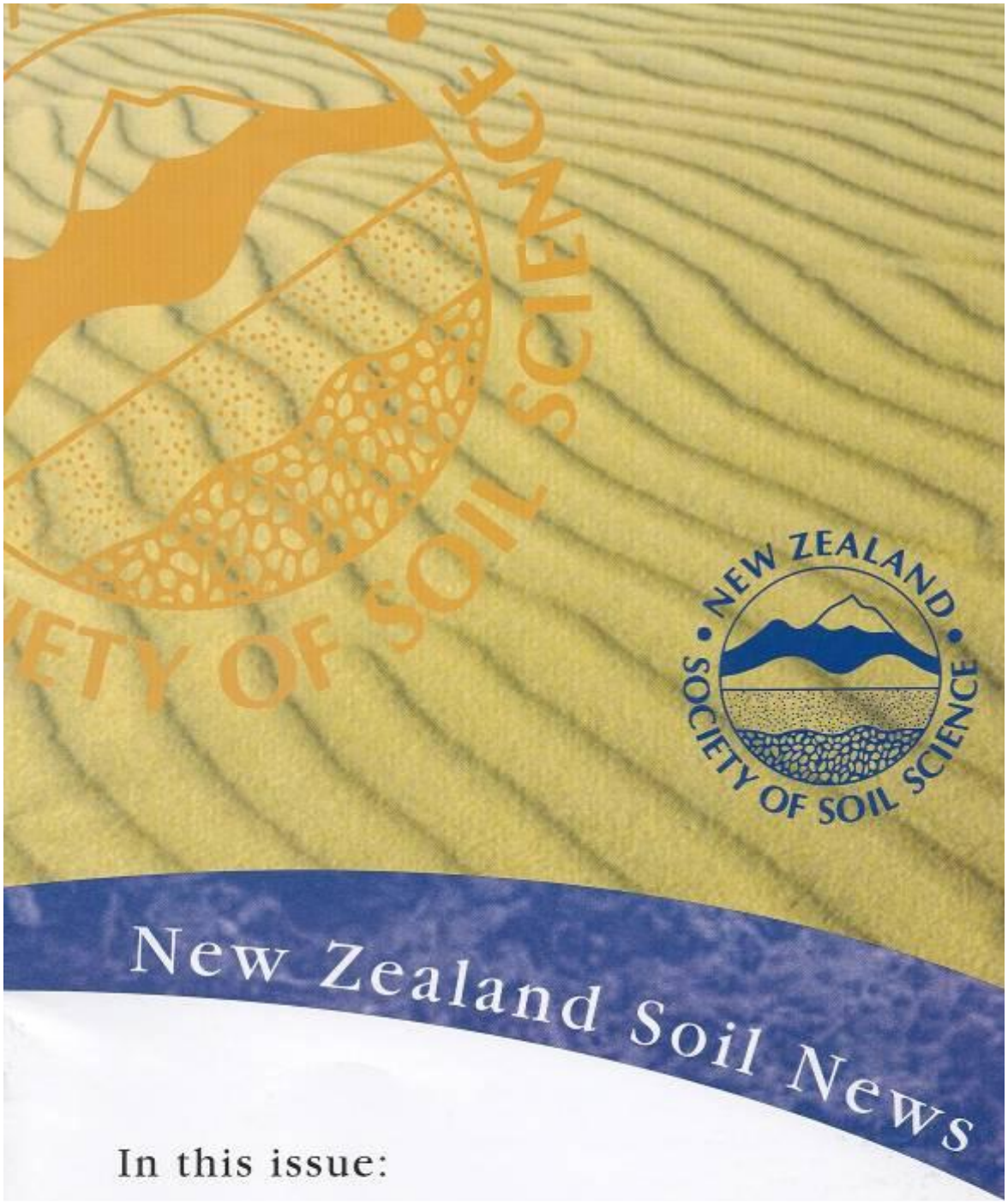

- **Editorial – 2015 International Year of Soils**
- **NZSSS Conference report**
- **Abstracts from NZSSS Conference**

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New Zealand Soil News

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Contents

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

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Deadline..... for the **February** issue of Soil News is **Monday 9th February 2015**

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New Zealand Soil News

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Editorial – 2015 International Year of Soils

World Soil Day was held on 5 December. Fittingly, the day coincided with our society's conference in Hamilton. Unfortunately I can't provide you with a post conference report as I wasn't able to attend, however I'm sure a report will be provided through the Soil News soon (if it isn't in the current issue!). But what I can say is that **World Soil Day** was used by the United Nation Food and Agriculture Organization (FAO) to officially launch the **International Year of Soils 2015**. As soil scientists each of us have an important role to play by raising awareness of the importance of our soils. And next year we need to make a special effort raising the profile of this finite natural resource that requires protection and careful, thoughtful management.

To help you with raising the profile of soils, why not use our new 'Soil Orders of New Zealand' poster, depicting the diverse range of soils across our beautiful nation. The idea of a New Zealand Soils poster was initially suggested by my colleague Seth Laurenson, championed by Megan Balks and Allan Hewitt of the Soil Science Society council and produced by staff at Landcare Research. You can download copies of the poster from the New Zealand Society of Soil Science website http://nzsss.science.org.nz/publications.html (it's just over 17 Mb) and print it off in all its colourful glory for others to see. Also newly available on the society's website is the second edition of Les Molloy's wonderful book '**Soils in the New Zealand Landscape: the Living Mantle**'. Individual chapters can be found below the Soils poster and downloaded free of charge.

At the official launch of the **International Year of Soils 2015**, the Global Soil Partnership (GSP) at the UNFAO have noted that "soils are the foundation for food, animal feed, fuel and natural fibre production, the supply of clean water, nutrient cycling and a range of ecosystem functions". To me, the catch phrase 'the living skin' captures the importance and fragility of our soils. How many times have we heard, or even repeated, the quote 'a teaspoon of soil contains more than a billion organisms'? This is actually a mind-blowing concept, and shouldn't be shrugged off as a cliché. The biodiversity in our soils is humongous (I like that word), providing essential functions and services that help to maintain our existence through food security. And then the word 'skin' reflects how thin and fragile this layer is. Considering most of our global food supply is reliant on this thin layer, providing a combination of functions including physical support, nutrient supply and water regulation, society needs to place greater value on soils.

Just as soils play a pivotal role in feeding humanity, we as soil scientists play a pivotal role in educating others of its true value. While our area of employment may see us focusing on research from the nanoscale through to impacts of land use, land use change and landscape design, we also need to embrace the role of extension agents, enlightening others of the importance of soils. Soil is susceptible to degradation and poor management, and with increasing pressures on land for food production due to an ever-increasing global population, we have many science challenges ahead of us. We are also increasingly losing productive land through urbanization. As the UNFAO stated back in 2013, during the International Year of Soils 2015, we need to "increase awareness of the life-supporting functions of soil if this trend is to be reversed and so enable the levels of food production necessary to meet the demands of population levels predicted for 2050". So, please, do your bit – and be an extension agent for the sake of protecting our soils.

Merry Christmas and safe travels,

Tony van der Weerden.

Article – Norman Wells: Memories of Malaysia - Sabah

In the early 1960s I was working on a survey of the trace element uptake of a plant, sweet vernal on various soils in New Zealand, using an emission spectrograph. A parcel labelled as cocoa leaves, from trials of various fertilisers on different plantations in Sabah, part of Malaysia, arrived on my bench for analysis, under the no-cost, goodwill approach of those days. The analysis showed expected low levels of several elements, but the unpleasant surprise was high amounts of aluminium and manganese in some samples. Toxicity in tree crops can be a more difficult problem to correct than deficiencies.

Malaysia had achieved independence in 1963, and comprised the former British colonies of Malaya, Singapore Island, and the northern area of Borneo (Sabah and Sarawak). There followed riots in Singapore, with its large Chinese population; they had been ruled by the British, then occupied by the Japanese, and some felt it might be no better to be governed from Kuala Lumpur. The People's Action Party, later under the leadership of Lee Kuan Yew, talked their way out of Malaysia, and in 1966 formed the Republic of Singapore. Malaysia finally comprised the Malay Peninsula, and Sabah in Borneo.

The Colombo Plan had been set up in 1951 to promote future economic and social development in seven Commonwealth countries, and was then expanded to include 26 more countries from ASEAN and SAARC.

Under the Colombo Plan Malaysia requested aid from New Zealand in developing its agriculture. Soil Survey staff from the Soil Bureau (DSIR) gave experience in soil mapping to Malaysian counterparts, while the laboratory sections added training in analysing the physical and chemical properties of soil units. In Sabah, the Director of the Agricultural Research Station at Tuaran, near Jesselton, applied to New Zealand for aid to purchase similar laboratory equipment to analyse soil and plant material.

At this time, in England, chocolate manufacturers were concerned to widen their sources of supply of cocoa beans from cacao trees beyond the countries of West Africa. Plantations of cacao trees were established in Sabah, on friable iron-rich brown soils derived from past eruptions of basalt. Traditionally, in Central America, they were planted on the edge of the jungle, where shade was considered an important factor. In Malaysia, the practice was to cut off the pods when ripe, split them open, and extract the almond-sized beans. These were allowed to ferment in wooden boxes together with the sweet white pulp from the pod cover, to form the cocoa beans, which were taken out, washed and dried, ready for marketing. Fermentation removed the bitterness which rendered the original bean inedible. This was then the raw material for the manufacture of cocoa and chocolate.

In the application for aid in purchasing laboratory equipment, the Director of the Agricultural Research Station at Tuaran had asked for nine items of equipment. These included an X-ray diffractometer for identifying clay minerals, X-ray fluorescence equipment for element analysis of soils and plants, and an emission spectrograph for analysis of trace elements in soils and plants. It was a tall order, comprising what had been acquired at the Soil Bureau over decades. At short notice I was required to include a week in Sabah on my way back to New Zealand from the U.K. to assess the suitability of their laboratory accommodation for the equipment, and to discuss the results of the analyses we had done of the cocoa leaves.

The journey from the U.K. required a stopover in Singapore, where the airport was then situated halfway between Singapore City and Changi, on abandoned coconut plantations on poor soils associated with an ancient terrace. The nearby hotel, on the coast near the Chinese Swimming Club, was Chinese in character rather than the later Western-style chain hotels. Today, the whole area is cut off from the sea by a large reclamation for multilane highways and parklands.
The flight next day landed at the capital of Sabah, then Jesselton, now named Kota Kinabalu. The Agricultural Research Station was a short distance to the north at Tuaran. The building was huge, in vast grounds and itself had the look of an aid project. It had the slow-moving ceiling fans standard in the tropics. The Director, in a small office off the main laboratory, was sitting right in front of a portable air-conditioning unit, turned on at full blast. As we sat talking about the request for aid with instrumentation, I felt the sweat of the tropics turning to ice on my skin. I had to get into discussion as fast as politeness allowed. The Soil Bureau in New Zealand could be expected to support the identification of clay minerals in the soils of Sabah, but the fact that I had analysed cacao plant leaf samples from cocoa plantations in

Sabah did not automatically mean that the Soil Bureau would support the purchase of analytical equipment for servicing the plantations. This point was in my mind when visiting plantations in south-east Sabah.

