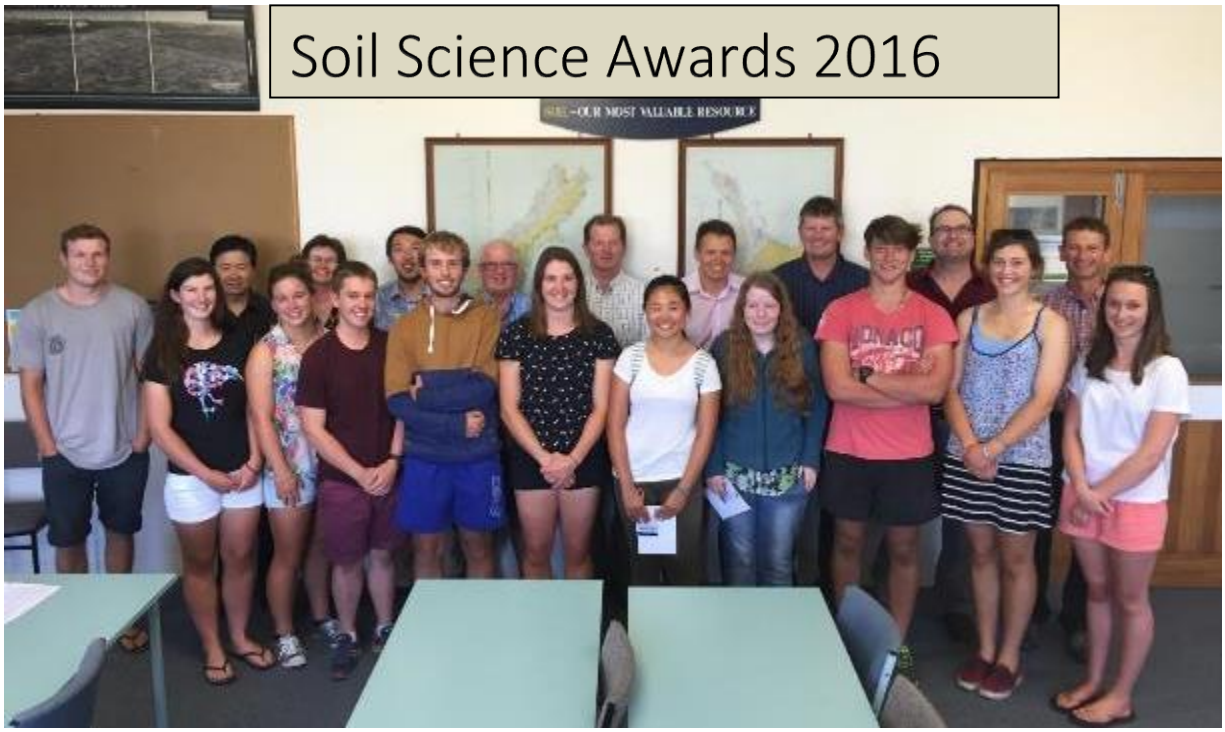
Congratulations to Prof. Leo Condron, who was awarded the degree of Doctor of Science (DSc) from the University of Canterbury in March of this year. The Doctor of Science (DSc) Degree is of a higher standing than either a Master's degree (MSc) or the degree of Doctor of Philosophy (PhD). Congratulations also to Dharini Paramashivam, Youngnam Kim, and Bernard Simmonds who successfully defended their PhD theses, entitled "Combining biosolids with carbonaceous materials to mitigate nitrogen-losses", "Interactions between soil biogeochemistry and native earthworms in New Zealand", and "Management of phosphorus losses from a marginal acid organic soil" respectively. Dharini was supervised by Brett Robinson, Tim Clough, Nick Dickinson and Jacqui Horswell. Youngnam was supervised by Nick Dickinson, Brett Robinson, and Stefan Boyer. Bernard's supervisors were Profs Leo Condron and Richard McDowell.

The Department of Soil Science welcomes Dr Bin Yao from the Chinese Academy of Forestry. He is visiting us for one year, working with Professors Di and Cameron, and the CSER team.

Lincoln University and the Christchurch City Council held a public open day at an experimental site near Duvauchelle, on Bank's Peninsula. The trial is investigating the feasibility of the land-application of treated municipal wastewater to grow NZ native plants.

The public open day at Lincoln University trial site near Duvauchelle.

Soil Science Prize Giving: Prizes are awarded each year to the top 3 students in Soil Science at each level of study at Lincoln University. The 2016 awards were presented on Wednesday 24th February. The prizes are awarded by the Centre for Soil & Environmental Research in recognition of excellence and to encourage top students to continue their high level of performance in Soil Science. The prize winners receive a Certificate and book tokens. Many of the previous prize winners have gone onto study for a post-graduate degree in Soil Science leading to careers in industry, farming, CRIs, regional councils, universities and government ministries.



From left, front row: Mr Connor Edwards, Ms Johanna Smith, Ms Sarah Hawkins, Mr Cameron Marshall, Mr Maarten Thiellier, Ms Georgie Lindsay, Ms Irene Setiawan, Ms Hayley Jensen, Mr Balin Robertson, Ms Genevieve Steven and Ms Georgia Broom
Back row: Prof Hong Di, Dr Janet Bertram, Dr Henry Chau, Mr Roger McLenaghen, Prof Tim Clough, Dr Nik Lehto, Assoc. Prof. Brett Robinson, Dr Jim Moir and Assoc Prof Peter Almond.

Lincoln University Plant Growth Chambers
P Carey

Lincoln University has recently opened its new growth chamber facility at the Field Service Centre that is now fully operational. Built to replace those lost in the demolishment of the Hilgendorf building, the new Conviron chambers are a significant advance on the previous chambers with high tech control of temperature (-10°C to 40°C) and precise lighting using ceramic metal halide bulbs, and humidity and CO_2 level control. This level of management will enable students, staff and outside users to conduct research over a far greater range of conditions than previously. As the inaugural user I felt compelled to sing their praises and advertise their presence. Facilities don't come much better than this! If you have any queries about their possible use contact Stephen Stillwell in the first instance (stephen.stillwell@lincoln.ac.nz).

New Lincoln University plant growth chamber facility at the Field Service Centre

Plant & Food Research, Lincoln

Visitors

Dr Alain Plante (Associate Professor, University of Pennsylvania) recently visited New Zealand under the America/New Zealand Soil Science Professional Exchange Award programme. **Mike Beare** and **Denis Curtin** hosted Alain at Plant & Food Research (Lincoln) during his 6 week visit which also involved collaborations with **Troy Baisden** (GNS Science) and **Miko Kirschbaum** (Landcare Research). The purpose of Alain's visit was to develop opportunities for collaborative research on environmental factors affecting the stabilisation capacity and vulnerability of soil organic matter to loss. The proposed collaborations align well with our current research in the Soil Carbon Theme of the *New Zealand Agricultural Greenhouse Gas Research Centre* programme and our own *Land Use Change and Intensification* programme. A key focus of our research is on understanding of mechanisms of soil C stabilisation and improving predictions of the stabilisation capacity of New Zealand soils. In addition to Mike and Denis, the NZAGRC project involves collaborations with **Sam McNally** (Plant & Food Research), **Frank Kelliher** (AgResearch), **Marta Camp** and **Roberto Calvelo Pereira** (Massey Univ) and Jeff Baldock (CSIRO, Adelaide). Alain also presented a seminar at Lincoln University entitled: *"Green carbon, black carbon, white carbon: Applying thermal analysis techniques to soil organic matter research"* that was well attended**.**

The Lincoln Campus was visited recently by 100's of school children from the local 'Lincoln school cluster' which includes Lincoln, Ladbrooks, Springston, Tai Tapu, Prebbleton and Broadfield schools, are visiting Plant & Food as part of an "MBIE Unlocking Curious Minds" project. See separate article

Staff news

We have recently appointed two PhD studentships (Carmen Medina and Jasmine Robinson) who will contribute to a new programme of research led by Landcare Research (**Pete Millard**) and entitled: *MANAGEMENT OPTIONS FOR INCREASING SOIL CARBON UNDER GRASSLANDS*, which is funded by Global Partnership for Livestock Emission Research. The first project involves the use stable isotope techniques to quantify the fixation of carbon by pastures under different management practices and the stabilisation of this carbon in different soil fractions. **Sam McNally**, **Craig Tregurtha** and **John Hunt** have been instrumental in the methods development and design of the first labelling experiment. The second project will examine how stable the new soil carbon is in the face of disturbance such as moisture and temperature variation and physical disturbance. The PhD students will be based at the University of Waikato and Lincoln University and will be co-supervised by **Tim Clough**, **Louis Schipper** and **Mike Beare**.

Gina Clemens married Jamie van der Klei on 7th May. Congratulations Gina and Jamie from all of us at Lincoln.

Brendon and Frances Malcolm welcomed their third child Chanelle recently. Another big congratulations.

Projects

A very large piece of field work on potatoes has recently been completed. The work was led by **Sarah Sinton** and **Steve Thomas,** and was core funded, along with Steve's Maximising Value from Irrigation project which over the next three years is designed to better integrate irrigation, crop, soil processes to provide growers with options to increase water use efficiency and profitability. The proposed work includes quantifying (and reducing) soil evaporation losses from row crops under different soil management (including residues, mulches) and irrigation frequency; increasing soil water storage and infiltration (while reducing drainage losses) through improved soil management under irrigation at different rates (e.g. tillage, beds, mulches and residue management); full versus deficit irrigation strategies using drip and spray irrigation to improve water use efficiency (reduce drainage and runoff, increase water storage), specifically including potatoes as an example crop in the MBIE plan; addressing soil water repellency issues possibly caused by lack of wetting of soil in ridges (fingering) and by high application rates under irrigation. The trial just completed further investigated the yield gap between potential and real production, this time investigating water availability as a function of row architecture (beds vs flat) with a sub-soiling treatment, and sub sets of soil amendment using cereal straw. Variable Rate Irrigation was used to apply water with the aim of growing one treatment well, and restricting water availability on the other to determine if more soil water was available to the crop under the differing treatments.

