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New Zealand Soil News

Newsletter of the New Zealand Society of Soil Science

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

News, views, letters, articles (serious or otherwise)—send to:

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Deadline..... for the **February** issue of Soil News is **Monday 10th February 2014**

Visit our website:

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

New Zealand Soil News

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Editorial – Cow Housing – blots on New Zealand’s landscape or a way to grow our dairy industry?

By Christine Christenson

As New Zealanders, we should be proud of the fact that the dairy industry contributes 25% of this country’s export earnings, making up a third of the global dairy trade. This is a significant portion of New Zealand’s economy and is an industry that must be maintained for the nation to prosper.

The dairy products that are marketed and exported to our global consumers are sold based on the *perception* that they have been produced in a “clean and green” environment, with cows eating lush green pastures under clear blue skies. Water supply is not an issue, being an island nation with a mountainous landscape leading to hundreds of kilometres of fresh streams and rivers.

Having recently completed my PhD in Soil Science, I am never going to claim to be an expert in marketing. However, I am aware that within the marketing world, perception does indeed equal reality. Our global consumers are demanding more: more protein, more quality control of the products they are buying, and more sustainability of the environment those products are produced in. That said, those things are also being demanded of the dairy industry right on our back doorstep. All New Zealanders want clean water and a beautiful landscape for our future generations to swim in, walk through, and enjoy, and to show off to the world.

There is currently a plethora of media attention (only some of it being well-informed) on the effects of dairy farming on the decline of water quality in New Zealand. We know that the urine and dung excreted from cows are the main culprits; urine patches contributing to nitrogen leaching, and dung spots providing a rich source of phosphorus in surface runoff. Managing those excretal areas is the task at hand to maintain or improve New Zealand’s surface and groundwater quality. As agricultural researchers, our duty is to ensure that on-farm solutions can be considered, questioned, proven, and, perhaps most importantly, disseminated, to our wider farming partners and policy makers.

One of these solutions is using Duration-controlled grazing. Controlling the time spent on pasture to grazing only (e.g. 4 hours between milkings), this practice reduces urine and dung deposition *in situ*, allowing it to be collected and stored in stand-off facilities (aka cow housing) and redistributing that excreta uniformly when soil moisture conditions are suitable. Effectively this allows pasture growth to utilise those nutrients more efficiently. Duration-controlled grazing reduces the highly concentrated urine patches so nitrogen losses are decreased (a reduction of 52% in nitrate leaching was realised over 3 years at Massey University), and a greater area of the pasture has the nutrients reapplied to it, resulting in potential increased efficiencies in nitrogen use by the pasture. In addition, the practice can be implemented to achieve other benefits, such as decreased treading damage on poorly drained, fine-textured soils.

Using a practice such as Duration-controlled grazing however, requires a suitable area or facility for cows to go when they are not grazing the pasture. To gain maximum benefit from the system, the facility must have suitable capability to collect and store the excreta for re-application, the capacity to hold cows for long lengths of time, and, suitable specifications so the public perception is of positive consequence. These stand-off facilities can range from feedpads, loafing pads, Herd Homes[®] to freestall barns, and contain materials such as bark chip, concrete, sawdust, river stone, or steel cubicles complete with foam or rubber mattresses. Animal welfare is of utmost importance when determining the design.

The idea of housing cows in New Zealand is not new – take a drive through the dairying areas of Southland and South Otago, and you will see several large, elaborate buildings being constructed, solely for the purpose of protecting pastures and solving their wintering-off dilemmas. A heavily-pregnant cow standing in a howling southerly in Central Southland in July would happily be kept with a roof over her head and feed brought to her. However, one must not forget that these farms are predominantly pasture-based – New Zealand’s competitive advantage of “producing milk from

cheaply grown grass” is not being compromised. In general the cows are not being housed all year round, 24/7, with their feed brought to them. They are simply being protected from the elements, maintaining or increasing body condition prior to calving, and protecting the pastures and soils from any further treading damage.

There has been some recent work conducted around the critical time of year for urine deposition to increase the likelihood of nitrogen leaching in the winter drainage season. Much of this work is pointing towards the autumn urine patches, with not enough time from deposition to the onset of drainage for the pasture to utilise all of that nitrogen that is deposited. Therefore, practices such as Duration-controlled grazing could be refined to be implemented in those critical times. Cows could be housed partially in the autumn to reduce nitrogen leaching, in the winter and early spring for reducing treading and surface runoff losses on poorly drained soils, and perhaps partially in the summer for receiving supplementary feed, while benefiting from shade.

The financial economics of cow housing are still being debated. Ranging from an initial outlay of ca. \$1000 to in excess of \$5000 per cow, the decision for a farmer to invest in such infrastructure is not one to be taken lightly. The absolute benefits of having a stand-off facility are also still being researched, as have been highlighted here. As researchers, it is not our task to tell the policy makers or the industry whether they should be housing cows or not. It is however, our responsibility to ensure we provide our present and future dairying partners with robust and meaningful solutions, so New Zealand’s largest export industry can continue to prosper while we live with clean water and green pastures. After all, that’s what everyone wants.

Christine Christensen
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Onsite wastewater training - update

Estimates of the failure rate of on-site wastewater treatment systems (OSWTS) in New Zealand vary, however there is widespread acknowledgement that system failure commonly results from poor site and soil investigations, inappropriate design, and/or lack of understanding of the operation and maintenance requirements. It is perceived in the industry that many designers, regulators and installers do not have the knowledge required to adequately perform their roles, and this contributes to the rate of OSWTS failure.

The industry has long identified that OSWTS training and assessment against a national standard is required to verify that system designers, regulators and installers do have the requisite knowledge. This is common place overseas.

Six Unit Standards (US’s) were registered on the NZQA framework in 2008, following extensive industry input. These US’s have not previously been offered by any training provider. Following recent industry consultation, including discussions with the New Zealand Land Treatment Collective and Water New Zealand, an accredited provider will be offering training to these US’s from early in 2014. This will provide the industry with training to a national standard which can be adopted with confidence by all. The training will provide pathways to two levels of achievement; “Principles of On-Site Wastewater”, and “On-Site Wastewater System Designer”. Both will require soil properties to be explained and their characteristics to form an integral part of the system design.

Hamish Lowe
Lowe Environmental Impact

Minutes of a phone-conference meeting of the NZSSS Council held at 9:30 a.m. on Friday 8th November 2013.

Present: Reece Hill, Roger McLenaghan, Trish Fraser, Alan Hewitt, Tim Clough, Tony van der Weerden, Megan Balks, David Houlbrooke, Iris Vogeler, Hamish Lowe.

Apologies: Mike Hedley

Secretariat:

Minutes of the meeting held 2nd August 2013

Corrections to these minutes were as follows:

- i) Include Megan Balks in the list of apologies (Megan was away in Europe and a communication break-down meant the apology was missed).
- ii) That the minutes referring to secretarial services provided by Groundwork be revised as noted below. An error was made in the August minutes. It should be noted that the NZSSS are happy with the services provided by Groundwork. NOTE the costs of the secretarial services provided by Groundwork are aligned with original forecasting. Correction as follows:

Secretarial Services (Groundwork).

~~The charging by Groundwork is still not transparent, despite Tony requesting and having received further information from Groundwork. The original quote from Groundwork was ca. \$5,500 and will not greatly exceed this in their projected estimate for 2013/2014. However, it is not clear how they are charging for their work. The statement of secretarial transactions from 1 Jul 2012 to 30 Jun 2013 shows the actual sum is closer to \$18,600. Far in excess of projected costs.~~

The budgeted cost for the last 12 months, including the establishment costs, was \$13,237 + GST. Whereas the actual cost was \$14,251.52 + GST: an increase of \$1014.52 + GST, due to extra time required for processing double-handling of some invoices and bulk mail outs. The revised budget for the 2013-14 year, prepared in June 2013, is \$8,725.00 + GST. This is an increase of \$2,259 + GST, based on a more accurate indication of time required for various tasks and activities. In an effort to keep costs to a minimum, Tony and Trish have identified savings of \$1500 + GST p.a., including management of the additional bulk mail outs, and correcting & revising the number of occasions Groundwork need to provide NZSSS with membership status, financial reports, and budget tracking & reporting. Thus, taking these reductions into account, the Revised Budget for Groundwork services to the NZSSS would be \$7225.00 + GST.

Groundwork notified the council of the potential financial benefits of being GST registered. In the last year, registration could have saved the society \$3,700.

“That the amended minutes be accepted as a true and accurate record”

carried Fraser/Clough

Matters arising from the minutes:

No matters arising.

Matters for General business:

Royal Society Constituent Societies meeting – Trish Fraser

IUSS – Megan Balks

Soil Science Essential – Hamish Lowe

Approval of Agenda:

It was moved that "The agenda be approved." Fraser/Hewitt

Conferences:

NZSSS Conference

Sponsorship package is being worked on.

Field trips are planned for Taupo/Rotorua region, Hauraki Peat Soils, Research stations/catchments. Programme themes are being organised with key-note speakers. Proposed date for abstracts is by 1st February 2014 with registrations at 1st March 2014.

WaiBOP 5th December

David Lowe is organising this. Ideally Mike Hedley will present the Norman Taylor Lecture at this and then co-ordinate the presentation at other venues in Palmerston North and Lincoln.

11th International Conf. of the East and Southeast Asia Federation of Soil Science Societies

Held in Bogor Indonesia (21-24th Oct 2013) and attended by Alan Hewitt attended this and noted there was some excellent work being presented with further information on the programme available at the web site:

<http://www.esafs11ina.org/>

Massey Workshop

Attended by c. 50 people and organised by Mike Hedley.

Full range of topics were presented and worked on in a strong net-working environment.

Awards were also presented to Kevin Tate who received the 'Grange Medal' and Alec MacKay who became a 'Life Member of NZSSS'.

20th World Congress of Soil Science

Organised by the IUSS and in 2014 will take place in Seoul South Korea.

New Zealand Land Treatment Collective Annual Conference 26th-28th March 2014, Hamilton.

Theme: Managing contaminants at a catchment level – back to basics.

Conference key note speakers include: Jo Bromley, Waikato Regional Council, Dr Theresa Wilson, Dairy NZ, Tim Manukau, Tainui. A biosolids workshop will be run on the 25th March.

Diary dates for 2014 include: abstracts close 18th November 2013, online registration opens 12th November 2013; early bird registration closes 17th February 2014, final manuscripts 7th February 2014; workshop 25th March 2014, conference 26-28th March 2014.

Joint NZSSS & AustralianSSS conference

Proposed for Queenstown 2016. Tony, Cecile and other local NZSSS members organising.

Treasury

Balance Sheet, Cash Summary and Profit & Loss accounts were presented. No major issues.

Accounts due to be audited by 21st November 2013.

Costs for secretarial services have been clarified due to some miscommunication on NZSSS's part (please see amendment of minutes of the previous meeting). Groundwork have explained the costs, provided a revised budget and are tracking well.

GST registration was investigated. This is good if NZSSS wishes to make a loss but if NZSSS breaks even or makes money then the benefits of GST registration are reduced. In addition there would be extra costs associated with accounting and administration charges for GST.

Membership

New members

Nimlesh Balaine	Post-doctoral Fellow	Lincoln University
Aaron Wall	Advanced Technician	University of Waikato
Samuel McNally	PhD Student	University of Waikato
Nadia Laubscher	Student	University of Waikato
Matthew Norris	Research Associates	AgResearch
Kapish Gobindlal	Student	Auckland University of Technology
Sujatha Senanayake	Lab technician	Landcare Research
Roberto Calvelo Pereira	Research officer	Massey University
Steve Wakelin	Senior Scientist	AgResearch
Bryony Dignam	Student	Lincoln University
Michael Wilson	Scientist	AgResearch
Maria Tourna	Post doc scientist	AgResearch

It was moved and carried that the nominees for membership be accepted (Balks/Hewitt).

Resignations & Deaths

Erin Telfer	(resigned)
Michael Laffen	(resigned)
Steve Flynn	(resigned)
Roger Swift	(resigned)

It was moved and carried that the offered resignations be accepted and the names removed from the membership list (Clough/Fraser).

Removal of members due to lack of contact details or excessive overdue subscriptions

Thomas Betitis	- lack of contact details
Upali Sarathchandra	- lack of contact details
Frank Scherr	- lack of contact details
Stephanie Watson	- lack of contact details
Julie M Zanders	- lack of contact details
Emma Moffitt	- 3 years outstanding subscriptions
Jennifer Prosser	- 3 years outstanding subscriptions
Laure Steiner	- 3 years outstanding subscriptions

It was moved and carried that the names of the members with excessive overdue subscriptions and who are no longer contactable be removed from the membership list (Clough/Fraser).

Correspondence on membership

One member had communicated indicating that the subscription renewal/reminder notice was perhaps too harshly worded and was not appropriate given the member's loyalty.

NZSSS Web page

The NZSSS site needs a link to be arranged with the NZSSS 2014 Conference.

Action: David and Iris to co-ordinate this.