Next day I was off to Tawau by air, as no roads linked the west and east coasts in the southern end of Sabah. A member of the laboratory staff, Shao, came with me, with all travel arranged according to Colombo Plan procedures. Most of the flight by low-flying turbo-prop plane was over jungle. Dense vegetation obscured the relief patterns of the ranges in the island's interior, but the river system showed when we were over the plains. A tug-boat could be seen, pushing a raft of cut logs down to the coast. That is where the money was being made. The shore-line near Tawau had a line of washed-up logs that must have escaped during transport, stretching as far as the eye could see. I did wonder if a market could be found for salt-cured tropical hardwoods.

We were met by a field officer, E. Wyrley-Birch, who drove us a long way inland to the plantation, Quoin Hill, where we were accommodated at its rest house. We took our meals at the manager's house, with the table legs standing in troughs of kerosene, as a barrier to ants. We were told that instead of the pleasant custom of sitting out of an evening on the verandah, we would be staying inside at present, as we were not far from the border with Indonesia and there were reports that odd shots had been fired at another plantation from the jungle edge at night.

I did go for a walk around the manager's verandah before dark. On turning a corner at the back of the house, I came almost face-to-face with an orang-utan, on a chain. He was slightly smaller than me, and I think I was a surprise, as he probably expected food. Having no words in common, I thought it best not to speak or smile and show my teeth, and gave him just a gentle stroke on his arm. He replied likewise, but his claws, though retracted for me, were used for tree climbing, and still scratched the skin surface. I retreated backwards around the corner of the house and once inside, sought out the First Aid box, and the tincture of iodine. The incident required reporting to the wife of the plantation manager, who ran the rest house. I said I had caught the pet orang-utan rather by surprise, and she assured me it did not attack people, but agreed it had probably been expecting to be fed. She then asked what colour of shirt had I been wearing, as I had changed after visiting the medical box. When I said, blue, she replied that it did not like blue. After I left her I pondered this. The orang-utan naturally inhabits the lower tree levels of the jungle, swinging along low branches, in a zone of green and brown gloom, where the colour blue is not met. The other primate in the jungle, the howler monkey, lives more in the canopy; their world is of green vegetation and blue or grey sky. Moving as a troupe, jumping from swinging branches with a swishing sound, they pass rapidly through the tree tops. Of the primates, man has the most difficulty in getting around on the jungle floor. The next day gave me a demonstration on how we humans proceed through dense jungle.

In the humid tropics it often rains around four o'clock in the afternoon, and darkness falls about two hours later, giving a long evening. At the evening meal with the manager and his wife in the warm tropical dark, talk turned to the bleak picture of England during the Second World War. This included my evacuation from London to Lancashire, where I lived at a public house run by a relative, and at the age of 11, made myself useful in its day-to-day running. I described the mechanics of beer on tap, pumped up by hand to the bar from the barrels in the cellar below, then the orders carried round on trays. My specialty was keeping the coal fires burning in the various small rooms, where friends had their regular haunts, often making their drinks last, as there was not a lot of money around.

On my first night at the Quoin Hill rest house, I was awakened in the middle of the night by the manager's wife, asking me to come, as her husband had been taken ill. What a place to be ill! It brought home to me all the difficulties of living in a patch cleared in the jungle, with no proper roads to civilisation. My flying visit, two nights, was in stark contrast to their life, the long period of virtual isolation, children away at boarding school in England, and, in addition, the plantation not doing too well. The debilitating effects of the way of life in the tropics might well lead to illness whether physical or depressive. I gave his wife some reassurance, and we agreed to take stock again in the morning, and returned to our beds. Next day he seemed back to normal, but did not go on my tour of the plantation, or to the Cocoa Symposium.

First in the tour came some education on how to get through the jungle. We had acquired three plantation workers, each with a fearsome machete, then drove along a plantation track to the edge of the jungle. When it was suggested I walk into it, I protested that the outer edge would have a dense guard of plants, benefitting from the light admitted through the track clearance. They said they would give me a start, but it took them only a few minutes to cut a slot into the darkness. I could not help asking what about snakes?

They answered that if I wanted to see snakes, they would take me to visit the rubbish tip, for where there are rats, there are snakes. I took that as reassurance I would not meet a snake here, and ventured into the slot. It was too dark to see much other than a tangle, and very difficult to fight a way forwards. So I turned around and did a backwards flip, with my bottom acting as a minor bulldozer to push a way forward. This kind of worked, better than risking one's eyes in an effort to select an easy way through. Taking pity on me, they showed me how they did it. The first man went in front cutting the vegetation with a heavy machete, from the waist level down, the next man cut from head to waist level, then me with a compass with phosphorescent needle, and a man in the rear, to stand in when the leading man tired. As a group we could make steady progress, though somewhat erratic through dodging round trees. What a slow way to make a soil survey!

Quoin Hill Plantation was sited well inland, on its own basaltic flow. The soil of reddish brown friable clay would be a classic fixer of phosphate and molybdate, and would also be liable to leach out potassium salts if applied as fertiliser. Plant roots were mostly in the litter layer where cacao trees had been planted in rather small patches. This soil required care during planting out, as the disruptive methods used in clearing large areas for a major plantation would affect the topsoil fertility. Small holders growing cacao in the neighbourhood of Quoin Hill appeared to be using the same clearance techniques as the main landholders, and not planting on the jungle edges. In most cases a shade tree had been planted, which would also have disturbed the soil. Oil palms planted at Quoin Hill had a twist in the trunk, possibly due to uneven root penetration of the soil. An alternative crop, hemp, was drying on fence lines, but compared with cocoa was a down-market crop.

We then set off towards the coast to visit other plantations. The Tiger Estate near the coast had been established on another basalt flow; however, it had what looked like a basaltic cone (small, rounded version of Rangitoto, N.Z.), which could have added volcanic ash to the topsoil. The soil appeared similar to that at Quoin Hill, but with a better litter layer, the cacao plants were stronger. Also growing well were oil palm and rubber trees. Beans from the cacao trees were at the first stage of processing, by fermentation in closed wooden boxes of tea-chest size, on a stepped stack that caught the sun but was protected from rain by a cover. This fermentation transformed the beans into cocoa beans which were dried on a mesh floor under cover from rain.

At the next plantation the Borneo Abaca Company Ltd were processing hemp as it came in by light rail for retting, then drying on a fence line before stripping. It all looked just like Foxton, in New Zealand.

We returned to Quoin Hill in total darkness, with the mosquito population in action. I thought to outwit them by having a cold-water bath, but they were already lining up in the bathroom, and the only respite was during total immersion, followed by the hastiest retreat possible.

Next morning after thanks and farewell, the three of us, Shao, Wyrley- Birch and myself, left for the Cocoa Symposium to be held at Semporna. Data on the soils, plant analyses, and other material from the conference, were written up as a Soil Bureau internal report. (Soil Bureau Information series no.21, 1966). At Semporna, the conditions differed greatly from those on the plantations. The soil here was a metre deep, sticky greyish-brown clay, from alluvium, overlying coral, totally different from the soils on basalt. This depth of alluvium suggested it could have resulted from earlier volcanic activity inland. It was growing a wider range of crops, oil palm, cassava, coconut and pineapple, even a single durian tree, and the closeness to a port meant that more perishable crops could be exported. In contrast, the crops produced at Quoin Hill had to be of greater value, and sturdier, to offset the costs and rigours of transport over the rough roads to the port.

The day after the Cocoa Symposium came a visit to a cacao plant trial at Lahad Datu, across the Bay from Semporna, with the District Officer supplying a launch and a boatman. Halfway across the bay our Field Officer stopped the launch, changed into swimming shorts, and dived off the boat, apparently heading for the Philippines. When I asked the other two if they were going to swim, they returned an emphatic no. My own experience of swimming in an unheated pool in an English school had not been encouraging, as I usually sank. I was tempted by the warm water of the tropics, so went over the side in my underpants, managing one splashing circuit of the boat before being pulled in. We collected up the serious swimmer, and were off to Lahad Datu for lunch. One of our group made a great point of wanting to try black dog. Shao shook his head in horror. Luckily, in this very small town there were only three eating places, and none had black dog, so our gourmet had to be satisfied with the less exotic rice and meat sauce. Afterwards

we watched the washing-up. Cutlery went into a bucket outside, crockery spread out on the pavement, and washed with a sprinkler hose, and left for the sun to dry.

We visited the small agricultural station where the field officer was conducting trials with cacao plants. Those growing on alluvium at the lowest part of the trial area showed excellent root penetration of the soil, but it was not clear whether the roots had grown that way, of whether alluvium from recent floods had buried the previously-established roots. In the main trial area, upslope, rooting was very much on the surface, with some roots feeding on the run-off from neighbouring tree-trunks. The soil was derived from sedimentary rock alluvium and the organic horizon was very thin.

Seeing a very good crop of tobacco nearby, I asked where it was sold. A string of speed boats moored just outside the harbour limits was pointed out, which would do a quick dash to the Philippines, unload at a remote site, and back to Sabah. This explained why Semporna and Lahad Datu had two-storey police redoubts, with the houses huddled up close for protection. There were odd reprisal raiders from the Philippines, who could be termed pirates. Our launch took us back across the bay, and next day Shao and I returned by air to Jesselton, and I met his family at the Research Station in Tuaran. Soon afterwards I left Sabah, with a wealth of memories, and ringworm.

The main conclusions I drew from my visits to plantations are as follows:

1 Plant analysis may not provide answers to why the yield of cocoa beans from large plantations was proportionately less than smallholders could get from crops on the edge of the jungle
2 Plant analysis can help with the interpretation on fertiliser trials
3 I would suggest that plant analysis routines be developed for successful crops (rubber, oil palm, tobacco) and the set-up then applied to the more difficult crops (cocoa)
4 The disturbance of a soil, with high phosphate fixation and loss of potassium could be detrimental to establishing plants.
5 The basalt flow at Quoin Hill (inland, high rainfall, no fresh mineral accession) could be weathering towards a mineral ore deposit (bauxite) rather than an agricultural soil
6 Although plantation management was not in my terms of reference, I observed that the planting of shade trees in a large plantation did not work, for reasons as yet unknown.

POSTSCRIPT

A year after my visit to Sabah, the X-ray diffractometer arrived at the Agricultural Research Station in Tuaran. J.S Whitton of the Soil Bureau took clay mineral samples to calibrate the machine, and in one month had it in action for a study of soils in Sabah.

The technical and scientific problems were not the only considerations. Market forces intervened. Cocoa prices rose enough to enable some marginal plantations to survive. World output then increased, and the price fell, so that some plantations in Malaysia changed to oil palm. Ten years after my visit, the symposium held at Semporna was entitled Cocoa and Coconut, perhaps reflecting a drift away from the problems of introducing high-value crops towards the well-tried and traditional.