Steven Dellow has completed another season of monitoring, data collection and tech transfer on a FAR SFF potato project investigating the effect of soil management and the effect of compaction on yield and quality of potatoes. Steve's work follows input from **Craig Tregurtha** from 2012. The survey looked at background levels of soil borne disease (*Rhizoctinia* stem canker, *Spongospora* root galls and *Sclelortinia* stem rotting) and soil quality parameters (soil disturbance, penetration resistance, aggregate distribution and stability, bed shape, bed architecture) and the combination of these effects on root distribution and vigour, disease incidence in the plant, and yield and tuber quality.

A team of **Mike Beare, Wei Hu, Richard Gillespie** and **Craig Tregurtha** have initiated planning for another objective of the Dairy NZ led Forages for Reduced Nitrate Leaching

program. The next experiment will look at the effect of compaction on plant performance following dairy grazing. The team are also working with the Bioengineering team at Ruakura to develop a cow treading simulator for the field compaction work at the end of the winter.

Planning and design of an experiment by **Sam McNally** and **Mike Beare** is in the early stages, with the aim of comparing the carbon input and turnover of soil organic matter under irrigated and dryland soils. This work is funded by the Global Research Alliance, with collaboration by Landcare Research and Waikato University. Sam plans to collect soil from Lincoln University's Ashley Dene farm and establish lysimeters for this work where labelled ^{13}C plants will be used to trace the movement of carbon from the plant into the soil. The project run over the next few months.

Dirk Wallace, a Lincoln University PhD student based at Plant and Food, has set up his final large scale experiment which aims to determine if soil amendment incorporation is a management practice that can improve water efficiency of shallow stony soils.

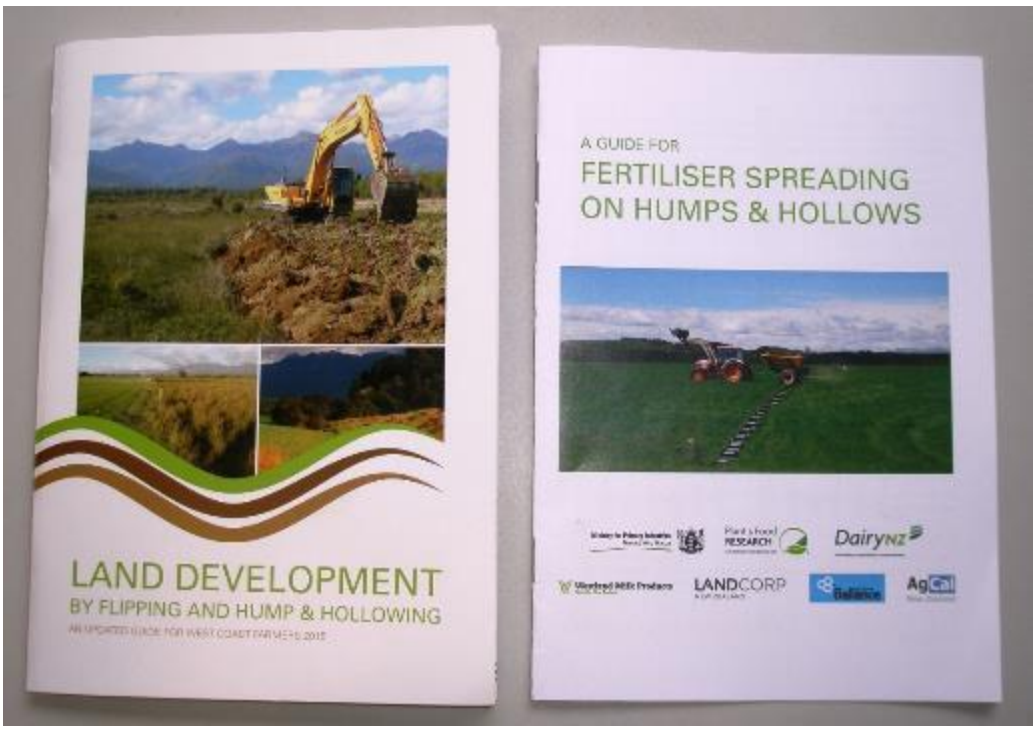
The experiment has taken close to a year to set up and will run for four months. Dirk has worked closely with **John Payne** at Landcare Research to build the lysimeters and **Neil Smith** and **Jen Owens** from Lincoln University to set up the sensors and loggers.

Awards

Hamish Brown, Ellen Hume and **Roger Williams** have been recognised with a Chairman's Award for their outstanding contribution to the design and delivery of the Matrix for Good Management Programme. The initiative is the result of a research collaboration between Plant & Food Research, AgResearch, Environment Canterbury, NGOs, and industry-good organisations within the primary sector. The Matrix for Good Management Programme provides communities and council with reliable information on nutrient losses from different land uses under industry-agreed good management practices. The significance of the matrix cannot be understated. As well as its practical management applications, it provides valuable guidance for informing policy under the national policy statement for water. Other government bodies around New Zealand are watching the success of the programme closely, especially its capacity to balance the goal of increasing economic prosperity with managing environmental outcomes. The matrix was designed with no existing blueprint, and its development has entailed balancing the interests of stakeholders across six primary sector groups, as well as attaining agreement by these sectors on good management practice and model predictions of nutrient loss. The team has played a major role in what is an excellent example of science leadership, co-innovation and cooperation.

Publications

Abie Horrocks, Steve Thomas and **Craig Tregurtha** have recently completed compiling and distributing two guides designed for South Island West Coast dairy farmers. One is an updated version of the 'Land Development by Flipping and Hump & Hollowing Guide' which aims to help farmers make well-informed land development decisions. The other is 'A guide for fertiliser spreading on humps & hollows' which aims to support nutrient management decisions to maximise pasture production whilst reducing the risk of environmental losses. Hump & hollowing and flipping are practices used on the West Coast to improve drainage and increase pasture production. The research was completed in collaboration with Ministry for Primary Industries, Westland Milk Products, Ballance Agri-Nutrients, DairyNZ, Landcorp, Nutrient Solutions, and AgCal New Zealand.



Abstracts

A new method to extract and purify DNA from allophanic soils and paleosols, and potential for paleoenvironmental reconstruction and other applications

Yu-Tuan Huang[a], David J. Lowe[a], Heng Zhang[a], Ray Cursons[a], Jennifer M. Young[b], G. Jock Churchman[c], Louis A. Schipper[a], Nicolas J. Rawlence[d], Jamie R. Wood[e], Alan Cooper[b]

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[d]Allan Wilson Centre for Molecular Ecology and Evolution, Department of Zoology, University of Otago, Dunedin, New Zealand 9054
[e]Landcare Research, P.O. Box 69040, Lincoln, Canterbury, New Zealand 7640

Abstract
Andisols, developed from late-Quaternary tephra (volcanic ash) deposits and dominated by the nanocrystalline aluminosilicate, allophane, contain large stores of organic matter and are potential reservoirs for DNA. However, DNA recovery from Andisols and other allophane-bearing soils has been difficult and inefficient because of strong chemical bonding between DNA and both allophane and organic matter, and also because much DNA can be encased and physically protected in nanopores in allophane nano/microaggregates. We have therefore developed a new two-step DNA isolation method for allophanic soils and buried paleosols, including those low in clay, which circumvents these problems. The method centres on (1) releasing mainly microbial DNA, and extracellular (unbound) DNA, using an alkaline phosphate buffer ("Rai's lysis buffer") that blocks re-adsorption sites on the allophanic materials, and (2) the novel application of acidified ammonium oxalate (Tamm's reagent) to dissolve the allophane and to release DNA which had been chemically-bound and also which had been protected within nanopores. Ammonium oxalate has not previously been applied to soil DNA extraction. DNA yields up to 44.5 μg g^{-1} soil (oven-dry basis) were obtained from three field-moist natural allophanic soil samples from northern New Zealand using this two-step method. Following extraction, we evaluated different DNA purification methods. Gel electrophoresis of the extracted DNA followed by gel purification of the DNA from the agarose gel, despite some DNA loss, was the only purification method that removed sufficient humic material for successful DNA amplification using the polymerase chain reaction (PCR) of multiple gene regions. Sequencing of PCR products obtained from a buried allophanic paleosol at 2.2-m depth on a sandy Holocene tephra yielded endemic and exotic plants that differed from the European grasses growing currently on the soil's surface. This difference suggests that the DNA extraction method is able to access (paleo)environmental DNA derived from previous vegetation cover. Our DNA extraction and purification method hence may be applied to Andisols and allophane-bearing paleosols, potentially offering a means to isolate paleoenvironmental DNA and thus facilitate reconstruction of past environments in volcanic landscapes, datable using tephrochronology, and also aid biodiversity understanding of andic soils and paleosols.

Geoderma (2016) 274, 114-125.