Facebook site is going well.

Soils in the NZ Landscape

There is an evolving issue here needing to get the book available on the NZSSS web page. It is proposed the chapters are put up as separate 'units' with pdf and print options.

Action: Reece to follow up and progress this.

IUSS Country Chapter books

IUSS have a programme going where each country places a chapter on the IUSS web page detailing soils of the given country. This is a good opportunity to be part of a series. Megan and Alan have proposed an outline that would take about 2 years to do. Proposed to base this around 'soil orders'. Timetable needs to be set or else the opportunity to be part of the series will pass. Action: Alan & Megan to have the timetable organised.

Awards

Reece has sent a letter to Altum asking if they could state why they didn't want to continue sponsoring the award. No response to date. Currently only one application for the award. The award needs to be withdrawn if a sponsor cannot be found for it.

Judging for Masters and PhD awards is underway. Deadline for decisions is beginning December.

Promoting Soil Science

There will be a science learning hub and session devoted to this at the NZSSS conference in 2014. In addition there will be a soil art exhibition. Alan is putting together some profiles – but some new photos are required.

New posters to promote soil science are needed.

Action: Megan will organise committee members to assist with content ideas/costings/potential audiences for the posters.

Science Fairs

Fourteen of 16 'science fairs' have responded wanting prizes. Need to consider what form the sponsorship takes after 'Soils in the NZ landscape' runs out.

Science Funding Issues

Correspondence was received from David Lowe with two articles attached for committee members to peruse. The first was a paper by Bryan and Lowe submitted to *New Zealand Science Review* where the authors criticise the bias and unfair outcomes prevailing within the ESA panel of the Marsden Fund. They note the very limited success of any soil science based application to the ESA panel and provide possible reasons for the limitations, and a possible solution. The second article was by Earl Bardsley and was a letter sent to the Hydrological Society's newsletter 'Current', about the same issues. It was pointed out that hydrological-based projects have never been funded by Marsden and that collective action should be taken by the Hydrological Society to recommend that the Marsden Council adopt a new 'Earth Processes' panel as distinct from an 'Earth Sciences' panel.

David Lowe suggested that the NZSSS Council might decide to make a submission to Marsden Fund Council about the issues raised, possibly on its own or in concert with those of other societies such as the Hydrological Society or the Coastal Society.

These articles were favourably received.

Action: Tim to write to David Lowe expressing support and to discuss a way forward on the issues raised.

General Business:

Royal Society of New Zealand Constituent Organisations Annual Meeting

Trish Fraser attended the Royal Society of New Zealand Constituent Organisations Annual Meeting, 16 October 2013.

The summary and minutes from the meeting have been finalised as a [Meeting Report, which you may view or download from our website](#) the Royal Society web site (825kb pdf file):
<http://www.royalsociety.org.nz/media/Report-RSNZ-COmtg-16Oct2013-final.pdf>

A request that arose during the joint meeting (with Regional Constituent Organisations) was for the presentation *Royal Society of New Zealand: A year in review*, made by Royal Society of New Zealand Chief Executive Dr Di McCarthy, to be made available. You may [view or download Dr McCarthy's presentation](#) as a pdf file the Royal Society web site (1.5 MB).
<http://www.royalsociety.org.nz/media/RSNZ-CE-Presentation-AGM-2013-web.pdf>

International Union of Soil Sciences

Megan noted there was a need to clarify how membership of the IUSS operated. NZSSS now subscribes as a society rather than at the individual level.

Soil Science Essential

Hamish reported that there is keen demand for soil science skills in several arenas at present. Dairy NZ are running an accreditation panel aimed at designing waste management systems with an aim of setting core competence goals. There is a need for soil related knowledge to be included. Irrigation New Zealand is also organising accreditation courses requiring soil science input. Dairy NZ are running a WOF system for dairy effluent systems. Water NZ are teaming up with OPUS for on-site water/irrigation training. Food industries (e.g. Talleys, Fonterra etc.) are looking at training within the food processing industries for core certification, and aiming to add an irrigation module. All these training providers need soil science input.

Next meeting: To be advised.

Meeting finished 11:45.

Norman Taylor Lecture



Professor Mike Hedley, of Massey University, will present the next 2013 Norman Taylor Lecture on **18th February at 5.15 pm in AH1, AGHORT Lecture theatre block, Massey University.** (This is after the first day of the 2014 FLRC Workshop)

<http://www.massey.ac.nz/~flrc/workshops.html>

The topic of the lecture is **“The next steps in nutrient management of grazed pasture systems”**.



A collection of soil-related oddities from Godzone and around the world

Getting down and dirty

Soil is often perceived as dirty by those with closed minds. However, there are several species which use soil or dust to cleanse themselves, and to protect themselves from the sun's rays - and pests.

In essence, poultry dustbathing involves passing a substrate, like sand or dust, through the feathers. In unrestricted conditions, hens will dustbathe every two days, and most likely during the hottest and brightest part of the day. Even when birds do not have any dust to bathe in (i.e. housed hens) they will regularly go through the dust bathing motions in what is termed "sham dustbathing". Dustbathing seems to work by removing stale feather lipids, which are what some parasites feed on, and fine dustbathing materials appear to work best. When



peat, sand or wood shavings were made available to birds, the birds housed on peat had the "fluffiest feathers, least feather lipids and lowest back temperatures"¹. Birds tend to dustbathe together, which some have thought to be a social behaviour, although it is more likely a survival instinct as birds are more vulnerable to predators when dustbathing.



Elephants also are keen users of soil to protect themselves from the sun and biting insects. Researchers have found that dusting frequency increases in proportion with environmental temperature². In some instances, elephants will blow dirt over themselves after a mud bath for extra protection. As with birds, there is a suggestion that dustbathing may have a function in the maintenance of social cohesion.

This left me wondering if we were missing out by not taking a few dustbaths ourselves. My internet search on 'human dustbathing' returned nothing.

The closest thing I could find is volumizing hair powder, of which clay is usually the main ingredient. Apparently it "creates crazy volume and texture". That must be why the birds like it so much.

¹ Olsson & Keeling 2005; ² Martin & Mullens 2012

Waikato/Bay of Plenty

AgResearch Ruakura

As part of his joint role with the NZ Life Cycle Management Centre at Massey University, **Stewart Ledgard** and colleagues from Scion, Plant + Food and Massey spent a day supervising students presenting on their review of Environmental Indicators at a Student Symposium. The students then got their own back by giving feedback on talks by the supervisors, with Stewart's talk on Allocation issues and accounting for different agricultural co-products from NZ dairy and sheep production systems to overseas markets.

Dave Houlbrooke and **Seth Laurenson** (Invermay) travelled with **Jie Lie** (an AgResearch based PhD student supervised by **Jiafa Luo**) to China in late October. The first part of the trip was to attend and present talks related to dairy effluent management in New Zealand to an international conference called RAPCP (Recent advances in Pollution control for the livestock breeding industry) in Jiaxing city. The conference was well attended largely by Chinese University delegates and provided a lot of context regarding the degree of nutrient excess and emerging contaminants that need to be managed from this industry in China. Following this Dave and Seth travelled to Beijing where they were hosted by Fonterra and Tsinghua University. Together with the Chinese Academy of Sciences Fonterra have begun a series of research trials investigating the agronomic response and environmental outcomes of land applying manures. AgResearch (together with Tsinghua University) is providing technical expertise to this newly established three year NZ China Collaboration project governed by the New Zealand Ministry for the Environment and the Chinese Ministry for Environmental Protection.



Seth Laurenson, Jie Lie and Dave Houlbrooke attending the RAPCP conference

Dave Houlbrooke, Seth Laurenson and Tian Jinping (Tsinghua University) beside some composted effluent solids at the Fonterra research site



Mark Shepherd attended a two-day meeting with the P21 Steering Group (Investors) and scientists from the P21 programme. The P21 (Phase 2) research programme is jointly funded by MBIE, DairyNZ, Beef and Lamb New Zealand, Fonterra and DCANZ. The aim is to develop adoptable beef and dairy production systems with improved profitability and reduced losses of nutrients to water and involves researchers from AgResearch, DairyNZ, Massey University, Lincoln University, Plant and Food, NIWA and Landcare. Day 1 was hosted in the Waikato with a visit to the farmlot experiment at Scott farm (DairyNZ/AgResearch study). Day 2 involved a visit to the new controlled duration grazing project being established at Massey University (No. 4 Dairy), where a \$1.4 million free stall barn with feeding and resting areas for 200-300 cows has been built as a part of the project. In the afternoon there was a visit to Ballantrae to see some of the work funded by B&L NZ. The overall programme is managed by AgResearch (**Alasdair Craig**, Operations Manager and Mark Shepherd, Science Manager).

And finally, our cohort of Ruakura Soil Science Society members has recently been joined by **Nigel Bell**, **Maria Tourna** and **Michael Wilson**; all from the Innovative Farm Systems group. Nigel Bell is Team Leader of the AgR Soil Biology team based at Ruakura and Lincoln. Nigel is a Nematologist working on many projects looking at plant feeding nematodes as pests and biosecurity risks and how these may be mitigated. He's got a strong interest in using nematodes as bioindicators of soil functioning with an MPhil student currently looking at the total nematode fauna under a range of ryegrass cultivars in two North Island sites.

Maria Tourna is a soil microbiologist with expertise in development and application of molecular methods to study the physiology and ecology (diversity, abundance and how are those affected by any kind of perturbation) of microbial communities involved in biogeochemical cycles. Much of her work has focused on microorganisms driving the cycling of nitrogen and more recently, the cycling of sulphur in agricultural soils.

Michael Wilson has a wide interest in soil biology with particular focus on biological control of soil pests (particularly slugs), interactions between soil animals and micro-organisms, and use of nematodes as bioindicators.

Our group also has a French visitor **Antonin Guigue** who will spend 4 months working on a joint project using LCA to compare the carbon footprint of NZ and French dairy farm systems, methodologies and benefits of mitigations. This is a joint project with Stewart Ledgard from AgResearch and **Jean-Baptiste Dolle** from Institut de E'levage in France (who will spend 2 weeks here on the project in early December).



The banner features a logo on the left with a stylized landscape. The text on the left side reads: "New Zealand Society of Soil Science", "Soil Science For Future Generations", "2014 Conference", "The University of Waikato, Hamilton", and "1-4 December 2014". The right side of the banner contains the following information:

NZSSS Annual Conference 1- 4 December 2014
The University of Waikato, Hamilton

IMPORTANT DATES		CONTACT DETAILS	
Abstract submissions open:	1 Feb 14	onCue Conferences	
Abstract submissions close:	1 Sep 14	PO Box 1193, Nelson	
Registrations open:	1 Mar 14	Tel: 03 546 6330	
Early-bird registrations close:	24 Oct 14	Fax: 03 929 5512	
Conference:	1-4 Dec 14	Email: lea@on-cue.co.nz	

www.nzssconference.co.nz

To receive regular updates on the conference to email lea@on-cue.co.nz.

Waikato University

In October the annual graduate conference of the Department of Earth & Ocean Sciences was convened by **David Lowe**. Various prize-winners, including **Jack Pronger** (best environmental paper), **Alex Keyte Beattie** (best MSc oral paper), and **Doreen Huang** (special merit) and their certificates are shown in Fig. 1.



*Fig. 1. Earth and Ocean Sciences graduate conference prizewinners, 2013.
Photo Sydney Wright.*



Fig. 2. Soil guru Jock Churchman on air in Hamilton 3 November, 2013. Photo Maria Lowe.

Jock Churchman (University of Adelaide/University of South Australia) visited in early November to help **David Lowe** and **Doreen Huang** (PhD student) with their Marsden project on carbon sequestration and the search for possible ancient DNA in buried allophanic soils on tephras. Jock kindly agreed to be interviewed on local radio, where he promoted his forthcoming book “The Soil Underfoot” and other topics on soils (Fig. 2). He also visited the outstanding early Maori garden “Te Parapara” at the Hamilton Gardens where he saw traditional soil modifications for growing kumara (Fig. 3).



Fig. 3. Kumara growing in traditional style in the ancient Maori garden in Hamilton Gardens. Pataka in distance painted with haematite derived from natural ferrihydrite transformed using traditional methods. Photo David Lowe.

We said farewell to **David Zweig**, a Fulbright fellow from Arkansas who worked with Louis. David completed a dissertation on the kinetics of nitrate removal in denitrification beds. While in Hamilton, David also presented his work to community groups, interned at Waikatolink, took maths courses, and learnt and coached Lacrosse at a nearby high school.

Louis Schipper attended the Soil Science Society of America annual conference in Tampa presenting his recent collaborative work with **Vic Arcus** (Biological Sciences, University of Waikato) on the temperature dependence of soil biological processes. He also presented a poster summarising work on denitrification beds being conducted by **Anna Carter** (MSc student) and David Zweig. After the conference Louis attended a meeting of the Croplands group of the Global Research alliance along with **Mike Beare**.