In this next decade E. Wyrley-Birch published a study of cocoa and soils in the state of Sabah, and a manual of cocoa planting that went into several editions. Still later A.M. Young, in a book, The chocolate tree,* noted that the flowers of the cacao tree present such small nectar rewards to the flying insects involved in pollination that only the mites could be induced to visit, with their very short flight path. Those living in the jungle could reach cacao trees planted on the edge of the jungle, but could not travel the distances for pollinating large plantations, an ecological explanation why the small-holders, planting at the jungle margins, could have more success than the larger planters.

*The chocolate tree / Allen M. Young. – Washington, D.C. : Smithsonian Institution Press, 1994.

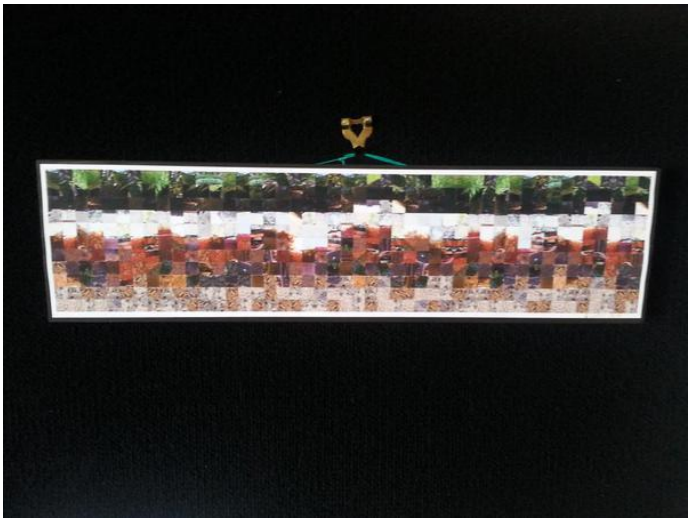
Dorodango: using art to start a conversation about soil

Louis Schipper
Professor University of Waikato

At the University of Waikato, we have a 1st year course on environmental science that includes introductory aspects of soil science. During one of the labs, I spend about 5 minutes showing the students Dorodango that I have made using several soils from around the North Island. This is a Japanese art form where saturated soil is rolled into a ball and slowly dried by hand into a sphere. Lastly, a thin outer coating of finely sieved soil is layered on the outside before polishing with a soft cloth. The beauty of different soil layers are immediately evident and the shape and stability of these Dorodango captures their imagination and raises many questions. What sort of soil are these, where do they come from, why do they stay intact, and can I make one? Some questions are easier to answer than others but by then you have started a discussion.

In second year, I bring these Dorodango back into my introductory soils course just before giving a lecture on soil mineralogy. Before and during the lecture I am able to show them very different Dorodango made from soils containing allophane, iron oxides, 1:1 clays and topsoils. These Dorodango start a conversation in a very different way about soil and their composition and structures. There are many videos on line that can be used to show how to make Dorodango.

Artwork and Dorodango from the NZSSS Conference



Waikato/Bay of Plenty

University of Waikato

Many hours over the past few years have been dedicated to planning for the national soils conference that was held at the University of Waikato from 1-4 December, 2014. Staff and graduates of the Earth sciences programme of Waikato University's School of Science featured prominently at the conference, with 23 (including numerous graduate students who ably provided IT support for concurrent sessions throughout the conference) of the 180 or so delegates who attended. Numerous participants have emailed convenor **David Houlbrooke** to (rightly) congratulate him and his committee for organising and hosting what some have called the best conference they have ever attended, commenting especially on the tone and friendliness, and the "superb field trips". Certainly, it was a real pleasure to host the New Zealand soil science community on the Waikato campus this year.

Prizes of NZSSS were awarded at the conference dinner including the following to Waikato staff or students (see photos). We acknowledge and thank the society for the great support of students in particular, as well as others, which it provides through these awards (and grants).

Professor Louis Schipper was awarded the M.L. Leamy Award (2014) for 'best publication in soil science for the past 3 years', a prestigious award indeed, mainly for a paper "Thermodynamic theory explains the temperature optima of soil microbial processes and high Q10 values at low temperatures" (published in *Global Change Biology*).

Dr Paul Mudge (former PhD student at Waikato) won the Fieldes Award for best PhD thesis.

Sam McNally (current PhD student at Waikato) won the Bert Quinn Award for best PhD student entering 3rd year.

L-R: Louis Schipper (Leamy Award), Sam McNally (Bert Quinn Award), Paul Mudge (Fieldes Award) Photo: D Lowe

Olivia Jordan (current MSc student at Waikato) won the highly competitive T.W. Walker Prize for best student oral presentation at the conference (2014) entitled "Root biomass and soil carbon under a range of pasture diversities and grazing practices".
Photo D. Lowe

Alice Barnett (former MSc student at Waikato) was awarded (albeit a year late!) the Rigg Award for the best MSc thesis for the previous year (2013).
Photo: D Lowe

Danielle Le Lievre (completed BSc student at Waikato in 2014) was awarded the 'best completing undergraduate student in soil science' award for Waikato University.
Photo: D Lowe

The conference organising committee included **Megan Balks** and **Louis Schipper** plus a number of former students/alumni from Waikato University (at some stage) including **Haydon Jones, Natalie Watkins, Reece Hill**, and convenor/chair **David Houlbrooke**. **David Lowe** organised and led one of three field trips, "Hot volcanic soils" (with support from **Megan Balks** and former masterate student **Nadia Laubscher**), and the other two field trips were also led by Waikato alumni, namely **Natalie Watkins** (with **Scott Fraser** and **Dave Houlbrooke**), "Wild west coast", and **Sharn Hainsworth's** "Competing land uses".

During David's trip to Taupo and Galatea regions on Tuesday 2 December, in perfect weather, Radio New Zealand science reporter **Veronika Meduna** recorded much of the commentary at each stop and interviewed Louis Schipper, David Lowe, and others during the day. The first of several programmes by Veronika, "World soils day: New Zealand's volcanic soils", was aired on Thursday 4 December on national radio's "Our Changing World" programme (also available online).The conference and further programmes are likely to be developed over the next few months, a great lead into 2015 which has been designated "The International Year of Soils".

DairyTeam scientist Bill Adam (left) being recorded by Veronika Meduna near Galatea – Photo D Lowe

'Hot volcanic soils' group on Eric Smeith's farm, Galatea area, 2 Dec 2014. (Photo D Lowe)

On David's trip, which featured the soil-forming Kaharoa tephra, two 700th birthday (septingentarian) cakes to celebrate its eruption in c. 1314 AD were dispensed to participants at the tour conclusion at the Galatea War Memorial Hall. Great support for David's trip was received from Ravensdown, who sponsored the trip, and others including Alan Bullick (Landcorp Farming), Nicola Hancock and Kevin Sears (Taupo District Council), Jon Palmer (Waikato Regional Council), Eric Smeith (Galatea farmer), Bill Adam (DairyTeam, Whakatane), and Ants Roberts (Ravensdown).

Janine Ryburn dispensing Kaharoa tephra 700th birthday cake, 'Hot volcanic soils' trip'. (Photo D Lowe)

A stand-out feature of the conference was the conference dinner held at the Hamilton Gardens. Participants were able to tour the gardens for several hours before dinner, and **Wiremu Puke**, who had earlier given a fascinating keynote address on the Te Parapara Garden (early Maori traditional garden), was on hand to describe and explain the garden's special features to more than 50 conference participants.

Wiremu Puke (grey suit) explains Te Parapara Garden, Hamilton Gardens (Photo D Lowe)

Also on show was the annual N.H.Taylor Memorial Lecture, given this year in superb fashion by **Dr Stewart Ledgard** (AgResearch) on "Nitrogen efficiency: from plant to planet".

Norman Taylor Memorial Lecturer 2014, Stuart Ledgard, with Trish Fraser

Finally, we congratulate **Brent Clothier** for the award to him of the L.I. Grange Medal. Brent has been an outstanding advocate for soil science and its practitioners and is truly well deserving of the award.

Dr Trish Fraser (outgoing president) and Dr Reece Hill (new president) cutting the World Soils' Day cake at the conference closure

News from the Land Monitoring Forum

The National Land Monitoring Forum is a forum for regional authorities to share ideas and identify issues and solutions around land and soil information.

Land and soil scientists from the regional councils meet at the bi-annual Land Monitoring Forum Meeting on the 13-14 February, in Wellington. Attendees included **Reece Hill** (WRC), **Haydon Jones** (WRC), **Matthew Taylor** (WRC), **Fiona Curran-Cournane** (AC), **John Drewry** (GWRC), Andrew Little (ES), **Jeromy Cuff** (ECan), Barry Lynch (HBRC), Andrew Burton (TDC), Rachael Rait (MDC), Duncan Kervell (NRC), Kerry Hudson (GDC).

It was a rather busy agenda. Soil Quality work was reported included the development of microbial indicators with Auckland University, an update on trace element work, and a report by guests **Erin Lawrence-Smith** & **Paul Johnstone** (PFR) on the Arable & pastoral soil quality monitoring programme in Canterbury. Presentations on Land productivity & land use capability work in Tasman District, and Trends in Canterbury high-country vegetation were also made. Later, guests Daniel Rutledge & Robbie Price (LCR) ran a workshop on guidelines development for monitoring land fragmentation.

The next meeting will be held in August 2014.

News from Waikato Regional Council

Congratulations to Reece Hill and Haydon Jones on their election, Reece as president and Haydon to council.

Haydon is busy with EMaR. EMaR (Environmental Monitoring and Reporting) is a new joint LGNZ Regional Sector-MfE initiative just getting underway. The overarching objective of EMaR is to provide integrated regional/national environmental data collection networks and widely accessible reporting platforms (via LAWA in particular). Waikato Regional Council has been asked to be the lead council for the Land domain project which, over the next year, which will likely review the current situation (existing information, datasets, indicators, etc.) and undertake a scoping of future work around national data collection network design/specifications and indicators for national reporting. The project team consists of Haydon (as lead), John Drewry (Greater Wellington), Andrew Burton (Tasman), Deborah Burgess (MfE), and with the LMF as primary supporting SIG.

Welcome to **Alice Barnett** and **Justin Wyatt** who have recently joined us. Alice is covering Reese Hill's position until the end of March while he is on secondment. Justin is working on sediment and peat issues.

Matthew is finishing sampling the soil quality monitoring sites.

All of us enjoyed the conference, well done organisers!

Landcare Research

Paul Mudge, **Scott Fraser** and **Danny Thornburrow** have been busy taking soil samples (0–60 cm) from 14 paired irrigated and dryland dairy pastures (Photo 1). 7 of the sites are on sandy soils near Foxton and 7 on pumice soils around Galatea. The work is a Sustainable Land Management and Climate Change (SLMACC) project to determine the effect of irrigation on soil carbon stocks under pasture. This is a joint project between Landcare Research, AgResearch (Frank Kelliher) and the University of Waikato (Louis Schipper). Landcare Research have aligned further work within the Sustainable Land Use Research Initiative (SLURI) to investigate carbon and nitrogen cycling at the same sites to compliment the C and N 'stock' data collected within the SLMACC project.