Comparing volcanic glass shards in unfertilized and fertilized Andisols derived from rhyolitic tephras, New Zealand: evidence for accelerated weathering and implications for land management

Matthew D. Taylor[1], David J. Lowe[2], Peter Hardi[3], Geerd A. Smidt[4] and Ewald Schnug[3]

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[2]School of Science, The University of Waikato, Private Bag 3105, Hamilton, New Zealand 3240
[3]Institute of Crop and Soil Science, Federal Research Centre for Cultivated Plants - Julius Kuehn-Institut, D-38116 Braunschweig, Germany
[4]Jacobs University, School of Engineering & Science - SES, Earth and Space Sciences, Campus Ring 1, D-28759 Bremen, Germany

Abstract
Enhanced weathering associated with the use of phosphate fertilizers has been identified in some of the major farming areas of New Zealand and an evaluation of its effects on soil properties and the implications for soil management are needed. We assessed changes in the character of volcanic glass shards in topsoils (0–10 cm depth) of two tephra-derived Andisols of differing ages (Udivitrands, Hapludands), and with and without long-term fertilization, to test if fertilizing accelerates the weathering of soil constituents. Using visual assessment based on scanning electron microscopy and electron microprobe analyses of glass shards from samples from paired sites, we showed that the average sizes of the shards and the sharpness of the glass-shard edges (angularity) diminished with the age of the soil, and that these decreases were more marked in the soils that had been fertilized. Silica polymorphs were observed only in the older soil (Hapludand) that had been fertilized. We concluded that the addition of phosphate-containing fertilizer enhanced the dissolution of volcanic glass, consistent with phosphoric acid and F^--induced dealumination and desilication, and thus soil weathering has been accelerated. The Al and Si may subsequently coprecipitate as secondary minerals, such as allophane. However, silica polymorphs may form where Al activity is low. The occurrence of neogenic silica in topsoils (despite high annual rainfall that should result in desilication of the topsoil and reprecipitation of silica deeper in the soil) is explained by the seasonality of fertilizer application and the spring-summer climate, where the soil remains moist for periods sufficiently long enough for the dissolution of volcanic glass (and possibly of other aluminosilicates), the formation of Al-humus complexes, and the subsequent precipitation of silica in dry periods. Implications of the accelerated weathering for soil and land management are discussed.

Geoderma (2016) 271, 91-98.

Soil recovery following landsliding at Whatawhata Research Station, Waikato, New Zealand: preliminary results

A.M. Noyes, M.R. Balks, V.G. Moon, and D.J. Lowe
School of Science, University of Waikato, Private Bag 3105, Hamilton 3240

Abstract
This research investigates soil recovery following landslides at the Whatawhata Research Station 20 km west of Hamilton. Six landslides were studied, ranging in age from pre-1953 to 2014. The landslides were divided into four zones: shear zones (mean of 25% of landslide area), intact accumulation zones (20%), transition zones (40%), and re-deposition zones (15%), along with a control. Soils were well developed in the control and intact accumulation

zones and least recovered in the shear and re-deposition zones. Mean A horizon depths ranged from 2 cm in the shear and re-deposition zones to 7 cm in the transition zone, 17 cm in the intact accumulation zone, and 20 cm in the control. Mean soil carbon contents were lower ($P<0.05$) in the landslide zones (range of 3.2-5.2%) than in the controls (8.2%). Older landslides showed great recovery; however, the differences between zones within the landslides were greater than the differences between landslides.

In: Proceedings of Hill Country Symposium 2016. New Zealand Grassland Association, New Zealand Society of Animal Production, and New Zealand Grassland Trust, pp. 83-88.

A dramatic landscape

D.J. Lowe and C.M. King
School of Science, University of Waikato, Private Bag 3105, Hamilton 3240

Abstract
This chapter introduces the story of Pureora Forest Park (PFP), in the central North Island, New Zealand, by describing the extremely violent Taupo eruption of c. AD 232 and its consequences for the surrounding forests and mountains. It gives a broad-scale local geological history, detailing the origins of some important local sedimentary rocks and landforms with a bearing on the story, including limestone caverns and coal deposits. It describes the location of the future PFP on the western edge of the Taupo Volcanic Zone, and how the history of volcanic activity, together with erosion, have determined much of the character of its landscape, the radial drainage pattern and deep entrenchment of its rivers, the distribution of its vegetation, and its long isolation from human access and permanent settlement.

In: King, C.M., Gaukrodger, D.J., Ritchie, N.A. (editors), *The Drama of Conservation – The History of Pureora Forest, New Zealand*. Springer, Berlin, and New Zealand Dept. of Conservation, Wellington, pp. 1-17.

Dusty horizons

D.J. Lowe[1], P.J. Tonkin[2], J. Palmer[3], K. Lanigan[1,4], and A.S. Palmer[3]

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[3]Institute of Agriculture and Environment, Massey University, Private Bag 11222, Palmerston North 4442
[4]Shell Todd Oil Services, Private Bag 2035, New Plymouth 4342

Abstract
Dust whipped up and deposited by wind forms sheets of loess, which drape over the land. These loess deposits and the soils formed within them yield insights into past climatic and environmental change.

In: Graham, I.J. (editor) 2015. "A Continent on the Move: New Zealand Geoscience Revealed, 2nd Edition". *Geoscience Society of New Zealand with GNS Science, Wellington*, GSNZ Miscellaneous Publication 141, pp. 286-289.

Far-flown markers

D.J. Lowe[1], B.V. Alloway[2], P.A.R. Shane[3]
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Abstract
Tephras are fragmentary materials that are blasted explosively into the air during volcanic eruptions. Distributed throughout Zealandia, tephras provide useful markers for connecting and dating land surfaces, sediment layers and archaeological sites.

In: Graham, I.J. (editor) 2015. "A Continent on the Move: New Zealand Geoscience Revealed, 2nd Edition". *Geoscience Society of New Zealand with GNS Science, Wellington,* GSNZ Miscellaneous Publication 141, pp. 172-175.

Evaluation of the stable isotope signatures of nitrate to detect denitrification in a shallow groundwater system in New Zealand

Clague, J. C., Stenger, R., Clough, T. J. (2015)

Evidence for the occurrence of denitrification in shallow groundwater systems in New Zealand (NZ) is poorly documented; however, an observational study of the Toenepi dairying catchment in the Waikato region of NZ revealed a prevalence of reduced groundwater with very low nitrate (NO_3^-) concentrations (predominantly <0.5mg L^{-1} N). Denitrification in the shallow groundwater system could play an important role in catchments with high NO_3^- leaching losses, by reducing the impact of land use and management practices on freshwater bodies. International studies have shown that denitrification below the root zone is often limited by the low availability of carbon (C) or other electron donors. In this laboratory incubation study we investigated three different profiles (to a maximum depth of 4.7 m below ground surface) in the Toenepi catchment (15 km^2).

Denitrification capacity was measured following the addition of ^{15}N-enriched NO_3^-, while glucose was used as a readily available C source when ascertaining the denitrification potentials. The largest total ^{15}N fluxes (without C amendment) were observed in samples from the Kereone (1.3–2.1 nmol N g^{-1} h^{-1}) and Topehaehae sites (2.8 nmol N g^{-1} h^{-1}); however, all sites had samples with fluxes of a similar magnitude (3.3–4.7 nmol N g^{-1} h^{-1}) with no significant difference between sites ($p > 0.05$) when glucose was added. The profiles were generally C-limited, as indicated by more than 80% of samples showing an increase ($p < 0.01$) in total ^{15}N gas ($^{15}N_2 + {}^{15}N_2O$) production after C addition. The composition of the total ^{15}N gas flux varied with depth but $^{15}N_2$ was ≥69% of the total ^{15}N flux and typically >92%. Extrapolation of denitrification capacity rates to field temperatures (14 °C) indicates that much of the material found at depth, particularly at the Kereone and Topehaehae sites could contribute substantially towards attenuating the estimated NO_3^- leaching losses (29–42 kg N ha^{-1} $year^{-1}$) from the root zone and is likely the cause of the very low NO_3^- concentrations prevalent throughout the catchment.

Agriculture, Ecosystems and Environment 202:188-197. (DOI: 10.1016/j.agee.2015.01.011).

A global spectral library to characterize the world's soil

Viscarra Rossel, R.A., Behrens, T., Ben-Dor, E., Brown, D.J., Demattˆe, J.A.M., Shepherd, K.D., Shi, Z., Stenberg, B., Stevens, A., Adamchuk, V., A¨ıchi, H., Barth`es, B.G., Bartholomeus, H.M., Bayer, A.D., Bernoux, M., B¨ottcher, K., Brodsk´y, L., Du, C.W., Chappell, A., Fouad, Y., Genot, V., Gomez, C., Grunwald, S., Gubler, A., Guerrero, C., Hedley, C.B., Knadel, M., Morr´as, H.J.M., Nocita, M., Ramirez-Lopez, L., Roudier, P., Campos, E.M. Rufasto, Sanborn, P., Sellitto, V.M., Sudduth, K.A., Rawlins, B.G., Walter, C., Winowiecki, L.A., Hong, S.Y., Ji, W., A

Abstract
Soil provides ecosystem services, supports human health and habitation, stores carbon and regulates emissions of greenhouse gases. Unprecedented pressures on soil from degradation and urbanization are threatening agro-ecological balances and food security. It is important that we learn more about soil to sustainably manage and preserve it for future generations. To this end, we developed and analyzed a global soil visible–near infrared (vis–NIR) spectral library. It is currently the largest and most diverse database of its kind. We show that the information encoded in the spectra can describe soil composition and be associated to land cover and its global geographic distribution, which acts as a surrogate for global climate variability. We also show the usefulness of the global spectra for predicting soil attributes such as soil organic and inorganic carbon, clay, silt, sand and iron contents, cation exchange capacity, and pH. Using wavelets to treat the spectra, which were recorded in different laboratories using different spectrometers and methods, helped to improve the spectroscopic modelling. We found that modelling a diverse set of spectra with a machine learning algorithm can find the local relationships in the data to produce accurate predictions. The spectroscopic models that we derived are parsimonious and robust, and using them we derived a harmonized global soil attribute dataset, which might serve to facilitate research on soil at the global scale. This spectroscopic approach should help to deal with the shortage of data on soil to better understand it and to meet the growing demand for information to assess and monitor soil at scales ranging from regional to global. We hope that this work might reinvigorate our community's discussion towards larger, more coordinated collaborations and encourage other contributions. We also hope that use of the database will deepen our understanding of soil so that we might sustainably manage it and push the research outcomes of the soil, earth and environmental sciences towards applications that we have not yet dreamed of.

Earth Science Reviews (2016), doi:
10.1016/j.earscirev.2016.01.012

Can geophagy mitigate enteric methane emissions from cattle?