On World Soils Day, Thursday 5th December, 2013, the second “Wai-BoP Soils 2013” conference was held at the University of Waikato. More than 70 people participated from around 20 different organisations (including three farmers), with participants coming from afar afield as Canterbury, Hawke’s Bay, Auckland, and the Manawatu as well as from the Waikato and Bay of Plenty regions. The format was the same as that used successfully in 2011: no abstracts, no posters, and no registration (see Schipper and Lowe, 2012). Generously sponsored mainly by the Waikato Regional Council with support from the University of Waikato and the Soils Group, and from **Trish Fraser** of NZSSS, the conference began at 8.15 am with a terrific 30-minute keynote talk by **Vic Arcus** “Temperature controls on soil microbial processes” (Fig. 5). Then followed five sessions comprising twenty-five 12-minute talks, including a very interesting talk by **Angela Schipper** and **Barbara Ryan** on

“Educational resources to help teach soil science in the classroom” (accompanied by a display during the morning tea and lunch breaks: Fig. 6), and nine student papers, all of excellent quality. David Houlbrooke spoke briefly about the society’s national conference that is being held at the University of Waikato from 1-4 December in 2014, updating us on planning and progress for what promises to be an excellent event.



Fig. 5. Vic Arcus (right), with chair Louis Schipper, ready to start his innovative keynote talk. Photo David Lowe.



Fig. 6. Angela Schipper (left) and Barb Ryan at their soils in education display. Photo David Lowe.



Fig. 7. Mike Hedley (right) receiving the revamped N.H. Taylor Auger from Malcolm McLeod. Malcom had the auger mounted on a piece of rimu that was previously part of a mapping table used in the Hamilton office of Soil Bureau, DSIR. Photo David Lowe.

Finally, the day was capped off at 4 pm in classical yet innovative style by **Mike Hedley’s** excellent N.H. Taylor Memorial Lecture for 2013 entitled “The next steps in nutrient management of grazed pasture systems”. Mike was presented with the Taylor Auger at the end by the 2012 N.H. Taylor lecturer, **Malcolm McLeod** (Fig. 7) and his certificate by NZSSS council member **Megan Balks** (Fig. 8). Waikato University’s “best completing undergraduate student in soil science” prize was also awarded during the conference to **Holly Bredin-Grey** (Fig. 9).



Fig. 8. Mike receives his N.H. Taylor Memorial Lecture certificate from Megan Balks. Photo David Lowe.



Waikato University’s “best completing undergraduate student in soil science” prize was also awarded during the conference to **Holly Bredin-Grey** (Fig. 9).

Fig. 9. Holly Bredin-Grey receives her NZSSS undergraduate prize (Waikato) from Louis Schipper. Photo David Lowe.

Finally, all those who attended the Wai-Bop Soils 2013 meeting, and others in the region, send their best wishes to the rest of the soils and land community in New Zealand (Fig. 10).



Fig. 10. Greetings from Wai-Bop Soils 2013 to all our colleagues on World Soils Day! Photo David Lowe.

Reference

Schipper, L.; Lowe, D.J. 2012. WaiBOP Soils – a “flash” conference? *New Zealand Soil News* 60, 18-19.

Landcare Research, Hamilton

Hannah Julian, a BSc (Tech) student from the University of Waikato has joined our team here at Landcare Research Hamilton, and will be with us until the end of February 2014. She will be working with **Sharn Hainsworth**, **Scott Fraser** and **David Palmer** looking to develop soil landscape models for the Tukituki Catchment, where the Ruataniwha Water Storage (and Irrigation) Scheme is proposed. Hannah is currently working on a literature review and beginning her site assessments.

Scott Fraser and **Sharn Hainsworth** have started a 1:50,000 mapping project in the Waipa catchment. This is a 2-3 year project that will extend the Waikato S-map coverage by approximately 300,000 ha, and fill a gap between the Waikato Lowlands, Matamata, South Waikato, Taupo and King Country regions which are already in S-map. John Bruce's 1978 Part Raglan County map is also now ready and will be uploaded to S-map in the coming weeks. For further information on S-map visit s-map.landcareresearch.co.nz.

Manawatu/Hawke's Bay

AgResearch Grasslands



Lei Zhong, a LEARN Scholar from China, has been working at Grasslands for the past year and is heading home this week.

Lei has been working on:

- 1) The long-term effects of elevated atmospheric CO₂ on N₂O production and reduction process in pasture.

The aim of this study was to test the effects of grazing and elevated CO₂ on the abundance of nitrification and denitrification microbial functional genes, nitrification and denitrification potentials, and on the expression of some microbial functional genes - in sheep-grazed pasture soils. This included (1) determination of the abundance of functional genes *amoA*, *narG*, *nirK/S* and *nosZ*, (2) measurement of heterotrophic and autotrophic nitrification and denitrification enzyme activities (NEA and DEA, respectively), and (3) determination of the expression of *nosZ* gene of soils under pastures that had ambient or elevated CO₂ for the previous 14 years and were either grazed with excreta returned or grazed without excreta returned. Soil physiochemical properties were also determined. All the field and laboratory work has been completed.

- 2) The effect of grazing intensity and slope class on N₂O production and reduction processes in pasture

The aim of this study was to investigate the effects of grazing intensity [(intensive (IG) and extensive (EG)] and slope class [low (0-12°), medium (13- 25°), and high (>25°)] on the abundance of soil microbial functional groups for nitrification and denitrification processes and their activities in hill country pastures. Here he (1) determined the abundance of functional genes *amoA*, *narG*, *nirK/S* and *nosZ*, (2) measured potential heterotrophic and autotrophic nitrification and denitrification enzyme activities (HNEA, ANEA and DEA, respectively), and (3) determined soil physiochemical properties (pH, carbon, nitrogen, NH₄⁺,

NO₃⁻), on hill country pastures at three different slope classes and under intensive and extensive sheep grazing.

All the field work and laboratory analysis are complete. Lei has also written a paper “*Enduring effects of elevated CO₂ on potential emissions of N₂O are due to increased heterotrophic nitrification and reduced expression of nosZ genes*” that will shortly be submitted to *Global Change Biology*.

Plant & Food Research – Palmerston North

With the start of summer, we welcome two summer students to the team. **Charlotte Robertson** (Massey University), working with Karin Mueller and Karen Mason, is evaluating phosphorus runoff from water-repellent soils in the lab and field, and is also testing several hypotheses around the origin of soil water repellency as part of the bilateral MBIE/JSPS research project on soil architecture and mass transport parameters in water-repellent soils. **Emily Smith** is working as a summer student with Claudia Wiedow, Ian McIvor, and Trevor Jones on the DNA fingerprinting of poplar and willow clones, and the drought tolerance of new hybrid poplar clones. The DNA fingerprinting study involves the use of microsatellite DNA markers for the identification of poplar and willow clones, using leaf samples. The study will verify the identity of poplar and willow clones from different source material that are being propagated for field trials. The drought tolerance of new hybrid poplar clones is being evaluated in a greenhouse experiment, to characterize the water-use efficiency of the clones and the capacity for drought acclimation.

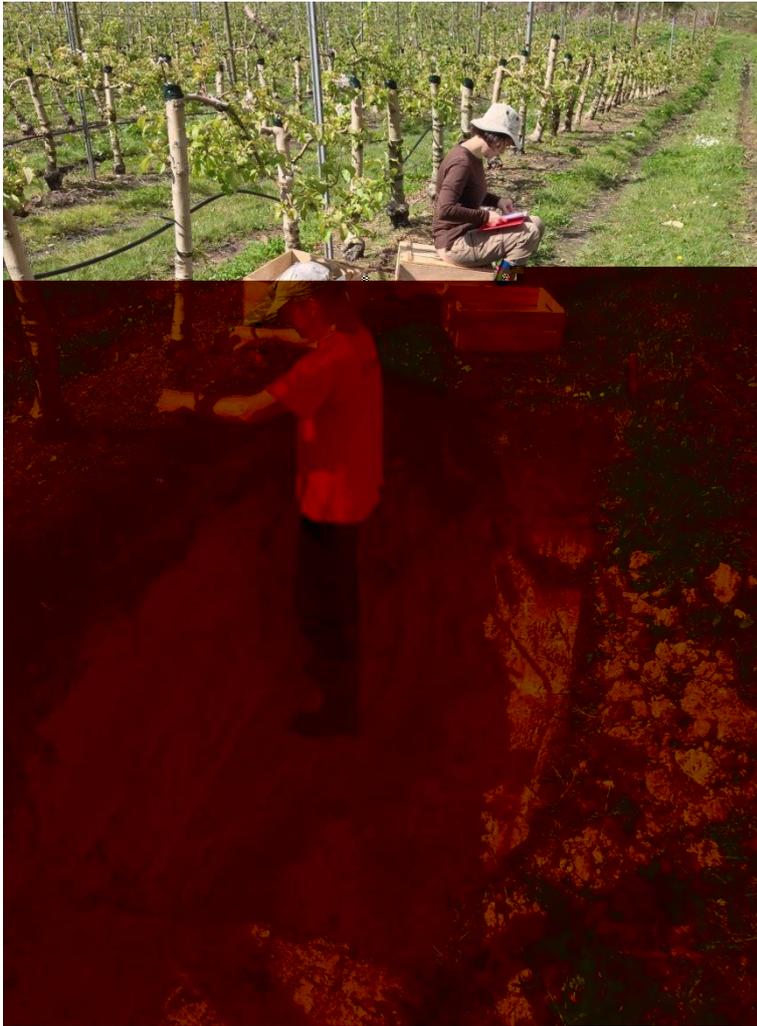
Edouard Périé is continuing to dig holes in quest of his PhD assessing the variability of soil carbon stocks in apple orchards. **Alejandro Galindo**, a Spanish visitor working with the team for 6 months, was introduced to NZ by hole digging in the Hawke’s Bay. Edouard is thankful for this help towards his last sampling campaign before writing his thesis.



Alejandro is introduced to NZ soils by digging holes for bulk density sampling to 1m depth.



Edouard: Is there a PhD down there?



In October, our team returned to Australia to resample apple orchards for soil carbon. In the final field work for our PIPS program, orchards in Victoria and Tasmania were resampled for soil carbon to determine any temporal trends in carbon stocks over the five year duration of the project. While **Carlo van den Dijssel**, **Roberta Gentile**, and **Brent Clothier** were in the pits collecting soil, **Steve Green** was assembling a new mobile light sensor trolley and installing sapflow heat-pulse sensors for ongoing work modelling tree water use.

Carlo and Roberta collecting soil in Tasmanian apple orchard. The wellington boots kept the rain at bay.

Out of Africa - Avocados

Plant & Food Research has just initiated a 5-year project in Kenya on avocados. The project is funded by the New Zealand Aid Programme and it is linked to the New Zealand company Olivado. Since 2007 Olivado has had an avocado oil-pressing factory in Kenya. The goal of the project is to lift avocado productivity and the quality of production to improve the economic performance of the smallholder farmers growing avocados under contract to Olivado. The low level of productivity by smallholders and their low and variable revenue streams are a real concern. This aid project by Plant & Food will address that issue, via Olivado.

The smallholder farmers generally have farms of just 1 ha, and there are a number of other tree crops along with the avocados (Photo 1). On average, the farmers supplying Olivado have about 15-20 trees. Furthermore, about 45% of the smallholder farmers are women. The low level of productivity by the smallholder farmers is a concern. By increasing both the productivity and the quality of production these will improve the economic lot of the smallholders. Linking this within-farm growth to the success of Olivado's business will provide resilience and sustainability to the smallholders.



The typical avocado farm of a Kenyan smallholder comprising avocados (left), chooks (foreground), a couple of cows and a few goats (background) and banana trees (right). The inset shows the distribution (blue dots) of the 1200, or so, smallholder avocado farms that supply Olivado. Nairobi (red hatching) is at the lower left and Mt Kenya is at the upper right.



Brent Clothier installing a Gdot sensor in the soil of the rootzone of an avocado tree in the Kendara Valley above Kenol, Kenya.

Brent Clothier, along with six Plant & Food scientists and the Olivado team met in Kenya during late October to begin this new project. Brent leads Objective 2 on better management practices with nutrients and water the prime goal. Soil-water shortages, especially in the lower parts of the highlands, would appear to have a detrimental effect on the production of avocados. An early goal is to quantify the magnitude of the impact of drought. So during this trip in October we installed Gdot sensors to monitor soil-water potential in an easily understood way. Early results indeed suggest that in the lower parts of the highlands, at least prior to the beginning of the short rainy season in November, the soils are dry enough to affect tree performance. We will return during the dry season prior to long rainy season in March to obtain more detailed information.

Landcare Research, Palmerston North

An exciting new international soils book “The Soil Underfoot” is due to be released early in 2014, with a number of contributors from our NZSSS community.

The book is edited by G Jock Churchman and Edward R Landa (see flyer).