Photo 1: 60 cm soil cores (top left) from a paired irrigated/non-irrigated site (bottom right). Scott Fraser (top right) extruding a core, and Danny Thornburrow (bottom left) collecting a vegetation sample from irrigated dairy pasture.

Many congratulations to **Paul Mudge,** who was awarded the 2014 Morice Fieldes memorial award for the best PhD thesis in soil science at the recent NZSSS conference in Hamilton.

Manawatu/Hawke's Bay

Massey University

FLRC are preparing for the 28th Annual Workshop in February 2015 with over 100 papers submitted for the three-day programme. The title is '**Moving Farm Systems To Improved Nutrient Attenuation**' and with over 100 solicited and volunteered presentations, this promises to be another very popular event. The Provisional Programme has been posted on the FLRC website at http://flrc.massey.ac.nz/ where details about registration can also be found.

The research being conducted on the No. 4 Dairy Unit for the Pastoral 21 'Regional Farm' project continues in full swing. **Mike Hedley** may have appreciated a wetter winter to test some research hypotheses, but the cows seem to appreciate their free-stall barn environment whilst also being able to spend time grazing fresh pastures. This year has seen the technician on the project, Natalie Butcher, move to the position of Herd Manager and the technician position has been taken by a recent graduate of Lincoln University, Quang Mai. Originally from Vietnam, Quang has fitted into the project very well and has some excellent skills that complement the other people on the research team. Recently the TV One 'Rural Delivery' programme featured a segment on this research, which can be viewed at the link http://tvnz.co.nz/rural-delivery/s10-ep40-video-6149110.

Christine and James Christensen became proud parents on November 13th with the birth of a healthy and (apparently) well behaved little boy, Maximus Gordon Christensen. Christine is describing him as "the next generation of agriculturalists" and she is enjoying the demanding role of motherhood.

Max Christensen

Ahmed Elwan, a PhD student supervised by Ranvir Singh and Dave Horne, recently won the 'Best Student Oral Paper' presented at the 21st Century Watershed Technology Conference and Workshop held in Hamilton. His research focus is on nitrogen attenuation and the journey of nutrients in different subsurface environments. He also recently received a Massey University Doctoral Scholarship in an award ceremony on the Manawatu Campus.

NZSSS Conference Report – courtesy of Helen Walker, Massey PhD student

Last week (Monday 1st – Thursday 4th December) a group of staff and students from Massey University travelled up for the Society of Soil Science 2014 Conference in Hamilton.

Monday started out with a very early wake up call to ensure we were all ready when our trusty drivers, **Mike Bretherton** and **Alan Palmer**, turned up sometime after 4am to pick us all up at our respective houses. Silence reigned on the trip up (at least in one van) with everyone, but the driver, trying to catch a little more shuteye. Stops in Taihape, Taupo and Cambridge ensured that the drivers caught some brisk, fresh air while most of the rest of us remained huddled in the vehicles keeping warm. Arriving at Waikato University we all bundled out at the student halls, checked into our accommodation for the week, and then wandered across the campus to find the conference and register. This was it, the conference had officially started!

Unfortunately, as we arrived slightly late, we missed the keynote speaker Prof. Dr. Ir. Oene Oenema from the Netherlands; so for us the conference started with lunch followed by plenary talks from Prof. Jacqueline Rowarth and Dr. Carolyn Olsen, both very interesting in their own respects. Once the talks concluded it was time for the Poster Presentations, in which the Massey delegates made a fine showing. Then it was afternoon tea time followed by a series of talks, of which at any one time you had three to choose from (the issue was choosing which one you wanted to attend the most), and then the NZSSS AGM. Many people shot off after that, but for those remaining there was a BBQ social function. This was a very relaxed time for social chit chat, discussion of the conference so far, a few drinks and a good meal. There was also that colossal "Oh" moment too when the buffet table collapsed and the food went flying (thankfully most of it landed upright), but all things aside it was a great conclusion to the first day at conference.

Day Two saw a few of us off on our respective field trips. I was fortunate to be on the Hot Volcanic Soils trip lead by David Lowe. It was an incredibly informative trip, with stops including a pine plantation to dairy conversion, the Taupo District Council Land disposal site, and a farm at Galatea where a soil flipping project is being trialed. As part of our trip we were given an extremely detailed guide book, complete with top notch photos, which stepped us through the geological/soil history at each site.

I found discussion of the Taupo eruption most interesting, as although I knew it was big, I truly had no idea of the extent and magnitude of this eruption. I found it fascinating that we can place the eruption as occurring in late March to early April based off preserved fruit and seeds, and lack of an outer latewood ring in forest trees; that the ignimbrite destroyed all the forest in its path (~1km^3 of timber); and that the pyroclastic flow that placed this ignimbrite was estimated to have been over in around 7 minutes…phew! No getting in your car and driving away from that one!

The other stop I found the most interesting was at the Smeith farm at Galatea. They have been bringing up different buried volcanic layers to the topsoil and trialing growing crops in them. It is the ancient Whakatane tephra which seems to be the most successful and Eric Smeith has now spread this on top of several paddocks, under both pasture and crops. The only disadvantage so far seems to be the low organic matter content, which he is attempting to increase by growing crops and letting the residue remain. It will be interesting to watch developments here. The field trip part of the trip was wound up with the cutting of a commemorative Kaharoa cake, expertly made by both David Lowe and his wife – everyone on the other field trips missed out in more ways than one!

Wednesday morning dawned bright and early – for me the most daunting day, having a presentation to give that afternoon, but made infinitely better by knowing that Marta Camps was chairing my session and wouldn't steer me wrong. I wasn't alone however, with several others from Massey also giving presentations that afternoon, and I must say that the representation from Massey was top notch. With my presentation over it was time to relax and enjoy the rest of the conference (while feeling sorry for everyone unable to yet relax), and the conference dinner Wednesday night was surely a great way to do that. Awesome company, good food (have to love that Taupo beef), and good entertainment made for a fun evening. I have to say the different farm systems created (dinosaurs and all) really did showcase what a bright, intelligent community that we are. With every table striving to outdo the other, who knew you could create riparian plantings with rosemary, erupting volcanos with red wine, herd homes with the menu…the list goes on.

Thursday came much too soon, with the final keynote speakers, session talks, the Norm Taylor Memorial Lecture by Dr Stewart Ledgard, and the World Soils Day Celebration marked by the cutting of a cake (soil layers and all). The trip home for us seemed almost quieter than the trip up (our poor drivers), with everyone well and truly worn out. If you missed coming to this soils conference, you will want to come to the next!

The group on the 'Hot Volcanic Soils' field trip during a stop at the Smeith farm at Galatea

James Hanly and Seth Laurenson with their rendition of 'The Gambler' at the conference dinner.

The majority of the 'Motley Crew' from Massey enjoying their time away in Hamilton

Plant and Food Research, Palmerston North

Karin Müller hosted Professor Ken Kawamoto and Kuroki Hisanobu from Saitama University and Dr Syuntaro Hiradate from the National Institute for Agro-Environmental Sciences (NIAES) from 26 November to 5 December 2014 at Ruakura. The purpose of the visit of our Japanese colleagues was twofold: We conducted a comprehensive soil sampling campaign at Mike & Sharon Barton's beef farm in the Taupo catchment as part of our joint bilateral MBIE/JSPS research project on soil architecture and mass transport parameters in water-repellent soils. The farm was selected as site for the project because of the high degree of soil water repellency of the Pumice soil in the catchment. Our Japanese guests also attended this year's New Zealand Soil Science Conference in Hamilton and presented some preliminary results from the Japanese site of the joint project. Kuroki Hisanobu, a Masters's student of the Graduate School of Science and Engineering at Saitama University, stayed in Hamilton for another week to process the soil samples collected in Tihoi. We were very surprised to find a reasonably high degree of water-repellency at the soil surface at this time of the year. We learned from Mike Barton that this winter had been unusually dry for the region with only half of the average rainfall. Hopefully they will get some rainfall before summer sets in...

Jade Gribben (Lincoln University), a summer student working with **Karin Müller** and **Karen Mason**, joined the team on 24th November. She plunged straight into the field work at Tihoi to collect soil slabs for conducting runoff experiments using Plant & Food Research's Runoff Measurement Apparatus (ROMA) as part of her studentship project. She is based in Palmerston North and will test several hypotheses around the origin of soil water repellency. Together with **Robert Simpson**, Jade will also analyse the soil samples collected at Tihoi for a range of biological soil parameters potentially linked to the occurrence of soil water repellency.

Top: Ken, Syun & Kuroki measure repellency to 30 cm depth (left); Syun is immerged (middle) in the Pumice soil (right).
Bottom: Jade & Carlo extract soil slabs for ROMA (left); Karen measures water drop penetration times along the 100-m long transects (middle); Carlo measures infiltration in the rain (right).

The Production Footprint Team was well-represented at the NZSSS Conference 2014. **Steve Green** gave a talk on date palm water use in the United Arab Emirates, before making an early departure to return to the UAE for ongoing field work. **Roberta Gentile** presented on greenhouse gas fluxes during a simulated irrigation even on an orchard soil, **Robert Simpson** talked about the depth distribution of soil water repellency and enzyme activity, and **Karin Müller** gave a talk on subcritical water repellency of arable soils in Cantebury. Karin also co-authored two soil water repellency posters with our Japanese collaborators on repellency effects on runoff and phosphorus losses and repellency effects on mass transport parameters.

Congratulations to **Brent Clothier** who was awarded the L. I. Grange Medal for Outstanding Service to New Zealand Soil Science. Brent was awarded the prize in acknowledgement of his extraordinary contributions to the promotion and advocacy of soil science, notably his mentoring, advocacy for funding and his major input into policy such as the "One Plan" legislation.

AgResearch Grasslands

In September 2014, **Dr Estelle Dominati** from AgResearch was invited to present at the 7th Ecosystem Services Partnership Conference hosted in San José, Costa Rica with over 350 participants from all over the world (www.espconference.org/ESP_Conference). Estelle presented her work on "Impact of on-farm built infrastructure investments on the provision of ecosystem services: Irrigation for dairy systems in New Zealand" in a session called "Integrated Agricultural Systems to Enhance Ecosystem Services" organised by Dr Harpinder Sandhu from Flinders University, Australia. Estelle's postdoc work, funded by the Rutherford Foundation of the RSNZ, investigates the impacts on soil properties (natural capital), the farming system, ecosystem services and environmental outcomes of introducing irrigation to existing dairy farms. This work was also recently presented at the NZSSS conference in Hamilton in December 2014. While in Costa Rica, Estelle also participated in a couple of workshops for the United Nation Initiative the "Economics of Land Degradation" (www.eld-initiative.org), as a member of the scientific committee of the ELD.

Canterbury

Lincoln Agritech celebrates 50th Birthday

In early October, we celebrated the 50th Birthday of Lincoln Agritech and its predecessor organisations NZAEI, AEI and Lincoln Ventures. The organisation's development as an agritech-focused science and engineering research company, serving agriculture, industry and the environment, was illustrated by eminent speakers, including Amy Adams, then still Minister for the Environment.