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Abstract
Mitigation of ruminant methane (CH_4) production remains a formidable challenge for both improving feed conversion efficiency and decreasing emissions of this potent greenhouse gas

but no viable solutions are yet available. We have taken a novel approach to addressing this challenge, based on our understanding of soil microbial ecology and clay mineralogy, and the practice of geophagy, that is, the deliberate consumption of soil materials including clay minerals by animals. In a series of preliminary *in vitro* studies, we have found that some clays can significantly, albeit inconsistently, reduce CH_4 production. A hydrothermally-derived kaolinite gave the most consistent results when the initial pH of the cow rumen content, used as an inoculum, was in the range of 6.0 to 6.2. In one *in vitro* incubation, this kaolinite (7.5 and 15 mg clay g^{-1} minced alfalfa), a condensed tannin (7.5 mg g^{-1} minced alfalfa), and a 1:1 kaolinite/condensed tannin mixture all caused a marked reduction in CH_4 production. Kaolinite has a lower surface area than the other clay minerals tested, so this finding suggests a common biological process that is related more to the pH-variable charge characteristics than the surface area of the clay sample. While the underlying mechanism is yet to be clarified, the use of suitable clays could potentially offer an animal- and environment-friendly approach to limiting enteric CH_4 emissions, especially when the rumen pH is depressed from feeding silage or grain.

Keywords: mineral consumption, ruminants, methane, clays

Tate et al., Journal of Preliminary Research 2015, Vol 2 (Issue 1), 1-8. Available at: http://sci-deit.net/journal/uindex.php/jpr/index

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Municipal Compost as a Nutrient Source for Organic Crop Production in New Zealand

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Abstract: About 1% of New Zealand farmland is managed organically. Nitrogen is the nutrient most likely to limit organic crop production. A potential solution is incorporation of compost to supply N. About 726,000 t of municipal garden and kitchen wastes are sent to landfills annually. Composting offers a means of reducing the impact of landfill wastes on the wider environment. Organically certified compost (N content typically 2 to 2.5%) is available from some municipal composting plants. To be effectively used on organic farms, the rate of N release (mineralization) must be known. Laboratory incubations were conducted to quantify mineralization of compost N under controlled (temperature and moisture) conditions. Nitrogen availability and crop yields from a one-off application of compost (25–100 $t \cdot ha^{-1}$) were also assessed in two field trials (using cereal and forage crops). The results suggested that a relatively small part (13–23%) of compost N was used by the crops in 3–4 years. Much of this was mineral N present at the time of application. Mineralization rates in the laboratory and field studies were much lower than expected from published work or compost C:N ratio (considered an important indicator of N mineralization potential of composts).

Evaluating biodegradability of soil organic matter by its thermal stability and chemical composition

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Abstract
The stability of soil organic matter (SOM) as it relates to resistance to microbial degradation has important implications for nutrient cycling, emission of greenhouse gases, and C sequestration. Hence, there is interest in developing new ways to quantify and characterise the labile and stable forms of SOM. Our objective in this study was to evaluate SOM under widely contrasting management regimes to determine whether the variation in chemical composition and resistance to pyrolysis observed for various constituent C fractions could be related to their resistance to decomposition. Samples from the same soil under permanent pasture, an arable cropping rotation, and chemical fallow were physically fractionated (sand: 2000-50 mm; silt: 50-5 mm, and clay: <5 mm). Biodegradability of the SOM in size fractions and whole soils was assessed in a laboratory mineralization study. Thermal stability was determined by analytical pyrolysis using a Rock-Eval pyrolyser, and chemical composition was characterized by X-ray absorption near-edge structure (XANES) spectroscopy at the C and N K-edges. Relative to the pasture soil, SOM in the arable and fallow soils declined by 30% and 40%, respectively. The mineralization bioassay showed that SOM in whole soil and soil fractions under fallow was less susceptible to biodegradation than that in other management practices. The SOM in the sand fraction was significantly more biodegradable than that in the silt or clay fractions. Analysis by XANES showed a proportional increase in carboxylates and a reduction in amides (protein) and aromatics in the fallow whole soil compared to the pasture and arable soils. Moreover, protein depletion was greatest in the sand fraction of the fallow soil. Sand fractions in fallow and arable soils were, however, relatively enriched in plant derived phenols, aromatics, and carboxylates compared to the sand fraction of pasture soils. Analytical pyrolysis showed distinct differences in the thermal stability of SOM among the whole soil and their size fractions; it also showed that the loss of SOM generally involved preferential degradation of H-rich compounds. The temperature at which half of the C was pyrolyzed was strongly correlated with mineralisable C, providing good evidence for a link between the biological and thermal stability of SOM.

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pH-dependence of organic matter solubility: Base type effects on dissolved organic C, N, P, and S in soils with contrasting mineralogy

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Abstract
Dissolved organic matter (DOM) is an important substrate for soil biological processes. Raising pH is known to cause release of DOM but less is known of the impact of different bases on the quantity and quality of DOM in soils. Three acid (pH 5.3–5.7) soils of contrasting mineralogy were used to examine how the quantity and quality of DOM changes when soil pH is raised using lime ($Ca(OH)_2$) or KOH (chemical analog of NH_4OH, a product of urea hydrolysis). Dissolved organic carbon (DOC) increased as the base addition rate increased, with the response to KOH being up to 9 times larger than to $Ca(OH)_2$. The proportion of carbohydrate-

C (hexose- and pentose-C) in DOM did not show consistent effects of base rate or type and was similar for the three soils (35% of DOC, on average).

Dissolved phenol-C increased as base addition rate increased. Only monomeric phenols were solubilized in $Ca(OH)_2$-treated soils whereas polyphenols were solubilized in increasing amounts as the KOH rate was raised. Although the quantity of DOM differed considerably between treatments, its bioavailability (45% on average; measured using a 7-day bioassay at 20°C) was similar across treatments and soil types, with good correspondence between carbohydrate-C and bioavailable C. Large base type effects on organically bound nutrients (dissolved organic N, P, and S) were also observed ($KOH \gg Ca(OH)_2$). A distinguishing feature of DOM released by KOH was the presence of large amounts of complexed Al and Fe. We concluded that KOH (and, by extension, NH_4OH) may render stable organic matter accessible to microbes by liberating it from the protective influence of soil minerals. Our results emphasize the importance of choosing an appropriate base when examining pH effects on DOM and associated biological processes.

Hu W, Si B C 2016. Estimating spatially distributed soil water content at small watershed scales based on decomposition of temporal anomaly and time stability analysis. Hydrology and Earth System Sciences, 20, 571–587.

Hu W, Si B C 2016. Technical Note: Multiple wavelet coherence for untangling scale-specific and localized multivariate relationships in geosciences, Hydrology and Earth System Science Discussions, doi:10.5194/hess-2016-154.

Li M, Si B C, **Hu W**, Dyck M 2016. Single-probe heat pulse method for soil water content determination: Comparison of methods. Vadose Zone Journal (In press).
Pernitsky T, **Hu W**, Si B C, Barbour L 2016. Effects of petroleum hydrocarbon concentration and bulk density on the hydraulic properties of lean oil sand overburden. Canadian Journal of Soil Science (In revision).

Shen Q, Gao G Y, **Hu W**, Fu B J 2016. Spatial-temporal variability of soil water content in a cropland-shelterbelt-desert site in an arid inland river basin of Northwest China. Journal of Hydrology (In revision).

The following are a further selection of abstracts from the 29th Annual FLRC workshop at Massey University, on the 9 – 11th February 2016

What difference does detailed soil mapping information make? a Canterbury case study

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This study is based on 120 hectare farm on the Canterbury Plains. We compare soil maps and soil data from:

- the Fundamental Soils Layer (FSL – https://lris.scinfo.org.nz /layer/137-fsl-south-island-all-attributes/);
- S-map (http://smap.landcareresearch.co.nz/);
- a detailed farm-scale soil series map at approximately 1:10,000 scale, and
- S-map sibling data associated with a survey of 723 auger holes across the farm.

Auger holes were on an approximate grid with 40 metre separation (approximately 7 auger holes/hectare). For comparative purposes the soil series identified in the FSLs and farm-scale soil maps have been recorded in the S-map database as siblings. At the different map scales the study area is represented by: four soil siblings in the FSL; by 12 soil siblings in S-map (7 dominant and 5 subdominant soil siblings across the map units); by 9 soil siblings in the farm-scale map; and by over 200 different soil siblings in the auger dataset. Different interpolations of soil properties were also generated, each using different sub-samples of the auger dataset, to visualise variation in representation of soils with different auger sampling densities.

The auger points give an idea of the variability in texture, horizon thickness, and depth to stones within a single S-map sibling, as well as within soil mapunits from different scales. The impact of this spatial variability on estimates of profile available water, drainage and nutrient losses from each soil mapunit, farm block and whole farm is determined and graphed. We also discuss the different costs of soil sampling and mapping at each scale, along with some general recommendations.

Nitrous oxide emissions from animal excreta deposited on hill country slopes

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The objectives of this study were to conduct field measurements of nitrous oxide (N_2O) emissions caused by deposition of sheep and beef cattle dung and urine on hill country pasture. This work was carried out on a free-draining volcanic soil at the Whatawhata Research Farm in the Waikato region as part of a series of field trials nationwide conducted in 2014 and 2015. This research provides field data to determine background N_2O emissions and emission factors (EF_3, % of the applied excreta N emitted as N_2O) for animal excreta deposited in the autumn-winter on steep (>25^o) and moderate(12-25^o) slopes . N_2O flux measurements were made using a closed chamber technique.

N_2O fluxes from controls on both medium and steep slopes were less than 0.55 mg N_2O-N m^2 hr^{-1} through the four month (winter/early spring) measurement period. Greater variability in background emissions was exhibited on the steep slopes than on the medium slopes. There was a slight trend for higher total background N_2O emissions from medium (0.035 kg N_2O ha^{-1}) compared to steep slope areas (0.021 kg N_2O ha^{-1}), but the difference was not significant ($P>0.05$).