The Soil Underfoot
Infinite Possibilities for a Finite Resource

G. Jock Churchman
Edward R. Landa

This book provides an expert analysis of challenges faced by humankind and their implications for the availability and sustainability of soils worldwide. It emphasizes cultural, historical, philosophical, and ethical approaches to understanding soil resources. Chapters cover climate change, diminishing plant nutrients and soil loss; religious views of soil; cultural/historical views and uses of soil; uses of soils for optimal production and conservation; non-agricultural uses of soils; and challenges for soil science. The book contains 30 contributions with chapter authors from 13 different countries.

Key Features

- Presents information from diverse cultural and geographical sources describing attitudes to soils including philosophical and ethical framework
- Identifies practical guidelines towards sustainable uses for soils
- Describes a range of philosophical and ethical frameworks that have either sustained soils or led to soil degradation in the past
- Explains the need to maintain and improve the quantity, quality and productivity of soils to support a changing environment

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THE SOIL UNDERFOOT
Infinite Possibilities for a Finite Resource
EDITED BY
G. JOCK CHURCHMAN
EDWARD R. LANDA
Cover illustration by Jay Moller
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Taylor & Francis Group

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Taylor & Francis Group

There is a chapter on climate change by Kevin Tate, and another on natural capital and ecosystem services of soils is addressed in a chapter written by Mary-Beth Kirkham & Brent Clothier.

Brent has provided us with a preview of the first paragraph of his chapter:

The natural-capital concept attempts to integrate economic thinking with ecological principles by considering nature’s stocks of materials and energy as capital. In economics, interest, or rents,

flow from financial or built capital, and so by analogy in nature, ecosystem services, which benefit mankind, flow from natural-capital stocks. Nature comprises an assemblage of natural capital stocks, and they, in sum, form our ecological infrastructure. Marchant et al. (2013) consider ecological infrastructure to be how natural capital is arranged. Bristow et al. (2010) noted that soil is a key component of ecological infrastructure, and that it is a prime natural-capital stock that provides valuable ecosystem services.

- Clothier, B.E. and M.B. Kirkham 2014. Soil: Natural Capital Supplying Valuable Ecosystem Services. **Chapter 11 - The Soil Underfoot: Infinite Possibilities for a Finite Resource.** eds. G.J. Churchman, and E.R. Landa, Boca Raton: CRC Press. 135-150.

Also – a good read are two chapters on NZ Maori, by Garth Harmsworth & Nick Roskruge

- Harmsworth, G. & Roskruge, N. (*in press*) 2013. Indigenous Māori values, perspectives and Knowledge of soils in Aotearoa-New Zealand: **Chapter 9 – Beliefs, and Concepts of Soils, the Environment and Land.** In *The Soil Underfoot: Infinite Possibilities for a Finite Resource.* eds. G.J. Churchman, and E.R. Landa, Boca Raton: CRC Press. 111–126.
- Harmsworth, G.R. & Roskruge, N (*in press*) 2013. Indigenous Māori values, Perspectives and Knowledge of soils in Aotearoa-New Zealand: **Chapter 20 – Māori Use and Knowledge of Soils over Time.** In *The Soil Underfoot: Infinite Possibilities for a Finite Resource.* eds. G.J. Churchman, and E.R. Landa, Boca Raton: CRC Press. 257–268.

Massey University Soil and Earth Sciences, Palmerston North

At the Massey graduation ceremony in November **Amandeep Singh Ghatohra** had his PhD conferred. His thesis was titled ‘EFFECT OF METHOD OF TILLAGE ON LOSS OF CARBON FROM SOILS’ and his supervisors included Surinder Saggar, Mike Hedley and Craig Ross. The research was supported in part by Cross Slot No Tillage Systems Ltd and one of the Directors of this company, Bruce Ullrich OBE was in attendance at the graduation ceremony in his capacity as a member of the Massey University Council. Amandeep recently took up full time employment with Landcare Research in Palmerston North.



Dr Amandeep Singh Ghatohra with Bruce Ullrich OBE, a Director of Cross Slot No Tillage Systems and member of the Massey University Council

Marta Camps attended the Global Soil Week 2013 in Berlin, Germany, from 27th to 31st October, on the theme “Losing Ground?” Participants were involved in plenary discussions, interactive dialogue sessions and an action forum. The discussions were organised around four thematic threads corresponding to key areas of response to global soil loss:

- (i) transforming global material and nutrient cycles;
- (ii) upscaling sustainable land management and soil engineering at the landscape level;
- (iii) integrating land and soils in the sustainable development goals debate; and
- (iv) responsible land governance.

On Thursday, participants held informal workshops to deepen the debate on key issues and to plan follow-up activities and collaboration. One of the workshops was organised by the FAO Secretariat of the Global Soil Partnership and involved discussions on Pillars 1 and 3:

Pillar 1- Promote sustainable management of soil resources for soil protection, conservation and sustainable productivity.

Pillar 3- Promote targeted soil research and development focusing on identified gaps and priorities and synergies with related productive, environmental and social development actions.

Marta Camps presented a talk on: “How to promote soil targeted research? Crucial elements that the plan should foresee”. More information about the Global Soil Week is available at the link: <http://globalsoilweek.org/gsw-2013/>.

Natalie Butcher has recently joined the staff of the Fertilizer & Lime Research Centre (FLRC) as a technician to work on the P21-funded research on the No. 4 Dairy Unit. Natalie has worked on research at the Massey Farms on previous occasions and has a strong affinity with the management of dairy production systems. Miles Grafton has been appointed Senior Lecturer with the NZ Centre for Precision Agriculture (NZCPA) and will work with Ian Yule on a Primary Growth Partnership project with Ravensdown Fertiliser, who were his previously employer.

Sasikunya (May) Cheuyglintase recently started her PhD programme titled ‘*Removal of dissolved reactive phosphorus from municipal and dairy factory wastewater using andesitic tephra soils.*’ Her supervisors are James Hanly and Dave Horne and the work is being partially funded by Fonterra.

Aaron Stafford, Science Extension Manager with Ballance Agri-Nutrients has embarked on a PhD to investigate aspects of *Cadmium accumulation and availability in New Zealand soils*. His supervisors are Chris Anderson and Mike Hedley.

FLRC are preparing for another busy workshop in February 2014 with close to 90 papers submitted for the three-day programme. The Provisional Programme will be posted on the FLRC website at <http://flrc.massey.ac.nz/> where details about registration can also be found.

Plant & Food Research – Hawke’s Bay

Matthew Norris recently took up a research associate role with Plant & Food Research in the Hawke’s Bay. As a member of the broader Land Use Management team, most of his work will be focussed in areas relating to sustainable production, with a particular focus on soils, field crops and nutrient management. Matt is looking forward to utilising his background in soil science as well as broadening his knowledge base in areas relating to sustainable cropping systems.

Canterbury

Plant and Food Research – Lincoln

Abie Horrocks attended the 2013 ISHS ‘Organic matter management and compost use in horticulture’ Conference was held in Chile in October 2013. Abie writes “One of the conference’s themes was around the sustainable use and management of compost in conventional production systems. I presented a paper titled ‘Productivity, profitability and N fertiliser reductions as a result of compost in an arable cropping rotation’ which I had put together with **Craig Tregurtha**, **Esther Meenken** and **Shane Maley**. It was an interesting conference with a lot of presentations relevant to managing a variety of organic matter inputs (e.g. municipal compost, spent mushroom substrate and animal effluent) into production systems. Materials to land re-use is a growing reality both nationally and internationally. Although there are benefits to be gained as a consequence of recycling nutrients, through returning organic matter to land, there are also risks if farmers do not have access to sound information regarding best practice for the use of these materials. Environmental, productivity and logistical implications of on-farm use were covered at the conference. I was especially interested in other researchers experience with farmer uptake and how best to get the science out to end users. A field trip to a vineyard and orchard which composted both its citrus and grape cuttings was also a highlight!”



Vivian Oliva is visiting us for 9 months from UFPR, Curitiba, Brazil. She is a post graduate student in Agricultural Sciences working in agro-forestry. While in New Zealand she is furthering her studies in soil carbon processes working with **Craig Anderson** on the contributions of crop roots and microbiota to soil structure and function. She will be aiding an experiment utilising stable isotope probing, microbiological analysis of samples associated with a C mineralisation experiment and helping with a biological study at the Millenium Tillage Trial.

Alannah Rickerby is a summer student working with **Trish Fraser** looking at variability in rates of irrigation applied by different irrigator types. She will be travelling to farms and using tipping-bucket rain gauges to take measurements of application intensity by irrigators. As time permits, she will be taking multiple measurements from different types of irrigators, so

that it will be possible to establish what is typical of a particular type of irrigator. This data will ultimately be used to simulate irrigation events in the lysimeter facility.

Mike Beare presented a paper at the annual meetings of the ASA/CSSA/SSSA in Tampa, Florida in the first week of November. The paper was entitled: *Estimating the organic carbon stabilisation capacity and saturation deficit of soils: a New Zealand case study* and was co-authored by **Denis Curtin** and **Jo Sharp** (Plant & Food Research), Stephen McNeill and Roger Parfitt (Landcare Research), Haydon Jones (Environment Waikato) and Mike Dodd (AgResearch). Mike and Louis Schipper also attended a meeting of the *Cropland Research Group* for Global Research Alliance on greenhouse gas mitigation and adaptation research.

Otago/Southland

AgResearch Invermay

Preparations are under way for a SLMACC-funded field trial examining the effect of grazing timing following irrigation on nitrous oxide (N₂O) emissions from a poorly drained soil in Otago. As part of the trial, compaction will be simulated using Plant and Food's 'hoofinator' – a piece of equipment with 18 feet that can deliver up to 300kPa pressure through each 'hoof'. **Tony van der Weerden** has this on loan from project colleagues **Steve Thomas** and **Gina Clemens** of Plant and Food in Canterbury. Tony, along with **Tom Orchiston** and **Tash Styles**, has been busy learning how to tame this beast in time for a start date of late January. Tony has also been coordinating a series of MPI-funded N₂O field trials in the Waikato, Manawatu, Canterbury and Otago to determine emission factors for fertiliser applied to both hill country and lowland pastures.

Cecile de Klein and Sergio Morales (Otago University) hosted an international workshop at Invermay for the Global Research Alliance funded project: 'Reducing N₂O emissions from urine patches through accelerating N₂O reduction'. The workshop was attended by Drs Karl Richards and Gary Lanigan (Teagasc, Wexford Ireland), Profs Lars Bakken and Asa Frostegard (Norwegian University of Life Sciences), Prof Tim Clough (Lincoln University) and Prof Surinder Saggar (Landcare Research).

Ross Monaghan, **Chris Smith** and **Tash Styles** have been busy summarising information collected from monitoring of a large cow standoff pad in Southland this winter. Carbon-based standoff pads are a reasonably common option used by some dairy farmers to keep cattle off pastures during wet winter conditions, yet little is known of their efficacy for capturing surplus liquid landing on the pad surface, nor the excretal nutrients deposited during periods of animal confinement. Monitoring of effluent generation by the AgResearch team during winter 2013 seeks to fill this knowledge gap and refine existing guidelines for the design and management of these types of off-paddock facilities.

Lincoln University

In December 2013, Prof **Leo Condrón** was invited to participate in the 4th International Symposium on Advances in Science and Technology of BioResources (and associated Symposium on the Soil-Plant-Microorganism Continuum), organised by the Universidad de la Frontera in Pucón, Chile. He delivered 3 talks on various aspects of soil phosphorus dynamics and nutrient management. The main purpose of the visit was to advance

development of a collaborative research initiative to investigate the nature and bioavailability of phosphorus in acid volcanic soils, which is led by Professor Maria de la Luz Mora from the Universidad de la Frontera in Temuco. This includes the development and evaluation of novel biological technologies designed to enhance the utilisation of soil and fertiliser phosphorus in grazed pasture systems. A number of projects were discussed and initiated, and Prof Condon has been awarded an OECD Fellowship to continue to develop this research at the Universidad de la Frontera in 2014. Prof Condon also visited the Pontificia Universidad Católica de Chile in Santiago to discuss and develop research on soil phosphorus biogeochemistry associated with a series of ecosystem chronosequences in the high altitude salt lakes region of southern Bolivia. This work will be carried out in collaboration with plant ecologists Drs Aurora Gaxiola and Fernando Alfaro from the Institute of Ecology and Biodiversity at Pontificia Universidad Católica de Chile and Dr Ben Turner from the Smithsonian Tropical Research Institute in Panama. Prof Condon then spent 5 days visiting Dr Andrea Vincent at the Universidad de Costa Rica to discuss options for developing new research on soil phosphorus dynamics in native and managed tropical ecosystems, and included a 2 day field trip to the famous La Selva Biological Research Station. Prof Condon also presented a seminar on the nature and bioavailability of phosphorus in soil-plant systems at the Centro de Investigaciones Agronómicas, Universidad de Costa Rica in San José.

Celebrating World Soils Day

WORLD SOILS DAY – 5 DECEMBER



Nathan Heath, Land Services Advisor, HBRC sent us a photo of some cakes that he and his wife created recently to celebrate World Soils Day. We thought the combined efforts worth showing!