Our 50th Birthday celebrations also offered a rare opportunity to take a photo of an almost complete Environmental Group – only Thomas Wöhling, who is based in Tübingen (Germany), missed out (Fig. 1).

Fig. 1: LAL's Environmental Group: Ali Shokri, Jens Rekker, Scott Wilson, Hugh Canard, Roland Stenger (back row); Brian Moorhead, Juliet Clague, Sophie Papanek, Simon Woodward (front row). Missing: Thomas Wöhling.

Reporoa Basin research sites

The Hamilton team has recently begun exploratory field work in the Reporoa Basin as part of our 'Groundwater Assimilative Capacity' research (Fig. 2). Over the next few months we are going to install a few new wells that will allow investigating water chemistry gradients in the uppermost groundwater zone, with a particular focus on redox gradients (Fig. 3).

Fig. 2: Brian Moorhead and Ali Shokri coring in the Reporoa Basin.

Fig. 3: 'Childs test' red colour response, confirming the presence of ferrous iron in the shallow groundwater zone (and thus indicating reduced redox status).

The New Zealand Soils Science Conference – through the eyes of a student

We were a small party of Lincoln University students travelling up to Hamilton to experience life at a conference. I feel like people often complain about having to go to conferences, a necessary evil they can call them. My primary concern was whether I would be able to stay awake during the speakers, if my university training would serve me well and see me promptly fall asleep after lunch hour. As a group we also pondered how much of the content we would be able to understand, would it be over our heads?

However the conference proved to be a great experience. On the second day we all went on a field trip out to the Wild Wild West Coast which gave us a chance to learn about the pedology and soil management of a different part of the country, not to mention the cruise around Raglan harbour that may or may not have influenced our choice of field trip. In terms of speakers we had some very interesting key note speakers that made us all think about a range of issues. Not only the challenges facing soil science and necessary advances to farming practices in NZ but also the importance of quality food and the missing links to science, particularly agricultural, in New Zealand primary and secondary schooling. We also all benefited from the opportunity to present speeches and posters as well as meet the scientists that had written many of the books and papers that we had been learning from throughout our degrees.

Many interesting topics were presented and discussed over the week, not to mention the food and good company! I really enjoyed the talks and didn't even fall asleep, except for slightly heavy eyes on the final day after the lively conference dinner the previous night. We all agreed that the conference made us more aware of the range of issues facing soil science and the possibilities open to us. It also showed us the range of people within the field who are working on key issues and improving knowledge surrounding the science as well as the scope for continued work on current and upcoming issues.

Nicole Mesman
Fourth Year Future Leader Scholar
Honours Soil Science
Lincoln University

Land Use and Water Quality conference 2015

As a previous attendee and member of the Scientific Advisory Committee, Roland Stenger would like to draw your attention to LuWQ2015, which takes place in Vienna, Austria, from 21-24 September 2015. LuWQ2015 is an international and interdisciplinary conference on the cutting edge of science, management and policy to minimise effects of agriculture and land use changes on the quality of groundwater and surface waters. Abstracts are due by 1 February 2015, via http://web.natur.cuni.cz/luwq2015/index.php?id=6. Please see website or conference section at the end of this issue for further detail.

Plant and Food, Lincoln

The recent NZSSS conference was well attended by PFR Lincoln staff. **Mike Beare**, **Trish Fraser** and **Gina Clemens** presented, while posters were shown by **Craig Anderson, Michelle Peterson, Craig Tregurtha, Abie Horrocks and Mike Beare.**

Tina Harrison-Kirk left us in September for greener pastures in the health industry as Quality Control Coordinator at Xtend Life Natural Products. **Kathryn Lehto** was appointed as a chemistry analyst. Tina has been replaced in her role as Lab Services Coordinator by Kathyn Lehto. So we're still down an analyst in the labs. **Frank Tabley** and **Rebekah Tregurtha** celebrated significant service milestones at a PFR function recently with Frank clocking up 40 years of service and Rebekah 25 years.

It's been a busy spring for PFR staff at Lincoln, with a large number of field trials requiring attention. Steve Thomas, Gina Clemens, Frank Tabley and Weiwen Qui have completed their first experiment in the lysimeter facility with automated rainout shelter opened earlier this year, with extensive gas sampling and leaching measurements and pasture production assessments. Another experiment conducted by Steve Thomas, Gina Clemens, Trish Fraser and Rogerio lasted a week, but had 24 hour sampling over that whole period. Such dedication!

Craig Tregurtha and **Peg Gosden** completed an extensive sampling program in September and October as part Denis Curtin's Soil Nitrogen Mineralisation Potential experiment. This is part of the LUCI program. Craig and Peg spent a week sampling in Southland, six days in Canterbury and 10 days in the North Island. Craig comments that there was more time spent finding the sites and planning the program than actual time in the field.

Abie Horrocks, Craig Tregurtha and Shane Maley have been busy on a FAR SFF "Reducing the footprint of arable crops" with two field trials, one using solid dairy effluent as a fertiliser source for crop production on winter wheat, and the other using legumes as an N source.

Richard Gillespie and **Steven Dellow** with **Paul Johnstone** are working with carrots as part of the SFF "Building a brighter future for process carrots". In year two, we're looking at K responses in two field trials in Canterbury plus a trial at Lincoln looking at factors affecting establishment including seedbed preparation, and interactions of drilling speed and wear.

The new lysimeter facility extensions are near completion after a lot of hard work from **Frank Tabley** and **John Payne**, Landcare and others. It relates to the MBIE programme "Maximising the value of irrigation using smart soil and plant management decision" with PFR's input managed by Hamish Brown. This new facility is designed specifically to do experiments on stony soils, of particular significance for dairy expansion in Canterbury. Very stony soils have not featured in previous lysimeter studies simply because it has proven impossible to collect soil columns from these soils. This programme has taken the obvious, but still controversial method in soil science circles, of repacking the lysimeters to achieve a controlled proportion of stones of different sizes.

Frank Tabley blending "synthetic" soil for the new lysimeter.

The new stony soil lysimeter facility

SIDDC held school and public open days in November. Each partner was allocated some exhibition space in the marquee, with the idea of showcasing research in an interactive manner. The theme was Sunshine into Food, and there were information stations in the paddock reflecting different parts of the supply chain (environment, grass, cows, milk and milking, careers, technology, food, business). Trish Fraser coordinated PFR's contribution which was staged around "interesting science facts" that would be engaging for the public/ kids. For example things like "in a field with healthy soil, the combined weight of all the earthworms under the ground is about the same as the weight of all the cows above ground" or "a cow urinates up to 12 times a day, and each time would fill a large lemonade bottle".

In November we hosted Dr Keith Prembleton from TIA Diary Centre in Tasmania. Keith gave a very informative seminar to staff and inspected our field trials.

Planning is underway for the environmental objective of the MBIE DNZ forages for nitrate leaching program. Mike Beare reports that progress is being made on Our Land &Water National Science Challenge.

The Sustainable Production portfolio enjoyed and lovely Christmas lunch recently, organised by Craig Anderson, Kathryn Lehto and Rebekah Tregurtha.

Two teams contest a simulated casualty extraction at the PFR SPP Lincoln Christmas lunch

The winning team from the SP Christmas lunch getting serious over the quiz questions. From left Mike Beare, Richard Gillespie, Esther Meenken (obscured), Abie Horrocks, Nathan Arnold, Steven Dellow and Erin Lawrence

A substantial sum of money was collected from a morning tea fundraiser for Josie Noble to help towards travel costs to the Special Olympics in LA next year. Well done to those who participated in the morning tea.

Otago/Southland

AgResearch Invermay

Members of the Invermay team have been working alongside staff from Otago Regional Council to install 310 suction cup samplers at pasture, crop and native bush sites located in the Matukituki Valley near to Lake Wanaka. The goal of the experimentation is to obtain quantitative measurements of nitrogen (N) and phosphorus (P) losses in leachate from the shallow soil types located in this high rainfall environment (c. 2500 mm pa).

Matukituki sampler installation

Cecile de Klein attended the 7th International Non-CO2 GHG symposium, in Amsterdam, The Netherlands, and gave oral presentations on "Improving and building the New Zealand agricultural N2O emission inventory – progress in the last 15 years" and on "N2O emissions from grazed grasslands: interactions between the N cycle and climate change – a New Zealand case study".

While in the Netherlands Cecile also visited various researchers at Wageningen University to discuss developments in 'future farming' and 'adaptation' research.

Seth Laurenson will be moving to AgResearch Lincoln in the New Year to join the Land and Environment team there.

New Publications

Soil Sequences Atlas. M. Świtoniak, P. Charzyński (Eds.). 2014. Nicolaus Copernicus University Press. ISBN 978-83-231-3282-0. Hardcover 212 pages. To understand the soil-landscape relation it is necessary to study the spatial diversity of soil cover. This book provides an extensive database of soil sequences from the following countries: Hungary, Latvia, Lithuania and Poland. The main objective is to present a great diversity of soil-landscape/climate/hydrology relations and its effect on patterns in soil cover. Most recent edition of the WRB system (2014) was used to classify soils. The collected data will be useful in soil-science teaching, helping to understand variability of soil cover and influence of various soil-forming factors on development of 'Earth skin'. Pdf can be downloaded for free from ResearchGate: https://www.researchgate.net/publication/266851450_Soil_Sequences_Atlas

Suelos con acumulaciones calcáreas y yesíferas de Argentina (Soils with calcareous and gypsiferous accumulations in Argentina). Perla Amanda Imbellone (Editor). Asociación Argentina de la Ciencia del Suelo. Ediciones INTA. Buenos Aires, Argentina. 2014. ISBN 978-987-521-477-4. 219 p. (In Spanish with abstracts in English). The book includes an Introduction on general aspects of calcareous and gypsiferous soils of Argentina and eight chapters devoted to specific studies on these soils, mainly in the Pampean Region and Patagonia, formed under arid to humid climates (1: Calcretes of SW Córdoba province. 2: Calcium carbonate accumulations in soils of Central-SE Buenos Aires province. 3: Calcareous soils of NE littoral Buenos Aires province. 4: Calcareous accumulations in the soil cover of southern Buenos Aires province. 5: Genesis of tosca in Pampean soils. 6: Soils with calcareous accumulations in the Upper Valley of Negro river, northern Patagonia. 7: Gypsiferous soils in the Colorado river basin. 8: Properties and genesis of carbonate accumulations in Aridisols from east central Chubut province). Website: www.agro.uba.ar/catalog/164?page=2

Determination of Metals in Water, Soil and Sediments. By T.R. Crompton. November 17, 2014. CRC Press. ISBN: 978-11-380-2106-8. Hardcover, 300 pages. Price $159.95. The potential health hazards that might arise from the presence of metals in natural waters, soils and sediments are a matter of increasing concern to the water industry, environmentalists, and the general public alike. This comprehensive reference volume draws together and systematizes the vast body of information available in the global scientific literature on the determination of metals in waters, soils & sediments. Sediments in rivers have the property of adsorbing dissolved metals present in the overlying water so that the concentration in the sediment is appreciably greater than that in the water by factors between 100-60,000. The concentration of metals in sediments is a measure of its concentration in water over a period of time and is therefore a useful measure of water quality. Determination of Metals in Natural Waters, Soils & Sediments provides comprehensive information on this subject.