Application of either animal urine or dung increased N_2O fluxes, but the patterns and magnitudes of the increases were not consistent between excreta types and slope classes. Changes in the fluxes were not significantly correlated to changes in soil moisture levels, mineral nitrogen (N) concentrations or temperature. EF_3 for all excreta types were generally very low, with the averages being less than 0.3% for urine and dung sources, and highly variable. There was a trend for higher EF_3 values on the medium slope than on the steep slope, with beef cattle dung on the medium slope having the highest EF_3 value and sheep dung on the steep slope having the lowest EF_3 value. There was no relationship between EF_3 and soil properties, including soil Olsen P, moisture and mineral nitrogen levels. The EF_3 values in the hill country appear to be affected by a complex range of physical and biological factors.

Assessing the significance of cadmium in New Zealand agricultural systems – preliminary results

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The New Zealand economy relies heavily on the primary production sector and the use of phosphate fertilisers. Cadmium (Cd) occurs naturally in the phosphate rock used to produce phosphate fertilisers and is present in fertiliser at varying levels. A preliminary assessment of the significance of soil Cd concentrations in New Zealand agriculture was undertaken by assessing the uptake of Cd in economically important cultivars of wheat, potatoes, onions and leafy green vegetables and important pasture and forage crops, and assessing effects on soil rhizobia. Crop species, cultivar and soil properties were all shown to affect Cd uptake in the crops and pasture investigated. Within a species, the relative order of Cd uptake by individual cultivars was often not consistent between different sites, suggesting an interaction between Cd uptake by an individual cultivar and soil properties. The relative significance of Cd at a given site was assessed using a plant uptake factor (PUF), which is the ratio of plant Cd concentration: soil Cd concentration. The PUF varied between sites and between different crops, with sites with low soil Cd concentrations often having a higher PUF (i.e. plants take up a greater proportion of the soil Cd) for a given crop in the range of soils tested. This indicates that soil Cd concentration alone is not sufficient to assess the risk of non-compliance with food standards of agricultural crops. Taking current soil Cd concentrations into account and using the measured PUFs, for the soils tested, a 1.3- to 2-fold increase and >2.5-fold increase in current soil Cd concentrations were suggested to potentially lead to non-compliance with food standards for wheat and other crops respectively – assuming soil properties do not change. Potential effects on pasture productivity and quality were indicated by effects of Cd on rhizobia and white clover being observed although this was at concentrations higher than current environmental concentrations. Compost addition to soil was demonstrated to reduce phytoavailable Cd and plant uptake of Cd in pot trials, providing a potential mitigation strategy.

Comparing nutrient loss predictions using overseer and stream water quality in a hill country sub-catchment

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Hill country represents a significant proportion of our water catchment areas, particularly in the Manawatu region (75%). Soil and nutrient management in pastoral hill country plays a vital role in the management and mitigation of water quality impacts. Improving our understanding of nutrient loss and nutrient attenuation in pastoral hill country will be essential in assisting beef and sheep farmers adapt to inevitable nutrient loss restrictions in the future. However, there is currently very limited monitoring and quantification of nutrient loss and its potential attenuation in pastoral hill country catchments.

We have established an ongoing water quality study, monitoring nutrient and sediment loads in selected streams and a seepage wetland, on the Massey University Agricultural Experimental Station at Tuapaka, Palmerston North. The largest area currently being monitored is an 84.7 ha sub-catchment, which incorporates both rolling and steep hill terrain, a number of seepage wetlands, and a range of different soil types. Detailed Overseer modelling of this sub-catchment has been undertaken and nutrient loads estimated using monitored stream flow and water quality. These findings, along with a comparison of historic (1976) nutrient loss data measured from a larger catchment on the same farm, will be presented and discussed.

Factoring in soil water repellency in a hill slope soil water balance model

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The incidence of soil water repellency (SWR) in New Zealand hill country (particularly on the North Island East Coast) increases the potential for runoff during the late spring through to late autumn seasons, thereby reducing the effective rainfall depth for pasture growth.

A modified soil water balance model for sloping land incorporating the infiltration restrictions imposed by SWR is presented. Detailed rainfall and runoff data collected at Alfredton in northern Wairarapa were used to develop a 2-tier daily soil water balance model - the first tier incorporating the top 50 mm soil layer, and the second tier incorporating the whole root zone. The reference crop evaporation was estimated using the FAO56 version of the Penman-Monteith equation after incoming solar radiation had been adjusted for slope and aspect. Repellency-induced runoff is only simulated to occur if two conditions are satisfied:

1) The top 50 mm soil layer is drier than a certain trigger water content value, and
2) The rainfall intensity is greater than a certain threshold value.

The model's input variables and shortcomings associated with SWR are discussed and the outputs matched against stream flow data gathered from a catchment near Waipawa in southern Hawkes Bay.

Some suggested uses of the model in terms of the management of SWR are presented.

Recent methodology developments in soil fluorine analysis

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New Zealand research into soil fluorine (F) has been hampered by lack of a reliable and simple test for soil F. The accuracy of different methods to quantify the presence of F in analytical preparations (soil extracts or solid-phase samples) is dependent on interfering elements such as the aluminium (Al) content of the sample; Al cations form very strong complexes with fluoride ions in acidic conditions. The routine analytical methodology of NaOH fusion is used to release F ions in the ion-selective electrode methodology. This technique is time consuming, expensive and is very dependent on the abilities of the operating technician. This technique is not ideal for environmental monitoring. We assessed the accuracy of several alterative techniques relative to the standard fusion protocol. We found that simple extraction of soil with dilute NaOH (4M) consistently reported 80% of the total soil F (measured by both in-house and international laboratories with fusion method) for allophanic soils. This soil order generally represents the soil order with the greatest history of build-up of soil F (and Cd) from superphosphate application as allophanic soils constitute much of New Zealand most fertile land. This paper discusses the further development in reliability of the NaOH extraction technique to quantify soil F, with specific focus on the relative accuracy of this technique between different soil orders.

Water: the world's most valuable natural asset

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The soil and plant-based ecosystems which cloak the lands of our earth are the planet's critical zones. They provide valuable ecosystem services. Through these soil and plant systems on the earth's surface, there are massive fluxes and storages of mass and energy. These flows and storages provide valuable ecosystem goods and services. Water is the prime natural capital stock. Water is the world's most valuable natural asset. We are vitally dependent on the myriad of ecosystem services that water delivers to us via our plants and soils.

There is only much water on earth as there was when the world began. Yet, there is far greater competition for it nowadays.

There is already great pressure of our water resources. Furthermore this is being exacerbated by the intensification of our primary production systems, rising population numbers, and climate change.

In thinking about the sustainability of our water resources, it is of heuristic value to consider the three water colours of green, blue and grey. Blue water is that which is in the surface bodies of our streams, rivers and lakes, along with that contained in our groundwater reserves. Green water comes from the rain that falls onto the earth's surface and is stored there, either to be used by plants, evaporated from the soil surface, or drained through the vadose zone to receiving waters. Grey water is the water that leaves our soils with a changed quality due to dissolved or entrained substances, or it is that can be that which is discharged, with, or without, treatment from urban sites or industrial processes.

We outline the imperative to minimise abstraction from our blue water reserves such we seek to use this water to achieve the best outcome for the least use. Efficiency is a flawed metric when considering blue water use. Further, we need to ensure that we make the best use of our green water resources, and this is especially so for the developing world where there is not the infrastructure to enable the use of blue water. As for the grey water discharged as leachate from farms and orchards, we need to develop sustainable land-management practices to protect the quality of the water in our blue-water reserves. Where the grey water is discharged from cities or factories we need to ensure that its treatment enables its re-use. Examples of all of these are given.

Effects of irrigation intensity on the preferential transport of solutes in a stony soil

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The use of irrigation has been increasing in New Zealand over the past 20 years; linked to the intensification of farming systems and particularly to the expansion of dairy farming. Most of the irrigated land is located in the South Island, the Canterbury region representing about 60% of the total area. The predominant irrigation system is the centre-pivot, considered an effective method for applying water uniformly. However, the instantaneous intensity of application varies considerably along its length, and by the end of the irrigation line it is far greater than that of typical rainfall. When irrigation intensity exceeds the soil infiltration capacity, water is likely to flow preferentially down cracks and large pores. If this occurs, the transport of solutes through the soil will involve only a fraction of pore space, increasing the rate of leaching. Determining this fraction is, therefore, crucial to evaluate the risk of leaching losses. Stony soils, considered vulnerable to nutrient leaching losses, are common in Canterbury and are present where most of the irrigation expansion is occurring.

To evaluate whether irrigation intensity has an effect on preferential solute flow in a stony soil, an experiment was performed at Lincoln using 12 steel-encased lysimeters with a Lismore Stony Silt Loam soil under two irrigation intensities, 5 and 20 mm/h. Drainage water was collected at regular intervals and the concentration in the leachate of two non-reactive tracers, bromide and chloride, was determined. The Burns' equation was then fitted to these data, to estimate the fraction of the soil's water involved in solute transport. The results from the chloride data indicate that irrigation intensity affects preferential solute transport and an exponential function can be used to describe this relationship. The data from bromide leaching suggest that antecedent soil moisture may also be important. Implications for management and further studies of nutrient leaching will be discussed.

Irrigation management to reduce nitrous oxide emissions and nitrate leaching losses

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While the benefits of irrigation for dairy production are well established the environmental consequences are not well quantified. In particular how irrigation management practices affect losses of nitrous oxide (N_2O) to the atmosphere and nitrate (NO_3) to groundwater.