Member Article – A ‘Chat’ with Lee Kuan Yew’ by Norman Wells

Norman Wells (b.1927, London)

Soil Bureau 1951- 1989. Became leader of the Physical Chemistry section when M. Fieldes became Director of the Bureau, and later acted as Deputy Director. Worked in Singapore under aid projects, followed by advisory work in Malaysia.

While working on a bilateral aid project in Singapore, I was kindly accommodated and fed by the New Zealand Army at their Dieppe base Camp. It was the former British army base, and quite large, as apart from buildings, it included an airfield and a golf course. The gate to the barracks was opposite the gate of the Singapore Agricultural Research Station, where I was working on the uses of digested sewage sludge. As it was a mucky job, the army was a far more appropriate place for me to stay than the usual type of hotel near the Diplomatic Quarter, where the Ministry of Foreign Affairs usually put up visitors. It was a good solution, they were hospitable, and I liked it there.

This was before cell-phones, so messages were written down and posted up, and one day, out of the blue, there was one waiting for me, saying that on Saturday, an official car would pick me up at Dieppe, and take me to see the Prime Minister, Lee Kuan Yew. Very simple message, and to the point, but what point? I thought a hint of the subject to be discussed would be helpful, and even, a mention of what time I should be ready for the pick-up. However, Saturday was close at hand, it was late in the day, so why make a fuss? The message had a rider, that the same car would take a young engineer, recently arrived from NZ DSIR, to the same meeting. I did then allow myself to wonder if Foreign Affairs were miffed not to have a staff member included, so had worked the new arrival in to find out what (if anything!) was going on.

Saturday arrived very quickly. I got up from my nice bed, and thought of breakfast, New Zealand Army style. Not much like that hotel in town, with its English colonial-style breakfast, perhaps with a kipper, or lightly smoked haddock, poached in coconut milk. The next question was where and when the car would pick me up. There was only one possible place, the camp bar, and as for what time, well, Saturday would be a lateish start, say, 0900 hours. I was mostly a non-drinker, capable of sitting in a bar all day without stress; after all, in the past I had declined vodka in Russia, and a choice single malt in Scotland, what better qualification for a whole day in the bar?

At lunch a car with driver arrived, but it was the camp commander. I asked if he had happened to see a posh car looking for a passenger. He said he had not, and went on to ask whom I was going to see. When I told him Lee Kuan Yew, he said “He’s a busy man; it’s not unusual to have to wait”. So I waited.

At mid-afternoon a large car with a flag on the bonnet arrived at the bar; I shot out quick, to waste no time, but still had to have the back door opened for me. I sat inside and began a regal ride to the presidential palace. On the way it struck me as rather odd, no name check. At the palace, the Istana, in extensive grounds in the prosperous area just off Orchard Road with its famous shops, we entered through an open gate, with just a man standing by. The palace was a grand old house, English colonial style, and with no guard on the front door, I just went inside. There at the foot of the stairs was my companion for the visit, the engineer, with whom I was only very slightly acquainted. He asked what had kept me so long, having been picked up earlier from his hotel by the same car. My colleague asked me “What is it all about? and I said “we shall soon find out”. Up the stairs we went to the first floor, where a young secretary-like lady led us to a door, and in we went. Lee Kuan Yew was sitting on a large sofa, with his back to a window, with a fine backdrop of trees, very appropriate, I thought. He greeted us and waved us to two simple wooden chairs facing him, opposite his sofa. It was a charming start to the meeting, and I was prepared to talk about anything he brought up. But then I realised that the room seemed wrong, with the wrong shape and proportions. The lovely old colonial reception room had been subdivided, seeming to have about one-third missing, and the wall behind us was not original; it was newer, and perhaps not even a wall, but a screen, painted. The screen would allow for discreet security monitoring; it could not be the full picture that the Prime Minister, though not much older than myself, should be sitting in the palace with no apparent protection.

Lee Kuan Yew explained the delay in our meeting, which he wished to schedule after his official day, so that it could be open-ended. Then it all came clear, the subject of interest was slipped in as he said to me "I hear that you have been to the Caucasus". This was a challenge. I had only a few seconds to construct a travelogue specific to his interests rather than to launch into the framework already existing in my mind. In 1974 I had been on a field trip from an international conference of soil scientists, where we had made a traverse from the eastern end of the Black Sea, through the forested slopes of the Caucasus, to the Caspian Sea. I had to flip my picture from seeing landscape based on soil profiles, to being one of ethnic groupings of people within a landscape. I had to find a starting-point that met his interests, and this was easy, as he had always been keen on using trees to soften the vision of the high-rise city-state, which must be the future for Singapore.

I started my presentation by skipping four soil profiles, and led off on a botanical approach. The Ajaria State Botanical Gardens at Batumi, on the eastern side of the Black Sea, represented a subtropical climate to the Russians who spent their lives in the cold winters of the vast interior. In fact, its average annual temperature of 14C, and annual rainfall of 2500mm. would be called Temperate, but its proximity to the sea, giving a winter minimum temperature of about 10C, with no frosts was ideal for growing trees on its iron-rich soil, with a nice friable structure. The trees exhibited a symmetrical form even in this coastal area, implying an absence of wind-blown salt. It was a botanic paradise. Nine out of its 100 hectares were allocated to plants from seven different geographic zones of the world, including New Zealand and Australia, but none from Singapore. The area was definitely not tropical.

Prior to entering the Botanic Gardens the soil was examined in a large pit (profile no. 5) dug outside the park. Professor Zonn, the leader, picked me out to start the discussion. The soil, a Krasnozem, had formed from unusual rock materials, and would be classified as intrazonal. The iron released by weathering had aggregated the clay to give a friable structure, which allows for good penetration by roots. I had met a similar soil in Singapore, used in Colonial days for growing rubber trees. It was essential that the rubber trees remained truly vertical, for the latex to flow from a spiral cut in the bark into a cup at the base. An unsuitable soil, with a clay pan that discouraged root penetration, could result in a tree with a lean, making it impossible to use the spiral cut for latex collection. Another feature of this reddish friable soil was its suitability for cemeteries, important to Singapore's Chinese community.

Having started my talk with the Botanic Gardens at Batumi, I had to back-track to cover the tour of the western Caucasus. We had examined the Jeltozem soils on the way to Sukhumi, where we stayed the night. These soils were pseudopodzolic, relevant to New Zealand, but not to Singapore.

The next day, we were given a quick run over hydroponics for soft stone fruit production, and had next visited a tea plantation, on sloping land that had been terraced, and planted as hedges, so that the new growth could be machine-harvested. Forget the women in bright-coloured saris picking off choice new shoots with delicate fingers and throwing them into the baskets on their backs. This was tea for a mass market, rather than export.

We had left the horticultural area and arrived for the night at Batumi on the Black Sea. The area had once been part of the Ottoman Empire, then after its break-up had been recovered by Russia, but the local people looked Turkish. My idea of walking along the beach towards Turkey was discouraged by the sign 'Mines'

Our hotel at Batumi had a modern appearance, but in the grounds at the back was a wooden hut where an old man sat with a coke-fired brazier, brewing Turkish coffee. By long simmering down he produced a high-caffeine liquid, needing a lot of sugar to nullify the bitterness. It was in effect the local drug shop, which in a Muslim country replaced the alcohol addictions of the West.

We were now in the Caucasus, the home of about 50 ethnic groups, many living in separate enclaves in remote valleys cut off in the mountain ranges. They are mostly refugees from the history of conflict where East meets West. Lee Kuan Yew had expressed interest in the area, and I gave him a modified version of what followed.

We left Batumi by a slow overnight train, which took us to the central Caucasus, where we first met the forest cinnamon-coloured soils. At our next stop, Gori, the old capital of the kings of Georgia, we paid our respects to the memory of Stalin. This was his hometown, where his political life had started, and as well as statues had his old house inside a museum. There was also a well, which had been used to hide Stalin's printing press, on which they produced subversive leaflets and posters, out of sight of the authorities. This visit would have been a standard offering to overseas visitors, this being still the 1970s, with Stalin not yet discredited.

Our next stop was at Tblisi, the new capital of Georgia, where the Welcome banner was out for us,. This was a key point in the Caucasus east-west land corridor, just before the gorge. At this point, in the palace audience room in Singapore, Lee Kuan Yew mentioned that he had been there as a student. I would have liked to ask more about this, but it was not my place to do so, so I do not know how it fitted into his life. The racial conflicts of the Caucasus could have been a subject that fitted into his time of study at the London School of Economics, rather than his later law studies at Cambridge. This was an enigma; I felt that in this meeting he was allowing himself to look backwards, and perhaps I might prompt his memory. In our visit to Tblisi, we found ourselves with a do-it-yourself afternoon, so I had walked around to see the sights, and had some common ground. The State university, established in 1918, specialised in law, economics, business, humanities and natural science. I had searched around and bought a small wine jar, as a memento of what the soil could produce in Georgia.. In the old city were the castle and the church. The church overlooking the river and its gorge could itself be seen be seen as a frontier castle, of Christianity. To the east was a different world with different customs, as our tour followed the foothills of the Caucasus towards the Caspian Sea.

The next day we went through the police check point on a back road, at the border between Georgia and Azerbaijan. It was a real check, but our group visa made life simple.

We stayed with a very wild ethnic group, living in a village on a large stony fan on the foothills near Zagatala, in Azerbaijan. It was a strange place; men and boys were about, but no girls or women in sight. The stony fan had built up over many years, so that the stream ran through the settlement in a channel between banks of concreted stone about waist height. The animals that grazed on the hills above the forest clearing were kept for the winter in the village.

The next morning the locals took our tour group up the mountain. Transport was by several 4WD vehicles, plus an old army truck for the elderly and the wives in the party. The drivers treated their vehicles as if they were wild horses. A stony streambed was approached at speed, in the same way as a horse takes the jump. Quite frequently a stop was made to tighten the front wheel bearings, then away again. The road climbed in large zigzags, and in the end only the army truck could make it up the open forested slope. We men just walked up, cutting off the zigzags. The soils we had come to see were just like those of the Tararua Ranges in New Zealand, with nice yellow-brown friable subsoils at lower altitudes. Up higher the shallower subsoil was gleyed as iron minerals had leached out giving a paler colour and a more massive structure. We met up again for lunch downhill where the 4WDs had met their limit. I gathered that over the mountain range was Dagestan, an even more remote enclave. The Brown Forest soils had formed under beech trees (*Fagus orientalis*). The whole forest was in a state of regeneration, and nowhere could we see large trees. However, the whole tour group was happy to say goodbye to the wild men and boys of these Caucasus foothills.

The alluvial soils of the valley, as we headed towards the Caspian Sea, began to reflect the lower rainfall (200mm/y) and high mean daily temperatures. In the arid conditions we had Solen Chak soils, unknown to me, with calcareous deposits in the profile, and a natural vegetation of *Salicornia*. Any slight hollow acquired salt crystals. Irrigation required very deep drainage ditches to carry away the surplus salts. Under this system maize was growing experimentally.

That night we were accommodated at the construction village on the slopes below the Tusi Observatory being built in the hills above Shemakha. I was among the unlucky ones taken up to huts at the building site, and unloaded at 1400m in total darkness. In the morning a vehicle picked us up to

rejoin the main group; the top was still in mist, but lower down we had a view of the Caucasus mountains stretching to the horizon.

Arriving at Baku, the capital and oil port on the Caspian, we got the feeling that while Russia controls the Black Gold (i.e. oil), the Azerbaijanis relish their culture, and that a huge amount of oil revenue has been fed into the local community. All the historic buildings were in an extravagant style. The civic buildings amazed us with a row of huge statues, but it showed great respect for the past. We were given a display of dancing and music, with the music of Khachaturian carrying one away into a mystic world, not of the west. The Caspian Sea has been drying up for decades, so that the promenade on the seafront now has three levels, each constructed when the water level receded, through over-use of the Volga River water for large-scale irrigation.

I gave Mr Lee edited highlights, which he seemed interested to hear, though he was not questioning, just listening. I don't quite know how and when I would have stopped, but it had put stress on my speech, and a little cough appeared more frequently, so I handed over to the engineer who gave his first impressions of Singapore, as I recovered. He suggested retaining the warehouses near the Singapore River as a heritage feature (I did not raise the questions about the drains going into the river). The session came to an end with mutual politeness, and we were back on our way home, in the car with the flag, as the early tropical dark fell on the trees of the grounds and Orchard Road. My companion was dropped at his hotel, and I arrived back at Dieppe Barracks, to find the evening meal was over, so it was a bowl of salted peanuts with a beer, in the bar, then off to bed. The ants had got at my mangosteens, arriving in a black column up from the ground outside, into my second-floor room, and I waged a brief war on them with a wet towel before they retreated, leaving a slight odour of formic acid from the casualties. It was Sunday next day, how nice!

That night, before going to sleep, I went back over my memories of the Caucasus tour. I had given the Prime Minister only edited highlights, without any mention of the incidental comedies and minor tragedies that came with the scientific programme and the scenic variety as we travelled through Georgia and Azerbaijan to the Caspian Sea.