Acid Mine Drainage, Rock Drainage, and Acid Sulfate Soils: Causes, Assessment, Prediction, Prevention, and Remediation. By J.A. Jacobs, J.H. Lehr, and S.M. Testa. 2014. Wiley. ISBN: 978-04-704-8786-0. Hardcover, 520 pages. Price $149.95. Written to help readers understand the formation of AMD, Acid Mine Drainage addresses the generation of acidic waters usually from both used and abandoned coal or metal mines. Offering the most up-to-date ideas on metals remediation, which makes finding control

methods relatively easy, the text provides a section on legal and policy issues and details the causes, control, prediction, prevention, and remediation of AMD formation. Case studies from North America, Europe, Asia, and developing countries highlight various approaches to AMD problems.

Soil Strength and Slope Stability, 2nd Edition. By J.M. Duncan, S. G. Wright, and T.L. Brandon., 2014. Wiley. ISBN: 978-1-118-65165-0. Hardcover 336 pages. Price $150.00. *Soil Strength and Slope Stability, Second Edition* presents the latest thinking and techniques in the assessment of natural and man-made slopes, and the factors that cause them to survive or crumble. Using clear, concise language and practical examples, the book explains the practical aspects of geotechnical engineering as applied to slopes and embankments. The new second edition includes a thorough discussion on the use of analysis software, providing the background to understand what the software is doing, along with several methods of manual analysis that allow readers to verify software results. The book also includes a new case study about Hurricane Katrina failures at 17th Street and London Avenue Canal, plus additional case studies that frame the principles and techniques described. Slope stability is a critical element of geotechnical engineering, involved in virtually every civil engineering project, especially highway development. *Soil Strength and Slope Stability* fills the gap in industry literature by providing practical information on the subject without including extraneous theory that may distract from the application.

Smith's Elements of Soil Mechanics, 9th Edition. By I. Smith. 2014. Wiley-Blackwell. ISBN: 978-0-470-67339-3. Paperback 488 pages. Price $49.95. The 9th edition maintains the content on all soil mechanics subject areas - groundwater flow, soil physical properties, stresses, shear strength, consolidation and settlement, slope stability, retaining walls, shallow and deep foundations, highways, site investigation - but has been expanded to include a detailed explanation of how to use Eurocode 7 for geotechnical design. The key change in this new edition is the expansion of the content covering Geotechnical Design to Eurocode 7. Redundant material relating to the now defunct British Standards - no longer referred to in degree teaching - has been removed. Building on the success of the earlier editions, this 9th edition of *Smith's Elements of Soil Mechanics* brings additional material on geotechnical design to Eurocode 7 in an understandable format. Many worked examples are included to illustrate the processes for performing design to this European standard.

Spring school on mapping and assessment of soils

From 18 to 22 May 2015, ISRIC - World Soil Information will organise a Spring School on digital soil mapping, soil assessment and classification for soil and environmental scientists, students, soil experts and professionals in natural resources management. This spring school is a contribution to the Global Soil Partnership implementation. The Spring School will take place on the Wageningen Campus in the Netherlands and will consist of two five-day courses that are run in parallel. For more information and registration: www.isric.org/content/isric-spring-school-2015

International Field Course and Soil Judging Contest

September 1-5, 2015 Hungary. As part of the celebrations of the International Year of Soils (IYS), an International Field Course and Soil Judging Contest will be organized September 1-5, 2015 in Gödöllő, Hungary. Participants (in the form of teams and individuals) will contest their knowledge and practical skills to describe, understand and interpret soil characteristics in the field. To prepare for the event, a three day technical training course is offered to learn and practice the international standards and guidelines on local soils and landscapes. Read more: http://soiljudging-iys2015.com/

Situations Vacant

Science Team Leader/Senior Scientist Agricultural Modelling – AgResearch Lincoln

A vacancy currently exists to lead the newly formed Agricultural Modelling team of about 15 FTEs. As the team leader of world class scientists, you'll be responsible for ensuring we have the expertise to meet current and future needs. You will provide leadership and guidance to staff, including planning, monitoring and feedback on performance.

The models developed and used in the team encapsulate the most recent and relevant understanding of the functioning of productive sector biological systems. Applications range from hypothesis-driven research using process-based simulation models through to decision support tools for land managers. Current mature tools include the OVERSEER Nutrient Budgets, APSIM and Farmax platforms, and new initiatives in various stages of development include Regional Multi-Agent Simulation, Farm System Optimisation, Nutrient Leaching Risk Management and critical contaminant source area modelling.

Additionally, this team leader role retains a significant personal science delivery component regarding the development and application of a range of system modelling tools that incorporate the key drivers and outcomes of pastoral systems. Consequently, you will already be recognised for innovative research leading to scientific discoveries, commercially valuable technologies or advances in public policy. You will hold a PhD in a relevant area; have successfully sourced funding and provided scientific leadership in significant areas. Ideally you will have experience in decision support tool development (e.g. OVERSEER) and/or process-based modelling of biological systems (e.g. APSIM).

https://careers.sciencenewzealand.org/jobdetails/ajid/r6Nm7/Science-Team-Leader-Senior-Scientist-Agricultural-Modelling,6247.html

Soil Conservator / Land Management Specialist

Christchurch
Permanent full-time
Closing Date: Friday, 16 January 2015

EOS Ecology provides industry-leading expertise in aquatic science and visual communication. Working throughout New Zealand, our team of scientists, technicians and communicators have been helping government-based organisations, consultants and industry since 2001.

We are seeking a passionate Soil Conservator with a special interest in sediment source identification. This permanent full-time position will contribute significantly to our solutions-focused surface water ecology programme. Highlights include:

– lead multiyear catchment scale projects
– wide variety of challenging projects
– opportunity to identify and develop new business
– a friendly and energetic team environment
– work for a well regarded specialist provider

For a confidential discussion or copy of the full job description, please contact Erron Henderson on (03) 389 0538 ext 701.

To view and apply online, please visit http://www.eosecology.co.nz/Vacancies/Vacancy_details.asp?vid=15

Manager – Farming and Forestry

Waikato Regional Council is looking for an experienced manager to lead regulatory teams that are responsible for implementing council's natural resource policies relating to pastoral farming and forestry.

This is a senior leadership role that has arisen from recent reshaping of the Resource Use Directorate. It is an exciting opportunity to develop innovative regulatory strategies and implementation activities to assist our primary industries achieve their sustainability goals and ensure our region's natural resource outcomes are achieved. This includes implementing some of council's flagship policies such as the Lake Taupo water quality variation, water allocation and fronting other high profile regional plan issues within the sectors. As we work closely with a range of partners and stakeholders to deliver our outcomes to the community, experience working and collaborating with others is essential.

It is expected the successful applicant will have:

- A relevant tertiary qualification
- Demonstrated ability to develop networks and partnerships, preferably with iwi and primary sector industries and groups
- Experience developing and leading teams
- Demonstrated experience developing and implementing effective strategies
- Experience working in a regulatory or political environment would be advantageous

Knowledge of implementing the Resource Management Act and resource management issues facing the primary sector would be advantageous.

It is expected successful candidates will be interviewed for this role during the period 12 to 23 January 2015.

Applications close Sunday 11 January 2015

http://www.seek.co.nz/job/27803455?pos=4&type=standard

The Occurrence and Causes of Pasture Pulling Under Dairy Farming on Pumice Soils: Preliminary Results

*Emma Bagley **(Presenter)**, University of Waikato*
Megan Balks, University of Waikato
Gina Lucci, AgResearch

Pasture pulling occurs on Pumice Soils, where dairy cows pull whole clumps of pasture from the soil, thus diminishing pasture production. This study investigated the occurrence, and causes, of pasture pulling under dairy farming on Orthic Pumice Soils in the central North Island. Fifteen paddocks containing pasture of differing ages were investigated at Pouakani dairy farm near Mangakino. Soil profile descriptions were undertaken, revealing the dominant soil texture to be sandy loam with pumice pieces which size varied with paddock. Soil samples were taken seasonally to monitor root depth and density, and soil macrofauna, dry bulk density, and penetration resistance. Pasture pulling was monitored every 3 weeks by recording the number and size of pulls in a 4 m^2 quadrant at five points equally spaced along a transect in each paddock.

Monitoring showed that pasture pulling occurred in pastures of all ages, though younger pastures (1-2 years old) were more susceptible to damage. Pasture pulling was observed to be most prevalent during late summer/autumn. Grass grub and black beetle populations did not appear to be high. Root densities were higher in the 0-5 cm depth, than in other depths, with some paddocks containing up to 80 % of the root biomass in the top 5 cm. Although there were no significant differences in bulk density with depth (range: 0.47-0.99 kg m^{-3}), penetration resistance measurements revealed a compacted layer at approximately the 5-10 cm depth, compared with the lower penetration resistance of the overlying 0-5 cm layer ($P<0.05$). It is suggested that the compacted layer restricted the downward growth of roots. Monitoring of the pasture pulling will continue to December 2014 to provide a full year of pasture pulling measurements.

Relationship between catchment characteristics and nitrate-nitrogen concentration in the rivers of Tararua Groundwater Management Zone

*Ahmed Elwan **(Presenter)**, Massey University*
David Horne, Ranvir Singh, Massey University
Jonathan Roygard, Horizons Regional Council
Brent Clothier, Plant & Food Research

Catchment characteristics, such as; land use, topography, rainfall, soil texture and rock type have an important effect on nutrient concentrations in surface and ground waters. These characteristics need to be mapped and quantified for an improved understanding of their influence on the spatio-temporal variations in nutrient concentrations and water quality at a catchment scale.

The objective of this study was to evaluate the relationship between catchment characteristics and nitrate-nitrogen concentration in rivers of the Tararua Groundwater Management Zone (TGWMZ) in the Manawatu River catchment. A total of 16 water quality monitoring sites in TGWMZ were used in ArcMap to delineate the 'sub-catchments' upstream of these sites. The shapefiles resulting from delineation were then used to extract different characteristics of each sub-catchment. The relationship between various sub-catchment characteristics and nitrate-nitrogen concentration in the river was evaluated using linear regression analysis.

The preliminary results indicate that there is a strong positive relationship between nitrate- nitrogen concentration and; drainage class 5, and soil the 'slit loam' soil type. There is a positive, but weaker, relationship between nitrate-nitrogen concentration and; sheep and/or beef area, and dairy

area. In comparison, there is a strong negative relationship between nitrate-nitrogen concentration and; native cover, greywacke, effective rainfall, stony loam soil type, and stony silt loam soil type. The results of this study suggest that it is not only the land use that controls the values of nitrate-nitrogen in rivers but other catchment characteristics also have an impact. The results highlight the importance of understating the role of catchment characteristics on nitrate-nitrogen transport and 'attenuation' between farms and rivers in the study area.