We used the APSIM (Agricultural Production Systems Simulator) model to simulate the effect of six different irrigation management scenarios on N_2O emissions from urine patches and non-urine areas on pasture of three different soil types. These were deep poorly drained (Otokia), deep well drained (Templeton) and shallow well drained (Eyre) soils. The effects of different climate and rainfall regimes were simulated using 20 years of data from two climate stations (Lincoln and Hororata, Canterbury). Simulation outputs included irrigation amounts, N_2O emissions, NO_3 leaching losses and pasture production.

Soil type, urine and the timing of urine application had the greatest influence on the variation of N_2O emission and NO_3 leaching. Greatest N_2O emissions were predicted from the Otokia soil, while emissions tended to be similar from the well drained soils. More frequent irrigation resulted in the largest N_2O emissions and NO_3 leaching losses. Greatest NO_3 leaching losses were predicted from the Eyre soil with the higher rainfall regime. Least were predicted from the Otokia soil with the lower rainfall. Pasture production was largely unaffected by irrigation management, except for the shallow Eyre soil when some loss of production was predicted from the two less frequent irrigation scenarios.

Based on the model simulations and supporting field experiments, N_2O emissions and NO_3 leaching can be reduced without penalising production by irrigating less frequently and maintaining soil water deficits. The contribution of indirect N_2O emissions (produced from leached NO_3) will be greater from shallow well drained soils compared to deeper (poorly or well drained) soils.

Water and nutrient management of avocados in the central highlands of Kenya

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Plant and Food Research (PFR) are working in the central highlands of Kenya on an NZ Aid programme with a New Zealand-born company Olivado which produces the world's leading brand of extra virgin avocado oil. We are working alongside local farmers and horticultural research/extension organisations to improve the supply of high quality organically-grown fruit. The goal of the programme is to more than double the average return to small-holder famers over 10 years through increased plantings, enhancing grower production capability, improved postharvest handling systems, and enhancing national horticultural research and extension capability to support the industry. One of our research activities is to better understand the water and nutrient status of avocados grown under current dry-land farming practices. Field experiments have been set up near Murang'a to monitor changes in tree water-use and soil water content over the course of a growing season. Sap flow sensors were installed in trees of different sizes (ages) to measure tree water use, TDR (time domain reflectometery) probes were installed in the root-zone to monitor changes in soil water contents, and a weather station was installed to monitor the microclimate and assess the potential evaporative demand (ETo, mm/day). We have also carried out regionally based soil and leaf analyses to determine plant nutrient status

and help identify target nutrients for remediation. These results are supporting the development of a model to assess the potential water requirements and yield gains that might be achieved from optimised irrigation.

Gamma soil surveys – investigating soil patterns for nutrient and water management

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Real-time management and accurate modelling of spatially and temporally variable drainage events is a challenging research topic for New Zealand's soil scientists. A new gamma soil survey system is therefore being trialled to investigate its potential to collect fine-scale soil information rapidly and affordably to improve dynamic management and modelling of nutrient and water management. The system consists of a GPS-enabled gamma sensor mounted on a quad bike, with on-board information system to collect soil geophysical survey data.

This proximal soil sensor detects gamma ray photons emitted naturally from the soil, and a typical spectrum has four 'regions of interest" (ROIs): total counts, and peaks relating to Potassium, Uranium, and Thorium. Gamma-ray spectrometry has been reported to be a valuable soil surveying tool because different parent materials contain varying amounts of these three predominant radioisotopes, as do the soils that weather from them. The spectrometry potentially compliments electromagnetic (EM) soil survey data, which respond to soil texture and moisture differences in non-saline conditions; the two sensors can be used simultaneously to improve soil prediction models.

We conducted a pilot study at Massey University No.1 Dairy Farm (160 ha) in 2015. Four gamma ROI maps were used with an existing EM map (5-m pixel resolution) to investigate relationships of sensor data to a soil drainage toposequence.

The drainage toposequence at this farm is from well-drained loamy gravels, sands, and sandy loams, through imperfectly drained sandy loams and silt loams to very poorly drained silt loam Gleys. Soils tend to become less freely draining and older with distance away from the river. The Gleys are exceptions to this rule, as they occur adjacent to a tributary stream in a frequently inundated area. Gamma ROI values are smallest for the loamy gravels, and tend to increase with this drainage and soil development sequence. The exception is the Gley soil, which has low total counts, potentially due to lack of weathering in these saturated soils, and the gamma signal may also be attenuated by the soil wetness.

Future research is planned to investigate the use of gamma survey data with and without other high resolution soil data, such as EM and Lidar, to improve spatial modelling of soil attributes, including drainage class, stoniness, clay content, available water storage, and carbon.

The conundrum of realising fertiliser benefits of wastewater for greater sustainability – opportunity vs reality

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Land application of nutrients in municipal effluent (ME) and farm dairy effluent (FDE) have the potential to support the New Zealand agricultural industry by reducing reliance on fertiliser, contributing to removing nutrients from waterways and sustainably recycling nutrients. However, these positives have to be weighed against perceived negatives, including: "not in my back yard", "it smells", "it contaminates groundwater", "it carries terrible chemicals" and "the products can't be consumed". It's not easy being green!

The discharge of FDE has changed from approximately 100 % to water to almost 100 % to land in 15 years. This change has come from better irrigation practices and greater awareness of water quality impacts. ME has traditionally been discharged to waterways, but like FDE, has the potential to benefit productive land and contribute to improved waterway quality. However, the uptake of ME to land has not been as successful, with less than 5 % currently applied to land.

Nationally New Zealand municipal wastewater treatment plants generate approximately 12,000 tonnes of N and 2,400 tonnes of P annually. This compares to 41,000 tonnes N and 6,500 tonnes P from dairy farms. The ME volume is 480 M m^3 annually compared to 93 M m^3 of FDE. At a N loading rate of 150 kg N/ha, this equates to 79,000 ha of land needed for ME and 270,000 ha for FDE. Applying an annual application of 400 mm irrigation would require 120,000 ha and 23,000 ha for ME and FDE respectively.

Environmental lobby groups and some government departments support land application of ME. But limitations have emerged with industry bodies (potential negative impact on market access) and other government departments (generation of contaminated sites).

Resource vs water quality vs adverse perception. What a conundrum! This paper identifies the opportunity of two key wastewater resources and the disparity, with reasons, between their use.

Describing n leaching from farm effluent irrigated on artificially drained soils

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Dairy farming generates a considerable amount of effluent which has to be stored and treated, representing both labour and cost requirements. Application of farm effluent to land via spray irrigation is the preferred option in New Zealand. This practice enables a better utilisation of nutrients in the effluent, but can have an adverse impact on the environment if poorly managed. Managing the application of farm effluent can be a major challenge in farms with poorly drained soil, as it can generate surface runoff in undrained soils and leaching losses in artificially drained soils. Because of this, irrigation of effluent over the winter months is not permitted in some regions. The increasing practice of housing animals over the winter months, especially in South Island, results in the collection of larger volumes of effluent that need storage and disposal, representing more costs to farmers. The potential for applying effluent over winter months, reducing the need for large storage ponds, is thus appealing to farmers, but the risks of nutrient losses need to be better understood before this practice can be implemented.

In this study the Agricultural Production Systems Simulator (APSIM) was setup to describe the fate of nitrogen (N) applied as effluent irrigated to artificially drained soils. The system described consisted of a dairy farm where the cows are wintered in an off-paddock system where effluent is captured and returned to land during winter. The applications use a low rate, low depth system and that happens daily unless large rainfall (>4.0 mm) occurs, thus minimal storage is needed. The modelling setup was refined and evaluated using data collected in field trials at Lincoln University's Telford Farm, in Balclutha. This simulation setup was then used to extrapolate the trial results to different soils and climates of South Island in order to assess the potential risks for N leaching losses. Implication on the practicality of applying effluent irrigation over winter are discussed.

Locating fresh cow urine patches; the key to cost-effective reduction in environmental n losses and improving n recycling and pasture growth

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The new Spikey® detection and treatment of fresh urine patches provides the means of not just treating fresh (invisible) cow urine patches with urease inhibitor and the nbpt growth promotant (ORUN®) to reduce nitrate leaching and greenhouse gas losses, the technology provides the platform to amend the urine patch soil-pasture environment in other ways as well.

For example, once it is proven that DCD, when applied to urine patches only, and only shortly after grazing, does not result in the presence of DCD residues in cow milk, DCD or DCD plus nbpt may be preferable to nbpt (Zaman et al. 2010).

Recent work indicates that on some dairying soils, nitrate concentrations are markedly attenuated below the root zone, presumably through either denitrification, particularly where a clay layer is present. The size of these reductions indicate this deep-soil denitrification may be equally important to denitrification in shallow groundwater.

While this denitrification is good for reducing nitrate leaching, it raises the important question of whether this denitrification is going through to N_2 production, or is leading to greater losses of N_2O.

In situations where undesirably high losses of N_2O are occurring, Spikey® permits the targeted application of products to reduce this, such as sources of readily mineralisable carbon.

Recently, Selbie et al. 2015 have provided confirmation that the process known as co-denitrification, the reaction of NO species (produced from urea-sourced NH_4^+) with soil amides, is a major source of N loss as N_2 from urine patches. While not an environmentally harmful mechanism, it can be a major economic loss, requiring more fertiliser N inputs to maintain a given level of production. This loss can be reduced with DCD (Selbie et al. 2015).

Regardless, increased focus needs to be placed on increasing plant N recovery from urine patches. The Spikey® technology provides the platform to achieve this.

Does gibberellic acid reduce nitrate leaching losses from animal urine patches?

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In New Zealand, the urine deposited by dairy cows onto the paddock while grazing year-round represents an input of nitrogen (N) into the soil-plant system greater than what the plants can use. The nitrogen which is not taken up by the pasture is often lost from the soil in drainage water. For this reason, N leaching is a significant environmental concern in intensively grazed NZ pasture-based systems.