Our group travelled under the magic power of a group visa, which allowed us to cross borders in a region of constant ethnic tension, without wasting time on individual passport scrutiny and formalities. The downside of this arrangement was that no separation from the group was allowed. We had all left Moscow together, and it was more than the Intourist guides' lives were worth, if we were not all there on the return to Moscow.

The significance of the group visa was first apparent when starting from Moscow Airport. We were told not to obey the departure sign for our flight, as we were not to go through the departure gate with the locals. A siege tower was wheeled up to the plane, and while local passengers were held in a large pen close by, our separate small pen had its gate opened first and we drifted across the tarmac, and up the steps. No individual seat bookings, so we all selected window seats. When the large pen was opened, there was a mad rush to the plane, with compression of passengers on the lower steps. Eventually all boarded and found seats. We were off into the clouds, with no view visible for anyone.

Feeding time came. A parody of an air hostess appeared, more like a prison guard, with a carton of wrapped sandwiches. No bending over to pass a lunch tray: they were neatly thrown from the central aisle, and people either caught them, or picked them up from the floor. A drink arrived, served with rather more care.

To while away the time in the clouds, I had acquired a Hungarian travel leaflet, that could have diverted one to Lake Balaton, where the following items of entertainment were offered: a paprika party, a piroska party, a highwayman party, a peasant wedding, Lake Balaton by moonlight, a mock highwayman's funeral, plus several other excursions. Why were we going to the Black Sea?

Our tour started with soil profiles in the hills, cleared of forest, around the region to the north east of the Black Sea; these soils at sites with high rainfall (1400mm/y). The next soil profiles were under

beech forest on the foothills of the mountains in Georgia, under moderate rainfall (900mm/y) Moving on to Azerbaijan the rainfall decreased, and at about 600mm/y the beech forest began to peter out, although scattered trees remained in seepage spots in the landscape. At 200mm/y the only vegetation on the alluvial soils was *Salicornia*. The forest soils were named as Cinnamon, Brown and Chestnut, as the climate changed to drier and warmer locations and their red coloration increased. My account has had to be written from memory, prompted by slides I took, without the handbook for the tour, as my copy went into the Soil Bureau library (now dispersed) 40 years ago.

At the beginning of the coach drive by the Black Sea, from Sochi heading towards Sakhumi, the tour leader, Professor Zonn from Moscow, came and sat with me, and asked, in very good English, why I was in army uniform. The tour guides had questioned this, and thought I might be a spy, carrying a gun. I had to explain the background. I was at the time working in Singapore, on the uses of sewage sludge to improve soils and for growing trees on reclaimed land. The Agricultural Research Institute where the work was based was opposite the New Zealand Army base, where I was living.. The tailor at the base gave me two choices for a lightweight safari suit, camouflage for the jungle, or khaki for the desert. Khaki seemed less conspicuous, and the bulge in one of the many pockets was not a gun, but a squashed-up toilet roll (sensible forethought when travelling in unknown parts). He seemed quite happy with this explanation, and our talk turned to the iron-rich soil that was the most useful for the uptake of sewage sludge.

In Georgia we met the fruit growers. They were pushing the concept of hydroponics, not a nice idea for soil scientists. I just had to take up the problem of the deterioration of fruit flavour under growing conditions free of stress. The Russian professor said the real problem was not with the taste of the fruit – you could sell almost anything in Moscow – but with the rail link thousands of kilometres long not enough fruit could reach that market. I told him of my experience in South East Asia, where the peasant growers would not use fertiliser to increase the size of the bananas; the big ones did not sell well on the local market, for the simple reason that they did not taste as good as the small ones (but a generation later, that would be the supermarket's idea of prime fruit!).

We took part in a cultural group dance, on a flat area outside the fruit co-operative building. Locals and we visitors formed a mixed circle, with a local ring leader, who walked around the circle eyeing each of us in turn, then went to the centre of the circle, spun himself around, and stopped, looking straight at me! (Inevitable, I was the youngest). He led me by the hand to the centre of the circle, and announced I would perform a dance for them. What a challenge! I said I would perform a sailors' dance from the days of sail. It started with a sort of hornpipe (a poor imitation of a Cossack-style dance) followed by mime of climbing the rigging, up to the lookout point on the mast, then sliding down a rope to the deck, and finished with washing the deck. I thought this was a good improvisation, and got rather carried away with the possibility of doing a Morris dance, but had no bells for knees and elbows, to produce the essential sound. At the sound of clapping, I retreated modestly to my gap in the circle. The applause signalled the entry of the local dance group. I was off the hook.

It was after the fruit co-operative that the first sad episode occurred. We had a young student from Moscow University as one of the translators. This was his first trip outside the Spartan living conditions of the capital, and the amount of fruit left over after a group meal went to his head. He acquired a cardboard box to hold some of the leftovers, and kept it under his bed, to take back to Moscow. The Intourist guides put their finger on him, and he was sent straight back to Moscow, needless to say, without his fruit. In his place came a young lady translator, very correct, who always appeared to be waving an invisible red flag. It was a sad loss.

Our departure from the hotel at Batumi was delayed by an event that was played out on the pavement by the side of the coach that was to take us to the railway station for the night train to Tblisi. The hotel manager would not release us for departure on the grounds that a German member of the group had stolen a small face-cloth. The unfortunate person was required to empty out his suitcase on the pavement for inspection. When nothing was found, the manager allowed us to leave. It seemed to us that some grievance dating from the war years was being acted out in front of us.

The train to Tblisi was a low-cost sleeper. The sign outside the toilet was in English, but the facility was eastern, a hole in the floor and foot prints indicating position. One of the accompanying wives, who had earlier in the trip become ill, decided she needed to go to hospital. The group visa had no provision for such a possible defection, but the hospital sent someone with us to treat her, so that our group remained intact.

I was the only witness of an interesting show by a German Professor of Soil Science. As he put it, he had left a leg at Stalingrad in the war, replaced by a artificial limb. He sat me on a chair facing the stage at the conference centre, then came up behind me with a tap, tap uneven gait, passed me, then suddenly turned and performed a haka, with all the facial expressions, and a loud stamping of his wooden leg. We were old friends and he did not scare me. I said, "Professor, if you had a team of six Maori warriors and six maidens each with a ball on a string, you would win every kapa haka competition in New Zealand." That sound of the wooden leg, without a shoe, on the wooden floor was terrific.

It was at this point that we visited the wild men of the Caucasus, which presented personal challenges. As a result of living closely with their animals, the area was fly blown. The communal toilet block had a constant black cloud hovering above. My reaction was to shut down my personal plumbing, by eating nothing, and drinking only boiled water with perhaps three green tea leaves floating in it. Mercifully we were saved next day by the failure of our mountain vehicles to cope with the road. We men just walked up to the site, with time to wander about in the forest, which provided us with the opportunity to relieve the difficult plumbing situation. No wonder we were glad to say goodbye to the area.

We were now in a large zone of soils under low rainfall. The Russians had grabbed control of oil production in the area, but they financed the local culture in a big way. There were settlements about 4000 years old, possibly referred to in the story of Jason and the Argonauts. It was a long day, and we were getting very late for our overnight stop, at the Tusi Astronomic Observatory near Shemakha. Sufficient accommodation seemed to be a problem, so that a few of us had to stay in huts right up by the Observatory at 1400m. We were dropped there in total darkness, and a torch shone its light briefly to direct each of us to what looked like a 2-man Army hut. When the light went out, it had to be by feel, but not a switch could be found. There was a bed, and blanket, no other facilities, but going outside, to rough pasture, in the dark was only when desperate. Return to the hut had to be by counting steps, and sticking strictly to the same route. In the morning the Observatory was ghost-like, wreathed in mist, and with no view from the top. Someone came in a vehicle and collected us to join the main party in the village. (Nowadays adventurous tourists are offered cabin accommodation a few hundred metres from the Observatory, improved, I hope, maybe even with electricity!).

We did get some breakfast to start us off on the next stage of our trip, off to Baku, on the Caspian Sea, capital of the oil-rich state, via a dark chestnut soil profile, used by the State grain growing farm. On the way we stopped at a co-operative winery, where the hot climate gave the grapes high sugar content. The very sweet wine did not appeal to our European palate, so that we only tasted, rather than drank.

At Baku, there were buildings with numerous huge statues of past heroes and poets, the largest statue of all being of Lenin, who seemed to be looking at the oil rigs with a grand gesture. We were treated to a full display of Azerbaijani culture, in a fine concert of dance and music, before we left the Caucasus by air to return to Moscow.

A final memory is from when I was taking photos in the oldest part of Baku. A small boy asked a question in his local language, which I deduced was "Why are you photographing my home?" It was in a four-storey block of flats, and a single grape vine reached the upper three balconies and provided shade and fruit. I used mime to express admiration of the vine, by throwing a kiss to the large stem, and his smile showed he understood and was happy with my explanation. It was luckily beyond my acting powers to add that I thought it must be rooted in the drains, and we parted on good terms. A brief encounter, but it was a good farewell.

Books available for borrowing

Attached is a list of books entrusted to Leo Condron by the late Prof TW Walker's family. If anyone would like to borrow any of these books then they should contact Amal Torky (Amal.Torky@lincoln.ac.nz).

Walker, T.W.

BSc (Hons), PhD, DSc, DIC



Thomas Walker was Professor of Soil Science at Lincoln College from 1952 until 1979. He had completed a Bachelor of Science with First Class Honours at the Royal College of Science, University of London, before embarking on research on the influence of soil type on the growth of plants for his Doctor of Philosophy. He then spent two years at Rothamstead Experimental Station before joining the University of Manchester. At Lincoln University, Professor Walker was an inspiring teacher and conducted extensive research work on biological nitrogen fixation in soils. In addition, Professor Walker embarked on considerable extension work, advising farmers and others about soils and expounding his philosophies. He was a foundation member and later president and a Fellow of the New Zealand Institute of Agricultural Science, President of the New Zealand Grassland Association, President and the first Fellow of the New Zealand Society of Soil Science. Emeritus Professor Walker died in November 2010.

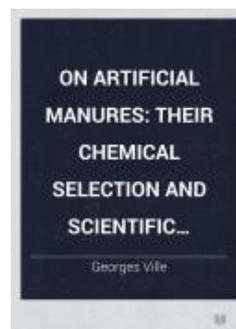
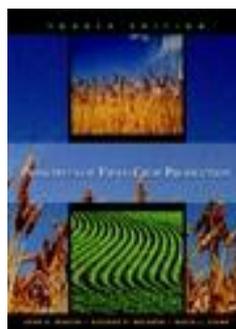
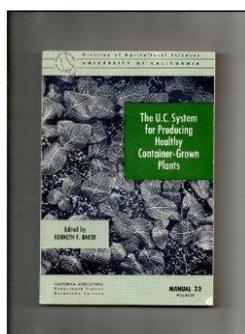
SOILS AND MANURES

IN NEW ZEALAND

BY
E. J. WILD
M.A., B.Sc., D.Sc., F.R.S., F.R.S. (Land)
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Prof T.W.Walker Books

Author	Book title	Edition
L.J. Wild	Soils and manures in New Zealand	Fifth revised edition
L.J. Wild	Soils and manures in New Zealand	Fourth edition
	Flash Point -A comprehensive and analytical study of co-ordinated soil, plant and animal nutrition and rural environment concerns based on 30 years of research advice	Fourth Edition
T.R.G.Gray and S.T. Williams	Soil micro-organisms	
P.B. Lynch	Nitrogen fertilisers in New Zealand agriculture	
Victor M. Shorrocks	Boron deficiency (Its prevention and cure)	
T. Wallace	Mineral deficiencies in plants (a colour atlas and guide)	
W.N. Townsend	An introduction to the scientific Study of the Soil	
Fredrick R. Troeh/J. Arthur Hobbs/Roy Donahue	Soil and water conservation for productivity and environmental protection	
B N Richards	Introduction to the soil Ecosystem	
G.A.Cowie	Potash (Its production and place in crop nutrition)	
E. A Kirkby	Nitrogen nutrition of the plant	
C.A.Cotton	Geomorphology (An introduction to the study of landforms)	
Samuel Tisdale & Wener Nelson	Soil Fertility and Fertilizers	
Jerome O. Nriagu	Cadmium in the Environment (Part I: Ecological Cycling)	3rd edition
Kenneth F. Baker	The U.C. system for producing healthy container grown plants	
Muth & Oldfield	Symposium: Sulfur in nutrition	
John Martin, Warren H. Leonard & David L.Stamp	Principles of field crop production	3rd edition
Donald Steila	The geography of soils (formation, distribution and management)	
Charles D.Sopher& Jack V. Baird	Soils and Soil management	
Wolfgang Bussler	Comparative examinations of plants suffering from Potash deficiency	1964
K. Mengel and E .A. Kirkby	Principles of plant nutrition	1982
Technical Bulletin No. 13	Soil Phosphorus	
D. Mulder	Soil disinfection(development in agricultural and managed-Forest Ecology 6	1979
FAO Fertilizer and plant nutrition Bulletin no. 18	Efficiency of soil and fertilizer phosphorus use (Reconciling changing concepts of soil phosphorus	

behaviour with agronomic information)

Clive A. Lind	Super in the South (The early history of the Southland Co-Operative Phosphate co. Ltd)	
Ministry of Agriculture Fisheries and Food/Agricultural Research Council	Diagnosis of mineral disorders in plants	Volume 1 Principles
A.J. Metso Soil Bureau	Methods of chemical analysis for soil survey samples	Soil Bureau Bulletin 12
Grassland Research and practice	Using herbage cultivars	Series no.3
Grassland Research and practice	Producing herbage seeds	Series no.2
E.G.McQueen & W.A. Temple	Pesticide perils menace or myth?	University of Otago
P.B. Lynch	Conduct field experiments	NZ Department of Agriculture Bulletin no. 399
Lucy Moore	Plants of the New Zealand coast	
G.W. Cooke	Fertilizers and profitable farming	1960
Georges Ville	Artificial manures (their chemical selection and scientific application to agriculture)	1879

PhD Opportunity:

Improving the performance of decentralised land treatment systems University of Waikato, Hamilton New Zealand

We are seeking a motivated and energetic PhD student to undertake research on engineered land treatment systems for on-site and decentralised wastewater management. The research will bring together knowledge on constructed wetlands, reactive filters/ bioreactors and soil application to develop integrated treatment systems capable of advanced treatment. The work aims to develop systems appropriate to the needs of small communities and rural facilities in New Zealand, in particular the needs and aspirations of Maori (indigenous peoples of NZ).