Root Biomass and Soil Carbon under Range of Pasture Diversities and Grazing Practices

*Olivia Jordan **(Presenter)***
Louis Schipper, University of Waikato
Paul Mudge, Landcare Research

Maintenance of soil C stocks is important as losses can contribute to increased greenhouse gas emissions and decreased soil quality. Root biomass is likely the most important contributor to the accumulation of soil C and recent studies have suggested that a higher diversity of plant species with higher root biomass may increase soil C content. The potential for storing additional soil C in pastoral soils is poorly understood. This study assessed root stocks and properties of soils under a range of pasture diversities to determine whether (i) there is greater root biomass under increasing plant diversity, (ii) changes in root properties between diversity treatments are evident and (iii) there is variation in root stocks between seasons.

Soil samples were collected from an existing small plot trial managed by DairyNZ and Landcare Research containing 14 different mixtures of pasture species (three replicates per treatment). From each plot, fifteen soil cores were taken to a depth of 60cm, and bulked by 10cm increments. Root characteristics were determined after removing soil, and root biomass determined following oven drying and weighing.

It is hypothesised that increased pasture diversity will result in an increase in root biomass. The exact nature of the relationship between increasing diversity and root biomass is not certain and likely will depend on specific combinations of pasture species. It is expected that with time, a proportion of root biomass will be stabilised as soil C which can be tested by subsequent measurements of soil C stocks. If higher diversity results in greater root biomass then this has the potential to sequester greater quantities of C to soil which provides a dual benefit of C capture and maintenance of soil quality.

Biowastes reduce Cadmium uptake by crop plants in NZ soils

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Guilhem Chanson, Soil and Physical Sciences Department, Faculty of Agricultural and Life Sciences, Lincoln University,
Muliadi Muliadi, Soil and Physical Sciences Department, Faculty of Agricultural and Life Sciences, Lincoln University,
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Richard McDowell, AgResearch, Invermay Agricultural Centre, Jo Cavanagh, Landcare Research
Brett Robinson, Lincoln University

Decades of applying Cd-rich superphosphate fertiliser has increased the concentration of cadmium (Cd) in New Zealand's agricultural soils. Recently, a government-commissioned cadmium working group, reported that high concentrations of Cd poses a risk to the NZ vegetable industry. We aimed to identify and test soil amendments that could reduce the transfer of Cd from soil to plants, while maintaining soil fertility and not incurring excessive costs. We measured Cd sorption by

lignite, sawdust, four types of compost, bentonite and zeolite using batch sorption experiments. Lignite and municipal compost were the most effective Cd-sorbing materials over a range of pH values. These materials were used in pot experiments to determine their effect on Cd uptake by onions (*Allium cepa* L.), spinach (*Spinacia oleracea* L.) and lettuce (*Lactuca sativa* L.) in two market garden soils with native Cd concentrations of 1.45 mg/kg and 0.47 mg/kg. There were 5 replicates of each treatment. Municipal compost, added at a rate of 2.5% by weight, reduced the Cd concentration in onions, spinach and lettuce by up to 60% in both soils. While lignite, added at 1% (w/w), significantly reduced Cd concentrations in the vegetables in one soil, a higher rate of addition, 2.5% (w/w) lignite was less effective. This unexpected result was attributed to a pH drop caused by the lignite. Municipal compost may provide multiple benefits of reducing plant Cd uptake, reducing the need for inorganic phosphate fertilisers and improving the physical condition of soil. We have not yet elucidated the duration of the beneficial effects of compost addition, which is the focus of current research. A fertile area for future research is the identification of the key components of the compost that result in Cd sorption. This will allow the creation of materials with a higher Cd-sorption capacity.

Root turnover and C input between a moderately diverse and a ryegrass-clover pasture

*Sam McNally **(Presenter)**, University of Waikato*
Louis Schipper, University of Waikato
Susanna Rutledge, University of Waikato
Mike Dodd, AgResearch
Daniel Laughlin, University of Waikato Johan Six, ETH Zurich

Soils contain the largest pool of carbon (C) in terrestrial ecosystems with approximately twice that contained in the atmosphere and three times that in vegetation. Increases to the soil C pool may play an important role globally to reduce CO_2 emissions. Roots have a greater contribution to the soil C pool than aboveground plant biomass with root turnover thought to be an important component in C sequestration. New Zealand agriculture is dominated by permanently grazed pasture systems, with a recent study highlighting an increase of root mass and rooting depth under a moderately diverse pasture compared to a ryegrass-clover pasture. However, very little is known on the root turnover of these pastures with limited studies displaying a large range of root turnovers under ryegrass-clover pastures. This study was conducted to investigate the root turnover and C input to soil under a ryegrass-clover and a moderately diverse pasture permanently grazed under a dairy system. An isotope pulse labelling method where plant biomass was labelled with $^{13}CO_2$ was carried out over to determine the root turnover and C input to soil. Results of this work demonstrated root turnover within each pasture system with turnover rates of approximately 322-411 days (0-100 mm depth) for moderately diverse and ryegrass-clover pastures respectively. The moderately diverse pasture displayed faster turnover times in general although results were highly variable. The subsequent C input to soil under these two pastures was similar with between 558 and 538 kg C ha^{-1} cumulative input (0-200 mm depth) over the course of 88 days (moderately diverse and ryegrass-clover pasture respectively). This work coincided with the 2013 summer drought which caused substantial soil moisture stress which may have contributed to the variability of the results.

Subsidence rates of drained agricultural peatlands in the Waikato Region and the relationship with time since drainage

*Jack Pronger **(Presenter)**, University of Waikato*
Louis Schipper, University of Waikato
Reece Hill, Waikato Regional Council
David Campbell, University of Waikato Malcolm McLeod, Landcare Research

About 80% of the Waikato Region's 94,000 ha of peatlands have been drained and converted to productive farmland over the past century. Drainage has lead to on-going surface subsidence because of densification and oxidation of the peat substrate. Subsidence is of concern because of the increased risk of coastal inundation (for example in the Hauraki Plains), increased infrastructural costs to keep farmland drained, and the oxidation of a large store of soil carbon. Knowing the rate of subsidence is important for future land-use planning, economic analysis of drainage and pumping costs, and carbon accounting. We measured subsidence rates over the past decade at 160 sites across three large agriculturally managed peatlands in the Waikato Region. The average contemporary (2000s – 2012) subsidence rate for Waikato peatlands was 19 ± 2 mm y^{-1} (± SE) and was significantly less ($p = 0.01$) than the historic rate of 26 ± 1 mm y^{-1} (± SE) between the 1920s and 2000s. This reduction in subsidence rate was attributed to the transition from rapid initial consolidation and shrinkage to slower, long term, on-going oxidation. These subsidence rates agree well with a literature synthesis of temperate zone subsidence rates. Within this synthesis, there was a strong relationship between temperate zone subsidence rates and time since initial peatland drainage: Subsidence (mm y^{-1}) = 226 × (years since drained) $^{-0.6}$ ($R^2 = 0.88$). This relationship suggests that time since drainage exerts strong control over the rate of peatland subsidence and that on-going peatland subsidence rates can be predicted to gradually decline with time in the absence of major land disturbance. Despite the on-going reduction in the rate of subsidence it is inevitable that under continued drainage our peatlands will ultimately vanish – is this an outcome we are willing to accept?

Improving the Performance of A Biofilter to Reduce Methane Emissions From Dairy Effluent Ponds

*Rashad Syed **(Presenter)**, Massey University & Landcare Research*
Surinder Saggar Kevin Tate, Landcare Research
Bernd Rehm, Massey university

Recent studies demonstrated the use of a volcanic soil as a biofilter medium to remove most of the methane (CH_4) from New Zealand dairy effluent ponds. Its success depends on a diverse group of methanotrophic bacteria in the volcanic soil that oxidises CH_4. However, the limited availability of this soil, and the associated transportation costs, limits its nationwide use. We have therefore adopted an alternative approach involving the transfer of an active microbial population (including methanotrophs) from the volcanic soil to other potentially suitable, and more economical and widely available, biofilter materials. These include in situ soil, biochar, garden waste compost, and weathered and fresh pine bark mulch. Initial results obtained over a 4-month period indicate that pasture soil, biochar, compost, and sterile, weathered mulch supported active growth of methanotrophs. As previously observed with the volcanic soil, the CH_4 removal initially declined before increasing over time, suggesting disturbances in the microbial community due to adaptation to the new medium. It was also observed that both sterile and non-sterile fresh mulch inhibited growth. This may indicate an inhibitory effect in the fresh mulch from the presence of active secondary plant compounds (e.g. terpenes) or predation by other organisms that may be hindering the growth and activity of methanotrophs. Further studies are underway to assess the effect of adding nutrients to accelerate the CH_4 oxidation in biochar and in situ soil. Results from these ongoing studies will be presented at the conference.

The extent of decomposition in soil of clover (Trifolium repens) and Lotus (Lotus pedunculatus) shoot and root material influenced by incubation technique

*Helen Walker **(Presenter)**, Soil and Earth Sciences, Institute of Agriculture and Environment, Massey University*

Mike Hedley, Soil and Earth Sciences, Institute of Agriculture and Environment, Massey University
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There is interest in the potential for agricultural emissions to be mitigated through acceleration of CO_2 sequestration into grassland soil C. The amount of C sequestered can be raised through: 1) increasing the rate of input or 2) decreasing the rate of decomposition.

It is well known that the rate of litter decomposition is influenced by both physical and chemical soil attributes. Less is known about the effect of different pasture species, plant parts (root and shoot litter), and traits within any one species (e.g. variable tannin, fibre or sugar content). Plant and litter type can alter soil microbial decomposer community but few experiments report how decomposition activity is affected.

A series of short term (~125 day) laboratory incubation studies were conducted to evaluate the influence on CO_2 emissions of plant species *Lotus pedunculatus* and *Trifolium repens* (high and neglible tannin, respectively), plant management (fresh vs freeze-dried, surface vs mixed application), and plant part (shoot and root).

Large variance in CO_2 emissions were associated with all treatments. The effects of species and plant management on C emissions were statistically significant ($P<0.05$). A higher amount of *Lotus pedunculatus* residue C was retained. For both species CO_2 emissions increased with the following management dried-mixed in topsoil> dried-surface applied> fresh surface applied.

Plant part and rate of application (2, 5, 10 mg C/ g soil) significantly influenced C emissions ($P<0.05$). The plant species effect differed between root and shoot material. *Lotus pedunculatus* emitted less CO_2-C from shoot material but more from root material (at all rates of application) than *Trifolium repens* ($P<0.05$). Within the shoot and root material treatments, CO_2-C emitted per mg C added was significantly influenced by plant species ($P<0.05$). The cause of the plant species and plant part effect is currently under investigation using chemical signatures of undecomposed residues determined through Pyrolysis GC-MS analysis.