One mitigation approach could be to apply gibberellic acid (GA) to increase the uptake of N by pasture, particularly during the cooler seasons where risk of leaching is high. GA is a plant hormone which occurs naturally in most plants and is responsible for stem elongation and leaf expansion. It is currently used by some farmers to stimulate dry matter (DM) production under rotational grazing when cool soil temperatures limit natural pasture growth rates. We hypothesized that application of GA to pasture in the autumn would increase pasture growth and uptake of urinary N during this time, and subsequently reduce N leaching loss.

A lysimeter study was conducted to measure pasture growth, N uptake, and N loss to water beneath pasture urine patches treated with, and without, GA. Results showed there was no significant difference in annual pasture DM yield, N uptake or N leaching loss between the urine + GA treated lysimeters compared with the urine-only lysimeters. These results suggest that, at the urinary N rate of 700 kg N ha^{-1} used in this trial, an application of GA would not reduce N leaching loss. However, pasture treated with N fertiliser (50 kg N ha^{-1}) has previously been shown to have an additive DM response to a GA application. Therefore future research could determine the GA response rate when applied to lower rates of urine-N to investigate whether a reduction in N leaching loss would occur.

Describing the effect of grazing on nitrogen leaching in winter forage-ryegrass rotations

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[3]*Plant & Food Research – Havelock North, New Zealand*
[4]*Plant & Food Research –Lincoln, New Zealand*

Animal feeding over the winter is a critical phase of pasture-based dairy farming with important influence on animal performance. An increasingly common management practice in New Zealand is wintering pregnant non-lactating cows on forage crops, thus avoiding damaging the pasture during wet periods. It is also a potential source of income for non-pastoral farms. Due to the high productivity of forages, cows are typically grazed on blocks or strips where stocking densities can be as high as 300-600 cows/ha. Grazing at high stocking densities cause the return large amounts of excreted nitrogen (N) to the paddock during winter when risk of losses are high. The high stocking densities can also cause soil compaction, exacerbating denitrification losses and potentially reducing growth of upcoming pasture. While the area used for winter grazing is relatively small, these winter forage grazing paddocks are believed to contribute a disproportionately large part of annual farm nutrient losses. Identifying good management for

wintering systems is, however, not an easy task. Several forage crops can be used, the grazing management can vary, as well as the land use after grazing. Computer simulation models are a crucial tool for evaluating management strategies for wintering systems under different climates and soils. In this study the Agricultural Production Systems Simulator (APSIM) was setup to describe the growth and grazing of winter forages followed by the establishment of ryegrass pasture. Firstly, data from trials in the Canterbury region were used to guide model refinement and assess its performance for wintering systems. Changes made to APSIM included forage crop parameters and the dynamic change of soil physical properties, such as macroporosity, bulk density and hydraulic conductivity, in response to animal trampling. This setup was then used to analyse scenarios where the fate of urine-N post-grazing winter forage was determined considering the effects of soil moisture during grazing, variations in stocking density and duration, and the fallow period after grazing.

Rootzone reality – a network of fluxmeters measuring nutrient losses under cropping rotations

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Nutrient losses are an important economic and environmental consideration across the wider cropping sector in New Zealand. Between August 2014 and May 2015 we established a network of passive-wick tension fluxmeters in commercial cropping farms in the Canterbury, Manawatu, Hawke's Bay and Matamata/Pukekohe regions to measure nutrient concentrations of nitrogen (N) and phosphorus (P) in drainage water under good management practices. Results from this study will provide farmers and regional authorities with measurements of nutrient losses from cropping farms across sites and seasons, and will be the basis for ongoing extension efforts to ensure good management practices are widely accepted and adopted by farmers.

The experimental design across the network includes the four monitor regions, three sites per region and twelve fluxmeters per site. Sites provide a range of cropping systems, soil types, climatic conditions and management practices relevant to each region. Fluxmeters were installed to collect drainage water at a depth of 1 m. In this paper we summarise activity for the period between fluxmeter installation and 30 September 2015.

Developing nutrient efficient clovers for New Zealand farmers

Shirley Nichols and Jim Crush
AgResearch, Hamilton

Repeated selection for higher rates of white clover shoot growth in New Zealand breeding programmes over the last 85 years, has been accompanied by a 10% increase in internal phosphate (P) use efficiency (PUE), with PUE defined as shoot dry weight per unit total plant P uptake. The agronomic significance of this change in PUE is unknown because no P response field trials involving contemporary clover cultivars have been reported, that we are aware of. There are obviously limits to how far internal PUE can be increased because of the role of P in

many plant metabolic processes. Having some inorganic P held in reserve in the cell vacuoles is probably a good insurance against short term fluctuations in P supply from the soil. Our current strategy is focussed more on improving phosphate acquisition efficiency (PAE) in white clover, though any coincidental gains in PUE are welcome. Introgression of traits from some of white clover's close wild relatives into adapted cultivars provides access to more variation than is found in the white clover gene pool alone. For example, *Trifolum uniflorum*, a Mediterranean wild clover has several characteristics indicating adaptation to low fertility soils. If it is crossed with white clover, and the hybrid progeny is then crossed again with white clover, the backcross (BC1) progeny are genetically 75% white clover and above ground they resemble typical white clovers. Under controlled conditions, some of these BC1 hybrids grow better than white clover in soils with Olsen P values in the 10 – 20 range. Of more importance may be their characteristic of investing heavily in root growth in lower P soils i.e. scavenging for P when it is in short supply. As soil P increases they switch over to shoot growth, but unlike white clover they accumulate P in their roots where it is protected from grazing, and made progressively available for shoot growth over a longer period. This trait would be particularly valuable in clovers for hill farming where P fertiliser inputs are less frequent than for lowland systems.

Analysis of the relationship between total nitrogen and available nitrogen in non-pastoral topsoils of New Zealand from a large soil test database

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Using a large soil test database, the relationship between total nitrogen and available nitrogen (measured as anaerobically mineralisable nitrogen) in non-pastoral topsoils (0-15 cm) of New Zealand was analysed by linear regression, grouping the data into 14 regions. For most regions, a statistically significant relationship between total N and available nitrogen exists (*P* values <0.001). Furthermore, six regions exhibited good R^2 values (range 0.48 to 0.79, *P* values <0.0001). These include the Bay of Plenty, Canterbury, Gisborne, Hawke's Bay, Wellington and the West Coast. For these regions, total nitrogen analysis can be useful to predict topsoil available nitrogen with a good degree of confidence that can serve as useful guidance in fertiliser nitrogen recommendations.

Cadmium accumulation by forage species used in New Zealand livestock grazing systems

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Little data exists on cadmium (Cd) accumulation in many plant species now commonly used as animal forages in New Zealand livestock grazing systems. A glasshouse trial was undertaken on 12 forage species to address this knowledge gap. Mean tissue Cd concentration decreased in the order chicory > plantain > turnip > lucerne > sheep's burnet > strawberry clover > kale > perennial ryegrass > haresfoot trefoil > red clover > crimson clover > white clover. Chicory and plantain had significantly greater mean tissue Cd concentrations (1.639 and 0.734 mg kg^{-1}

DM, respectively) than all other species. Cadmium in ryegrass and white clover (0.103 and 0.035 mg kg^{-1}, respectively) was similar to that reported in other field and laboratory studies.

A survey undertaken across a range of commercial farms with varying soil type, land use and phosphorus (P)-fertiliser history validated the results of our glasshouse trial; chicory had a mean Cd concentration of 1.82 mg kg^{-1} (range 0.40-4.50 mg kg^{-1}) and plantain had a mean Cd concentration of 0.80 mg kg^{-1} (range 0.23-2.40 mg kg^{-1}).

Modelling of lamb kidney Cd accumulation indicated that food standard maximum levels may be exceeded in animals younger than the current meat industry 30 month offal discard age. With increased use of chicory and plantain as specialist forage crops in New Zealand, this information will be important for improving livestock Cd accumulation risk assessment models.

Can a winter-sown catch crop reduce nitrate leaching losses after winter forage grazing?

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Direct grazing of winter forage crops to feed non-lactating, pregnant dairy cows prior to calving is a common management practice in the New Zealand South Island. However, the high crop yields per hectare grazed, combined with a high stocking density of cows, means this potentially leads to large amounts of urinary nitrogen (N) deposited on bare, wet soil, that in turn, could lead to high nitrate leaching losses. We undertook a study to simulate a winter forage grazing (WFG) event using field lysimeters planted with a kale (Brassica oleracea L.) crop. We report the effect of delaying sowing a "catch crop" of oats (Avena sativa L.) following simulated WFG on nitrate leaching losses from urine applied at different times throughout the winter.

Measurements showed a catch crop sown between 42 and 63 days after urine deposition in early winter reduced N leaching losses from urine patches by 39% (22-65%) over the winter-spring period, and 26% (18-46%) overall, compared with no catch crop. Generally, the sooner the catch crop was sown following crop harvest, the greater the uptake of N by the catch crop and the greater the reduction in nitrate leaching losses.

The results indicate that sowing of a catch crop following winter crop grazing could be an effective management strategy to reduce nitrate leaching as well as increase the N use efficiency of dairy winter feed systems.