The University of Waikato and National Institute of Water and Atmospheric Research (NIWA) has available a 3-year PhD fellowship for a student to examine approaches to improve the performance of decentralised land treatment systems. Preferred candidates will have strengths in at least one of biogeochemistry, hydraulic properties, and/or processes engineering integration with an MSc or BSc (hons).

Funding for the PhD includes a 3-year scholarship of \$25,000 (NZD) per annum, plus study fees and research costs. For further information or to apply, please email or send letter of application, contact details for 2 referees, and CV to:

Professor Louis Schipper, Schipper@waikato.ac.nz, Earth and Ocean Science, Private Bag 3105, University of Waikato, Hamilton, New Zealand. The research will be jointly supervised by Dr Chris Tanner, Principal Scientist at NIWA.

Background on Schipper's research team can be found at www.waiber.com. Screening of candidates starts December 2013 until position filled.

Nitrous oxide emissions from grazed hill land

Luo J, Hoogendoorn C, Van Der Weerden T, Saggarr S, De Klein C, Giltrap D, Rollo M, Rys G 2013.

Sheep and beef cattle grazed hill land represents a potentially large source of nitrous oxide (N₂O) emissions globally. However, N₂O emissions and associated emission factors for the dominant nitrogen (N) source of excreta N (EF₃) are thought to be highly variable due to spatial differences in soil conditions across hill land units (HLUs; defined according to slope, aspect and soil type). Variability is also determined by animal grazing and resting behaviour affecting excretal-N deposition. Knowledge of spatially different EF₃ values could be used to improve estimates of N₂O emissions from grazed hill land. This paper presents N₂O emission factors for sheep urine (SU) and dung (SD) and for beef cattle dung (BD) determined in four regions in New Zealand (NZ) (Waikato, Southern Hawkes Bay, Manawatu and Otago). Urine (spring 2009) or urine and dung (autumn 2011) was applied to low (< 12°) and medium (12° - 25°) slopes in each region. N₂O emissions were measured for 3-4 months for urine and for a whole year for dung using a static chamber technique. There were large variations in EF₃ between seasons, between regions and between slope classes within a region and season. Over all regions, there was a marginally significant ($P = 0.08$) difference in EF₃ for spring 2009-applied SU on low and medium slopes, with EF₃ values averaging 0.46% and 0.08%, respectively. In the autumn 2011 trial, there was no significant slope effect, with EF₃ averaging 0.12% and 0.11% on low and medium slopes, respectively. By combining the datasets, EF₃ for low slopes (0.24 with 95% confidence intervals of between 0.14 and 0.40) was significantly greater ($P < 0.05$) than for medium slopes (0.07% with 95% confidence intervals of between 0.02 and 0.14). EF₃ values for BD and SD were not significantly different. The contribution of sheep excreta to NZ national N₂O emissions, based on a spatial framework model that disaggregates excreta deposition according to slope class and using the current inventory EF₃ values of 1% for urine and 0.25% for dung and assuming that all NZ sheep grazed on hill land, was 6.08 Gg N₂O in 2012 in NZ. This is considerably higher than the 1.02 Gg N₂O estimated using the measured EF₃ values, 0.24% for urine and 0.06% for dung, from this study. These results suggest that the current IPCC GHG inventory methodology is likely to overestimate N₂O emissions from animal grazed hill land.

Agriculture, Ecosystems and Environment 181: 58-68.

Comparative tolerance of *Pinus radiata* and microbial activity to copper and zinc in a soil treated with metal-amended biosolids

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A study was conducted to evaluate the effects of elevated concentrations of copper (Cu) and zinc (Zn) in a soil treated with biosolids previously spiked with these metals on *Pinus radiata* during a 312-day glasshouse pot trial. The total soil metal concentrations in the treatments were 16, 48, 146 and 232 mg Cu/kg or 36, 141, 430 and 668 mg Zn/kg. Increased total soil Cu concentration increased the soil solution Cu concentration (0.03–0.54 mg/L) but had no effect on leaf and root dry matter production. Increased total soil Zn concentration also increased the soil solution Zn concentration (0.9–362 mg/L).

Decreased leaf and root dry matter were recorded above the total soil Zn concentration of 141 mg/kg (soil solution Zn concentration, >4.4 mg/L). A lower percentage of Cu in the soil soluble + exchangeable fraction (5–12 %) and lower Cu²⁺ concentration in soil solution (0.001–0.06 µM) relative to Zn (soil soluble + exchangeable fraction, 12–66 %; soil solution Zn²⁺ concentration, 4.5–4,419 µM) indicated lower bioavailability of Cu. Soil dehydrogenase activity decreased with every successive level of Cu and Zn applied, but the reduction was higher for Zn than for Cu addition. Dehydrogenase activity was reduced by 40 % (EC₄₀) at the total solution-phase and solid-phase soluble + exchangeable Cu concentrations of 0.5 mg/L and 14.5 mg/kg, respectively. For Zn the corresponding EC₅₀ were 9 mg/L and 55 mg/kg, respectively. Based on our findings, we propose that current New Zealand soil guidelines values for Cu and Zn (100 mg/kg for Cu; 300 mg/kg for Zn) should be revised downwards based on apparent toxicity to soil biological activity (Cu and Zn) and radiata pine (Zn only) at the threshold concentration.

Environmental Science and Pollution Research
Springer-Verlag Berlin Heidelberg 2013

<http://link.springer.com/article/10.1007%2Fs11356-013-2271-z#>

The fate of phosphorus of ash-rich biochars in a soil-plant system

Tao Wang, Marta Camps-Arbestain, Mike Hedley

Aims: The objectives were to investigate (i) the forms and release pattern of P from an ash-rich biochar amended sandy soil; (ii) the transformation of biochar P in a soil-plant system. **Methods** Several methodologies (a bioassay test, soluble P extractions, a sequential P fractionation and successive P extractions via resin strips) were used to study the bioavailability and transformation of P in a sandy soil fertilised with either conventional P fertilisers [Ca(H₂PO₄)₂ (CaP) and Sechura phosphate rock (SPR)] or biochars produced from cattle manure (MAe) and alum-treated biosolids (BSe) at four temperatures (250, 350, 450, and 550 °C). **Results** Biochar P mainly contributed to increase soil resin-extractable P- and inorganic NaOH-extractable P fractions, and thus to plant available P. The decrease in P concentrations of those fractions was caused by the uptake of P by plants rather than their transformations into more stable forms. P release rates diminished following the order: CaP > MAe > BSe > SPR, which indicates a decline in P availability from these P sources. **Conclusions** Phosphorus-rich biochar can be used as a slow-release fertiliser. It is necessary to determine available P (either soil or fertiliser tests) in biochars prior to its application to soil, so that dose, frequency and timing of application are correctly established.

2013. *Plant and Soil*. 357:173-187.

Detailed carbon chemistry in charcoals from pre-European Māori gardens of New Zealand as a tool for understanding biochar stability in soils

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<http://onlinelibrary.wiley.com/doi/10.1111/ejss.12096/abstract>

Summary

The stability of biochar, a form of charcoal intentionally made to be added to soil to sequester carbon (C) and improve its function, remains unclear. As it is not feasible to perform long-term (decades, centuries) laboratory experiments to assess biochar evolution after soil amendment, the study of ancient archaeological charcoals can help to identify characteristics (and possibly molecular markers) associated with the decomposition and preservation dynamics of biochar in specific pedoclimatic environments. In this study, the chemical composition of the organic carbon fractions of three charcoals from pre-European Māori gardens of New Zealand (buried > 25 cm depth) was thoroughly assessed. Complementary short-term incubations of charcoals in sand were used to (i) evaluate the stability of C in the short-medium term, (ii) model its mineralization processes and (iii) estimate the C turnover. Elemental analysis, thermogravimetric analysis (TG), X-ray photoelectron spectroscopy (XPS), solid-state ¹³C nuclear magnetic resonance (NMR) and pyrolysis gas chromatography/mass spectroscopy (Py-GC-MS) gave consistent results in describing the charring intensity and the degree of polycondensation of these charcoals. The oldest buried deposit (770 ± 50 years BP) still retained un-charred or weakly charred lignocellulosic material, indicating that such material survived decomposition processes for several centuries. The amount of organic C mineralized in 109 days was < 0.5% of the initial charcoal-C. No differences in MRT among samples were detected in spite of inferred differences in thermal impact. Longer-term incubations are needed to obtain better estimates of C turnover rates in charred material.

2013. *European Journal of Soil Science*. DOI: 10.1111/ejss.12096

Molecular characteristics of permanganate and dichromate oxidation resistant soil organic matter from a Black C rich colluvial soil.

Manuel Suarez-Abelenda, Joeri Kaal, M. Camps Arbestain, Heike Knicker, Felipe Macias Vazquez.

2013. *Soil Research*. In press.

Samples from a colluvial soil rich in pyrogenic material (Black C, BC) in NW Spain were subjected to K₂Cr₂O₇ and KMnO₄ oxidation and the residual soil organic matter (SOM) was NaOH-extracted and analyzed using analytical pyrolysis gas chromatography mass spectroscopy (Py-GC/MS) and solid-state ¹³C cross polarization magic angle spinning nuclear magnetic resonance (¹³C CP MAS-NMR) in order to study the susceptibility of different SOM fractions (fresh, degraded/microbial, BC and aliphatic) towards these oxidizing agents. NaOH extracts of untreated samples were also analyzed. Py-GC/MS and ¹³C NMR indicated that KMnO₄ promotes the oxidation of carbohydrate products, mostly from degraded/microbial SOM and lignocellulose, causing a relative enrichment of aliphatic and aromatic structures. Residual SOM after K₂Cr₂O₇ oxidation contained BC, N-containing BC and aliphatic structures. This was corroborated by a relatively intense resonance of aromatic C and some signal of alkyl C in ¹³C NMR spectra. These results confirm that dichromate oxidation residues contain a non-pyrogenic fraction mainly consisting of aliphatic structures.

EUROPEAN JOURNAL OF SOIL SCIENCE

Contact angles of water-repellent porous media inferred by tensiometer-TDR probe measurement under controlled wetting and drying cycles

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Abstract

The time dependency of water repellency (WR) in hydrophobic porous media plays a crucial role for water infiltration processes after rainfall and for the long-term performance of capillary barrier systems. The contact angle (CA) of hydrophobic media normally decreases with continuous contact with water, eventually allowing water imbibition. However, the effect of the reduction in CA with soil-water contact time on the water retention function of hydrophobic media is not yet fully understood. In this study, water retention characteristics were measured using a hanging water column apparatus equipped with a mini-time domain reflectometry (TDR) coil probe under controlled wetting and drying in a water-repellent volcanic ash soil (VAS) and in sands coated with different hydrophobic agents. The contact angle (CA_{SWRC}) under imbibition was evaluated based on the inflection points on the water retention curves. For both water-repellent VAS and hydrophobized sand samples, the calculated CA_{SWRC} increased with increasing WR. This was determined from both the water drop penetration time and the initial contact angle (CA_i) by the sessile drop method. Calculated CA_{SWRC} values ranged from 20° to 48° for the water-repellent VAS and from 40° to 63° for the hydrophobized sand. The CA reduction with contact time was quantified by relating CA_{SWRC} and CA_i . This gave a significant linear relationship for the hydrophobized sand [$CA_{\text{SWRC}} = 0.40CA_i + 11.3$ ($30^\circ < CA_i < 120^\circ$), $R^2 = 0.66$]. A large difference in water-filled pore distributions under controlled wetting and drying cycles was found on calculating the soil water capacity and pore size density as a function of water potential.

Soil Sci. Soc. Am. J. 77: 1944-1954 (2013)

The joy of teaching soil science

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Abstract

The fundamental purposes of teaching are to impart knowledge, insight, and inspiration. Around the world, university teaching principles are changing as students also gain knowledge and inspiration in ways other than in the class room. Likewise, the soil science discipline is evolving as there is a new set of tools and techniques available by which we investigate soils, and the foci are shifting toward other disciplines and changing research questions. In many universities, the teaching of undergraduate soil science increasingly takes place to non-soil science majors. All these forces require some thinking about how we teach the subject and here we present some of our experiences and ideas of teaching soil science in different parts of the world. Some 15 examples are presented from Australia, Canada, France, Germany, New Zealand, Russia, Taiwan, The Netherlands, and the USA. As the research is widening so is our teaching. The examples are diverse and, despite cultural and personal differences, they show several trends. The cases represent vibrant and creative ways to teach soils, and the initial focus is to create a sense of wonder about the soil and its utilitarian and scientific value.

Geoderma (2014) **217-218**, 1–9. (<http://dx.doi.org/10.1016/j.geoderma.2013.10.016>)

Dynamic analysis of stream flow and water chemistry to infer subsurface water and nitrate fluxes in a lowland dairying catchment

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The use of process-based, dynamic and spatially-explicit models to describe water and nitrogen fluxes at the catchment-scale is often hampered by a shortage of detailed land use, hydrological and biogeochemical information. Accordingly, such complex models tend to be restricted to a small number of well investigated catchments, often associated with research projects. On the other hand, stream flow and stream water chemistry time series data are available for a much larger number of catchments, e.g. for many catchments that are routinely monitored by government agencies for state-of-the-environment reporting. It was the main aim of this study to provide a spatially lumped model that allows meaningful analysis of catchment-scale water and nitrate fluxes based on such data sets.

Based on stream flow time series data, catchment hydrodynamics are often analysed using approaches derived from the linearised Boussinesq equation, which has analytical solutions for dynamic groundwater discharge expressed in terms of eigenvalues and eigenfunctions (eigenmodel approach). Calibrated Boussinesq models generally yield a good reproduction of stream flow dynamics, and stable estimates for aquifer parameters such as hydraulic conductivity and mean aquifer depth. By linking a soil water balance model with two Boussinesq groundwater eigenmodels linked in series, and assuming constant solute concentrations discharging from each source, a dynamic catchment model predicting stream flow and water chemistry at the catchment outlet (“StreamGEM”) was developed. Compared with previous approaches, inclusion of water chemistry in this model both aided hydrological understanding, and allowed assessment of catchment scale nitrate fluxes. Simultaneous calibration of the model to stream flow and nitrate concentration data from a small lowland dairying catchment yielded good predictions to both variables (Nash–Sutcliffe Model Efficiency of 0.90 and 0.84), and the fitted parameters were able to be used to estimate annual flow and nitrate fluxes through near-surface, shallow groundwater, and deeper groundwater reservoirs conceptually present in the catchment. The calibration was cross-validated using an independent time series from the same catchment. The results support the hypothesis, based on groundwater observations, that stream flow in

the catchment is the result of mixed discharge from a shallower, rapidly draining zone of oxidised groundwater carrying relatively high loads of agricultural nitrate, with a relatively deeper and slower draining zone of reduced groundwater that is essentially nitrate free. The proportions of stream flow discharging from the near-surface, shallow groundwater, and deeper groundwater reservoirs were estimated to be 5%, 80% and 15%, respectively. In spite of its small contribution to total stream flow, the deeper groundwater reservoir sustained stream flow during summer and dominated stream water chemistry 61% of the time. By combining the flow and nitrate concentration estimates derived from model calibration, it was estimated that discharge of shallow groundwater was responsible for 91% of the nitrate load entering the stream. However, the predicted nitrate concentration in this reservoir was significantly lower than the predicted

nitrate concentration of near-surface flow and root zone leachate concentrations estimated using a nutrient budgeting model. This indicates that denitrification occurs within this reservoir. On the basis of the calibrated model, it was estimated that 36% of the nitrate recharged from the vadose zone gets denitrified within the shallow groundwater reservoir, and up to 9% in the deeper groundwater reservoir.

Journal of Hydrology 505 (2013) 299–311

Conferences



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www.soilmatters.org

Soils change in response to land use, land management and climate. Understanding the mechanisms and rates of change in fundamental soil properties, and their extent across the landscape, is critical for management of soil and land to ensure enduring productivity and provision of ecosystem services. Soil Change Matters will bring together scientists who can explain the critical changes in soils, particularly during the past century of increasingly intense land use. Soil Change Matters will include dialogue between policy makers and scientists to clarify policy needs, as well as the current capability of soil knowledge systems and soil monitoring approaches. We invite you to be part of this international workshop organised by the Victorian Government's Department of Environment and Primary Industries, and supported by Soil Science Australia and the International Union of Soil Sciences. Please visit www.soilmatters.org

20th World Congress of Soil Science – Korea

June 8 – 13 2014

www.20wcsc.org



The 20th World Congress of Soil Science will be held at the International Convention Center Jeju (ICC Jeju) on Jeju Island, Korea, from June 8th to 13th, 2014. The theme of the conference is Soils Embrace Life and Universe, and the congress is also a celebration of 90 years IUSS. Jeju is an oval-shaped volcanic island with 1,950 meter Halla Mountain in the middle. Jeju is known for its unique volcanic features making the entire island a volcanic museum. For further information see www.20wcsc.org or e-mail wcsc@20wcsc.org

Key dates: Notification of Abstract Acceptance: January 15, 2014

Deadline for Early Registration; March 20, 2014

Deadline for Regular Registration: May 8, 2014

9th International Symposium AgroEnviron, 3-7 August 2014 in Goiânia, Brazil.

www.agroenviron2014.com

With the theme “Impacts of Agrosystems on the Environment: challenges and opportunities”, the scientific program will focus on problems and solutions related to the environmental sustainability of agrosystems. The conference will address broad topics on soil and water conservation and management, agriculture and environmental policies, environmental sustainability, technology innovation, and education. A guided one-day field trip to the savannah with examples of tropical agriculture is included in the registration fees. Abstracts submission is open at www.agroenviron2014.com



ELS 2014 - the Earth Living Skin: Soil, Life and Climate Changes - the first Conference of a Series organized under the auspices of the Soil System Sciences Division of the European Geosciences Union. **ELS 2014 will be held next 21 – 25 September 2014 in Nova Yardinia, Castellaneta Marina (TA), Italy.**

The Conference Series set up the ambitious goal of studying soils as the main environmental interface where atmosphere, hydrosphere, biosphere and geosphere design and model incredible living systems with time. ELS 2014 aims to gather the thoughts and the findings of scientists coming from all the different disciplines related to the soil system: soil science, geomorphology, biogeochemistry, hydrological sciences, environmental microbiology, ecology, climatology, and natural hazards, only to mention the main ones. Scientists and researchers with a temporary or consolidated interest for these fields of science are warmly invited to participate to this Conference, to bring their knowledge or their doubts, thus contributing to create a permanent forum of stimulating scientific debates.

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<http://www.spp1315.uni-jena.de/>

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- ❖ Venue: Leipziger "Kubus", Helmholtz Centre for Environmental Research-UFZ, Leipzig /Germany

Important Dates:

- ❖ Final circular: March 31, 2014
- ❖ Online & early registration open: April 7, 2014
- ❖ Abstract submission ends: July 7, 2014
- ❖ Acceptance notification: July 21, 2014
- ❖ Early registration ends: July 28, 2014
- ❖ Regular registration ends: September 26, 2014



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Abstract submissions close:	1 Sep 14
Registrations open:	1 Mar 14
Early-bird registrations close:	24 Oct 14
Conference:	1-4 Dec 14

CONTACT DETAILS

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NZSSS award recipients

President's Invitation Lecture

1972 W A Pullar
1973 T W Walker
1974 A J Metson
1975 H S Gibbs

Norman Taylor Memorial Award

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

NZSSS Postgraduate Awards

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

Morice Fieldes Memorial Award for PhD Thesis

1976 J C Ryden
1977 -none-
1978 A N Sharpley
1979 K W Steele
1980 -none-
1981 A G Hogg
1982 A W Limmer

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

Sir Theodore Rigg Award for Masterate Thesis

1976 K D Earl
1977 T H Webb & N E Logan
1978 -none-
1979 D A McKie
1980 C Hedley (née Hubbard)
1981 D Karageorgis
1982 D J Lowe
1983 L A Benny
1984 K B Marsh
1985 B McLaughlin
1986 -none-
1987 C D A McLay
1988 B E Green
1989 S P Cameron-Lee
1990 P J de Lange
1991 G N A Wigley
1992 R B Doyle
1993 -none-
1994 P L Carey
1995 J Moir
1996 -none-
1997 S Park
1998 S Thiagarajan
1999 H Jones
2000 R Dragten
2001 B Robinson
2002 S Tutua
2003 D J Palmer
2004 M W Hughes

2005 R Standish
2006 D Dewar
2007 E Hoftsee
2008 N Watkins
2009 DA Lloyd
2010 P Mudge
2011 DF Wallace
2012 E Harris
2013 A Barnett

Summit Quinphos Bursary (renamed Altum Award 2012)

1993 J Luo
1994 W J Morrell
1995 I Vogeler
1996 C W Gray
1997 B Robinson & B Miller
1998 A Mitchell
1999 A Khan
2000 Chengrong Chen
2001 Suman Mishra
2002 S Gaw
2003 D Houlbrooke & R Bhandral
2004 D Palmer
2005 J Singh
2006 S Khan
2007 B Kusomo
2008 S Carrick
2009 P Jeyakumar
2010 G Lucci
2011 N Wells
2012 R Dodd
2013 -

The L C Blakemore Award (Biennial award)

1992 N P Smith
1994 H Kettles
1996 No award
1998 L Currie
2000 B Daly
2002 P Theobald
2004 T Hendry
2006 B Toes
2008 C. Smith
2010 M Sprosen
2012 C Tregurtha

The M L Leamy Award (Biennial award)

1992 B E Clothier
1994 A Hewitt
1996 No award
1998 S Cronin
2000 H J Di
2002 K R Tate
2004 N S Bolan
2006 S Sagar
2008 R. McDowell
2010 Not awarded
2012 D Curtin

The T W Walker Prizes

- 1992 (oral paper)—S T Olykan
(poster)—G N Magesan
1994 (oral paper)—J Luo
1995 J Zanders & S Park
1998 (oral paper)—J Menneer
(poster)—C P Rooney
2000 (oral & poster papers)
—L Barton
2002 (oral paper)—D Houlbrooke
(poster)—K Wilkins
2004 (oral paper)—J Singh
(poster)—D Dewar
2006 (oral paper)—R Parkinson
(poster)—F Scherr
2008 (oral paper) – P. Mudge
(poster) – G M Lucci
2010 Not awarded

Undergraduate Prizes

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

- 2002 A Souness
(Lincoln University)
T A O'Neill
(Massey University)
D Worthy
(Waikato University)
2003 S O'Driscoll
(Waikato University)
F Shanhun
(Lincoln University)
2004 M Clancey
(Waikato University)
J Bertram
(Lincoln University)
2005 Vanessa Coombe
(Waikato University)
Samuel Dennis
(Lincoln University)
2006 Laura Buckthought /
Georgina Mackie
(Lincoln University)
Louise Fisk / Paul Mudge
(Waikato University)
2007 Paul Bowater
(Lincoln University)
Hamish Mulcock
(Massey University)
Georg Kruger
(Waikato University)
2008 Glen Treweek
(Waikato University)
Emma Anne Phillips
(Massey University)
Nicola Jane Kelland
(Lincoln University)
2009 Rebecca Bylsma
(Waikato University)
Helen Free
(Massey University)
Sean Gresham
(Lincoln University)
2010 Josh Scarrow & Jack
Pronger
(Waikato University)
Louise Anne McCormack
(Massey University)
Aimee Elizabeth Robinson
(Lincoln University)
2011 AM Carter
(Waikato University)
Joel Perry
(Massey University)
Roshean R Fitzgerald
(Lincoln University)
2012 L Creswell (Waikato
University)
J Howes (Massey)
A Whitley (Lincoln)
2013 H Bredin-Grey (Waikato)
Massey – TBA
N Mesman - Lincoln

Fellows of the NZ Society of Soil Science

- L C Blakemore R G McLaren
M R Balks R Naidu
N Bolan V E Neall

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

Honorary Fellow

B Miller

Life Members of the N.Z. Society of Soil Science

- L C Blakemore
I B Campbell
C W Childs
R J Ferkert
R Lee
R B Miller
V Orchard
W M H Saunders
J K Syers
P J Tonkin
T W Walker
J P C Watt
J Adams
R McLaren
P. Gregg
A Mackay

Grange Medal

K Tate