Conferences:

July 2016

12-19 July: XXIII ISPRS Congress Prague Czech Republic 23rd Congress of the International Society of Photogrammetry and Remote Sensiing (ISPRS) **http://www.isprs2016-prague.com/**

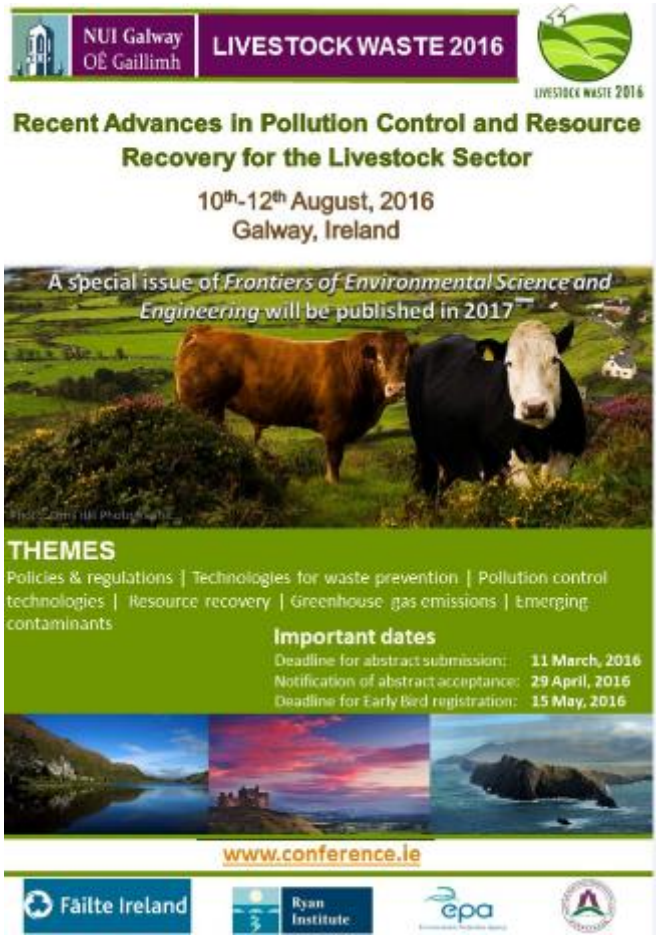
17-23 July: 8th International Acid Sulfate Soil Conference College Park, Maryland, USA Conference website:
http://www.midatlanticsoilscientists.org/acid-sulfate-soils-conference
2nd Circular download

17- 22. July: Eurosoil 2016 Istanbul, Turkey Conference **http://www.eurosoil2016istanbul.org/**

24-28 July: Enzymes in the Environment: Activity, Ecology and Applications Bangor Wales United Kingdom **http://www.oardc.ohio-state.edu/ee2016/**

August 2016

http://www.conference.ie/Conferences/index.asp?Conference=394



August 15-19: 15th International Peat Congress 2016 (IPC 2016), Kuching, Sarawak, Malaysia. **http://www.ipc2016.com**

September 2016

September 5 -9: Lake District England Organic Phosphorus Workshop Early bird registration closes 31 May 2016 **https://op2016.com/**

September 21-23: Ferrara Italy Rem Tech European Conference on remediation markets and technologies **http://esdac.jrc.ec.europa.eu/event/remtech-europe-2016**

26-30 September 2016: INSPIRE conference Barcelona Spain. Infrastucutres for Spatial Information in European Communities. **http://inspire.ec.europa.eu/events/conferences/inspire_2016/page/home**

October 2016

17-19 October: Sustainable Development of Soil and Water Resources in Nile Basin Countries Cairo, Egypt. Abstracts submission deadline: end of June 2016. Full texts should be submitted no later than 31 August 2016.
http://www.iuss.org/files/nil_basin_conference_brochure.pdf

October 24-28, 2016: Quito, Ecuador, XXI Latin American Soil Science Congress & XV Ecuadorian Soil Science Congress This conference will have the theme "All soils in the middle of the world" and will deal with soil, support of landscape diversity, life and culture. Read more (in Spanish only)

November 2016

http://www.agronomysociety.nz/2016-agronomy-conference.html

2016 Agronomy Conference

2016 Agronomy Conference - Productive and resilient farming

The 2016 Agronomy Society Conference will be held jointly with the NZ Grasslands Association in **Timaru** from **November 2-4, 2016**.

We are now calling for papers on all aspects of crop agronomy that relate to our theme "**Productive and resilient farming**".

Topics of interest may include (but are not limited too):
- Redesigning production systems
- Water allocation and crop water use
- Delivering higher value crops
- Climate change and adaptation
- Modelling crops and pastures
- Precision technologies and applications
- Seed, vegetable and forage production

More details will be available on our website in the coming months, including a full programme outlining the mix of plenary speakers, technical sessions and field visits.

The **registration link** on the Grassland Association website will become available later in the year.

Key dates to remember:

Title and abstract due	**24 February 2016**
Authors advised of paper acceptance	**2 March 2016**
Full manuscript due	**18 May 2016**
2016 Proceedings published	**November 2016**

Titles and abstracts should be submitted using the attached template to:
Paul Johnstone at *secretary@agronomysociety.org.nz*
(for further information call +64 6 975 8899)

Please forward this call for papers to other colleagues and students who may be interested in submitting a paper.

9th Australasian Soilborne Diseases Symposium

Heritage Hanmer Springs, Canterbury, New Zealand
14-18 November 2016

The 9thASDS will be held in the spa resort township of Hanmer Springs, in the early summer of 2016, under the auspices of the Australasian Plant Pathology Society

Hanmer Springs is a "magical" place, surrounded by mountains and forests, with crisp alpine air. Beside the lure of plant pathology and soil (!!), attractions include boutique shopping, excellent cafes and restaurants, an 18 hole golf course, farm parks and adventure activities (e.g. fishing, hunting, jet boating, bungy jumping). The award-winning Hanmer Springs Thermal Pools and Spa is a key attraction

Symposium themes (and Keynote Speakers)

- **Biocontrol** (Prof Gabriele Berg, Austria)
- **Soil Health** (Prof Jos Raaijmakers, the Netherlands)
- **Biosecurity** (Dr Treena Burgess, Dr Nick Waipara)
- **Disease Management** (Dr Steve Johnson, USA)
- **New Technologies/Diagnostics** (Dr Andy Pitman)

The Symposium will highlight research on all aspects of soilborne plant diseases, through *Offered papers*, delivered as posters or oral presentations

Key dates

4 April 2016	Registrations open
9 Sept 2016	Last day for abstract submission
3 Oct 2016	Notification of paper acceptance
28 Oct 2016	Registrations close

9thASDS website www.lincoln.ac.nz/ASDS

[Reduced registration fees for Students]

APPS

November 27 – December 5, 2016: 15th International Conference on Soil Micromorphology Mexico City, Mexico. This conference will be organized jointly with the IUSS Commissions 1.3 Soil Genesis and 1.6 Palaeopedology. The early registration fee for full participants at the Conference will be 200 €; the student fee will be 150 €, with appropriate verification of student status. Read more

December 2016

4-8 December 7th International Nitrogen Conference Melbourne MCG Victoria Australia **www.ini2016.com**

4 – 8 December 2016

International Nitrogen Initiative Conference

On behalf of the Organising Committee and INI, authors are invited to submit four-page papers for possible inclusion in the conference program of the **7th International Nitrogen Initiative Conference (INI2016)** to be held in Melbourne from **4 – 8 December 2016** at the iconic MCG. All submissions are due by 29 April 2016 and can be submitted electronically via the INI 2016 Presentation Portal. Please use the word template provided, incorporating the formatting guidelines when preparing your four-page papers. All presenters will be required to register for the conference and pay the appropriate registration fee. Unless agreed to by the organizing committee, presenters need to meet their own travel and accommodation costs.

www.ini2016.com

12 December 2016

Abstracts are due in by 4 July 2016

Joint New Zealand and Australian Soil Science Conference

Queenstown, New Zealand

Hold the date: week beginning 12 December 2016

'Soil, a balancing act down-under'

What does this mean to you?

- balancing land management goals?
- productivity vs environmental impacts?
- rural vs urban drivers?
- balancing different land-uses?
- research, extension, education and policy?

Are we getting it right?
Are we prepared for the future?

Send us your thought provoking comments; YOUR input will decide the focus of some of the sessions at the conference. Email : SoilScience@on-cue.co.nz

**********All entries go into the draw to win Central Otago wine**********

May 2017

A 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.

LuWQ2017
3rd International Interdisciplinary Conference on LAND USE AND WATER QUALITY:
Effect of Agriculture on the Environment
The Hague, the Netherlands, 29 May – 1 June 2017

Abstract submission will be possible before end June 2016,
abstracts are due by 17 October 2016.
More information is on **http://www.luwq2017.nl/**.

Objectives
This conference aims to discuss the entire policy cycle for water quality improvement. This cycle includes problem recognition, formulation of technical options, the process of policy development, interaction with policy makers, stakeholders and pressure groups, policy implementation, monitoring and research. This conference also aims to intensify contacts, on the one hand, between scientists with a background in natural sciences and scientists with a background in social and economic sciences and, on the other hand, between scientists, water managers and policy makers. In short, the objectives are:

- to provide forum for exchange of scientific knowledge, research on system knowledge, modelling and uncertainty;
- to discuss the entire policy cycle for water quality improvement;
- to intensify contacts (a) between soil/water related scientists, agro related scientists, social scientists, ecological scientists and economists, and (b) between scientists, water managers and policy makers.

LuWQ2017 is the follow-up to the successful LuWQ conferences, LuWQ2015 held in Vienna, Austria, in September 2015 and the LuWQ2013 conference held in The Hague, the Netherlands, in June 2013.

Target groups and keywords
Target groups (professionals, fields of expertise, audience) are scientists, managers and policy makers involved in the policy cycle for water quality improvement. The conference deals with themes and topics characterised by the following keywords:

- **Keywords for fields of expertise and scientific disciplines:** agronomy, agro-economics, agro-sociology, water management, water policy, action plan, river basin management plan, hydrology, soil science, drinking water supply
- **Keywords for system description:** aquatic ecosystems, terrestrial ecosystems, unsaturated zone, groundwater, surface waters, monitoring, modelling, chemical water quality, biological water quality, nitrate vulnerable zones, river basins, catchments
- **Keywords for best management practices:** buffer zones, sedimentation ponds, constructed wetlands, incorporation of fertilisers, catch crops, erosion control, cost effectiveness, voluntary measures, laws and regulations
- **Keywords for substances:** nutrients, nitrate, phosphorus, pesticides and other organic agrochemicals, heavy metals.