Soil microbial community and biochemical responses to repeated application of biosolids in a Pinus Radiata plantation

*Minhuang Wang **(Presenter)**, Scion*
Jianming Xue, Scion
Zhiqun Huang

Land application of biosolids is a beneficial reuse option by recycling organic matter and nutrients and improving soil quality. However, the impacts and mechanisms of biosolids application on soil microbial community and biochemical processes in forest ecosystems are not well understood. The aim of this study was to determine the interrelationships between soil microbial processes and biochemical changes and their impacts on soil C and N dynamics under different biosolids application rates. A biosolids trial was established in a 6- year-old *P. radiata* stand in the Rabbit Island in 1997, at three application rates: 0 300 and 600 kg N ha^{-1}. Biosolids were applied to the trial 3-yearly and recently in 2012. Soil C and N pool sizes, activities of 6 enzymes involved in C, N and phosphorus cycling, and phospholipid fatty acid profile were analyzed in July 2014. Our results showed that soil microbial communities were significantly changed with biosolids application rates. Soil organic matter (SOM), dissolved organic C and N, and mineral N also showed significant differences between biosolids treatments. Biosolids application had different effects on the activities of hydrolytic enzymes, cellobiohydrolase (CBH) and peroxidase. Both the redundancy analysis and multivariate regression tree analysis indicated that changes in substrates availability (i.e. C and N availability and efficiency) explained a larger percent of the total variation in the microbial community composition, which in turn feedback to the extracellular enzyme activities in regulating

the degradation, mineralization and assimilation in plant-soil system. The decrease in activities of CBH and the opposite tendency in oxidases may imply an imbalanced nutrient acquisition process of plant-microbial competition associated with litter decomposition and SOM degradation in winter time. Our results confirm that soil microbial communities and biochemical processes responded distinctly to the N-loading from biosolids application, which affected the soil N pool dynamics and turnover.

Buried secrets in allophanic paleosols on tephras: insights in the search for ancient DNA from past terrestrial environments

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Ray Cursons, University of Waikato
Heng Zhang, University of Waikato
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Louis Schipper, University of Waikato
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Alan Cooper, University of Adelaide

Buried allophanic soils developed on sequences of well-dated tephras sequester organic matter over long time periods. Allophane in these paleosols also potentially enables DNA to be preserved, and this ancient DNA (aDNA) could provide a means for reconstructing past environments from terrestrial sequences comparable to, for example, phytolith analysis. We undertook experiments to better understand mechanisms of DNA adsorption on synthetic and natural allophane. We showed that DNA binds chemically to allophane and helps the formation of allophane nanoaggregates which subsequently adsorb DNA physically within interstices. However, humic acids can reduce DNA adsorption on allophane by occupying active bonding sites, namely aluminol (Al−OH) groups. DNA then binds to humic acids chemically and so attaches to allophane indirectly. We developed a two-step DNA extraction method including (i) first extraction using an alkaline buffer, and (ii) second extraction by oxalate. After trials with synthetic allophane and salmon-sperm DNA, we extracted DNA from a sequence of buried allophanic soils (on rhyolitic tephras) near Mt Tarawera to a depth of 2.5 m. The extracted DNA was separated from humic acids chromatographically through gel electrophoresis followed by PCR amplification, cloning, and Sanger sequencing. From a paleosol on the Rotoma tephra (tephra deposited ~9400 years ago), plant DNA (trnL) of Araliaceae (ivy family) and Myrtaceae (myrtle family) was found. The present-day land surface is characterised by pasture. The preserved plant DNA in the Rotoma paleosol may have originated from ancient plants growing on the Rotoma soil prior to its burial (by Whakatane tephra) ~5500 years ago, or from ‘modern’ plants growing (some decades) prior to the current vegetation. More work is needed to enable us to separate these hypotheses. We conclude that our new extraction method, with further development, provides the potential to exhume genetic materials that have been preserved in allophane-rich soils or paleosols.

Mass transport parameters in gaseous and aqueous phases for water repellency affected agricultural soil

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Karin Müller, Plant & Food Research
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Soil water repellency (SWR) has been commonly related to organic compounds in soils. Especially, agricultural land under organic management may be particularly vulnerable to SWR as a result of frequent organic fertilizer applications. The occurrence of SWR may affect mass transport parameters in soil gaseous and aqueous phases such as soil-gas diffusion coefficient and hydraulic conductivity, and may alter the soil-gas-water dynamics. The objectives of this study are i) to investigate the spatial variation in SWR at the surface of a soil under organic agriculture, and ii) to measure mass transport parameters at soil core samples taken from both water-repellent and non-repellent areas of the same field. The site for this study was located in Miki city, Hyogo prefecture, Japan, and had a fine-textured haplic brown lowland soil. Field measurements and soil sampling were carried out in a greenhouse in December 2013. The greenhouse is used to grow vegetables such as spinaches and scallions, and organic fertilizers are regularly mixed into the surface soil. In the field, water drop penetration times (WDPT) were measured at a 0.5 m or 0.25 m grid interval in a rectangular area of 10 m length and 3.5 m width. Soil cores of 100 cm3 volume were collected at 0.05-0.10 m depth and 0.5 m intervals along a transect. The mass transport parameters soil-gas diffusion coefficient, air permeability, and hydraulic conductivity were measured at these core samples in the laboratory. Field WDPT values varied widely from non-repellent to extreme SWR (~1000 sec) irrespective of the organic matter contents of the soil. Soil samples with gravimetric water contents of 0.05-0.15 g/g gave higher degree of SWR compared to most dry region and most wet sampling points. The effect of SWR on mass transport parameters and their correlations will be discussed.

Anthropedogenesis: The future of land development?

Alec Mackay, AgResearch (Presenter); Anne Wecking; Estelle Dominati, AgResearch;
Alan Palmer(Massey);
Andrew Manderson & Roger Parfitt, (Landcare Research)

New Zealand trades the products of its natural capital stocks. The most important of these stocks are our soils. With the area of elite and versatile soils (i.e. LUC classes 1 and 2) limited to 1.4 million ha, most pastoral agriculture is practiced on less versatile soils. These include soils derived from loess, alluvium or coastal sands, all of which have a weakly- developed soil structure due to the combination of a narrow particle size range of the parent material and young age. Associated with these soils are poor drainage, limited water- holding capacity, a lack of nutrient adsorption and limited physical strength. It is estimated that there is > 2.0 million ha of flat and rolling land in this category. Over the last one hundred years we have been very successful in developing a wide range of technologies to assist with the provision of services, not available in sufficient quantity from the natural capital stocks of many of these less versatile soils. However, this means that production costs are higher on these soils, as are potential impacts on receiving environments. With the ongoing upward pressure on the cost of inputs and the emergence of environmental limits, "new thinking" needs to be developed on resource-efficient options for continuing to improve the performance of these poorly structured and less versatile soils. A project has been initiated to assess if there are technical options for giving pedogenesis a "nudge" to initiate a cascade of processes to shift the inherent properties of a soil sufficiently. The project will quantify the changes in the provision of ecosystem services, and determine the feasibility and cost associated with implementation of these technical options, using a pallic and two contrasting recent soils, in a series of structured field experiments.

Investigating the Influence of Biochar Particle Size and Depth of Biochar Deployment on Nitrous Oxide from Cows-Urine-Amended Soil

*Ainul faizah Mahmud **(Presenter)**, Massey University*
Marta Camps, Massey University
Mike Hedley, Soil and Earth Sciences, Institute of Agriculture and Environment, Massey University

Recent assessments on the effect of biochar on N_2O emissions from soil indicate either a decline, increase or no effect. This contrasting results have been attributed to the fact that in oxic microenvironments biochar may increase nitrification and thus the N_2O emissions associated with this process, whereas in anoxic microenvironments it can favor the complete reduction of NO_3 to N_2, thus decreasing the associated N_2O emissions (Cayuela et al. 2013). Few studies have paid attention to the role of biochar particle size on denitrification and associated N_2O emissions. The objective of this investigation is to investigate the effect of biochar particle size and depth of biochar deployment on N_2O fluxes after amending a soil with cows-urine. For this, a glasshouse experiment using 24 PVC columns (40 cm height and 20 cm diameter) attached to the water flux-meters is currently established. The Tokomaru silt loam soil was sampled at 0-10, 10-20 and 20-40 cm depth. Biochar from pine chips was produced at 450°C, crushed and sieved into two different particle sizes (<2 mm and >4 mm). The top 10 cm soil collected was mixed with biochar (2% w/w) and repacked into the soil core either at the original 0-10 cm depth or at 10–20 cm depth to simulate ploughing. Annual ryegrass (Lolium multiflorum) will now be seeded, grown and harvested when needed to simulate cow grazing. This will be followed by a urine application. N_2O fluxes will be measured before urine application and then thereafter for every 2 to 3 days, up to 3 or 4 months. Leaching will also be monitored and, at the end of the experiment, measurements of soil physical properties will be carried out. The findings of this study will help provide additional insights on the influence of biochar on N_2O emissions from soil.

The Effect of Irrigation Frequency on Nitrous Oxide Fluxes from Urine Treated Soils

*Jen Owens **(Presenter)**, Lincoln University*
Timothy Clough, Lincoln University Johannes Laubach,
Landcare Research John Hunt, Landcare Research
Rod Venterea, United States Department of Agriculture, Agricultural Research Service
Niklas Lehto, Lincoln University

To enhance the quality and quantity of milk production, many dairy operations in New Zealand are employing irrigation regimes to improve pasture quality and yield. Nitrous oxide (N_2O) is a potent greenhouse gas and urine patches from ruminant animals, such as cows, are a significant source of N_2O emissions. Despite the widespread use of irrigation on grazed pastures, there has been little research done to identify how N_2O emissions from urine patches may be affected by irrigation practices. Irrigation scheduling may affect N_2O dynamics as soil moisture is often cited as a strong controller on N_2O fluxes due to the relationship between soil moisture, and supply and demand of soil oxygen (O_2). Despite the importance of soil O_2 to biological N_2O production and uptake, it is rarely measured. The objective of this study was to test whether irrigation frequency influenced N_2O emissions from urine patches on a free draining grazed pasture soil. Urine and non-urine treated soils were subjected to either a three day or six day irrigation regime. Daily N_2O fluxes were measured *in situ* for 35 days along with other environmental and soil variables, including soil O_2, on a commercial dairy farm on the Canterbury Plains, New Zealand. Temporal dynamics of N_2O fluxes differed with irrigation frequency but cumulative emissions did not. Both urine and irrigation frequency significantly affected soil moisture. Soil O_2 decreased following urine deposition but was not affected by irrigation scheduling. The emission factors for the three and six day irrigation frequency regimes were both 0.18 kg N_2O-N per kg N applied. This research contributes to our understanding of how irrigation management practices affect the relationships between soil O_2, soil moisture and N_2O fluxes from grazed pastures.

Is there any difference between distributions of cadmium in different soils with the same fertiliser history?

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Adam Hartland, University of Waikato
Louis Schipper, University of Waikato

Cadmium (Cd) is a biotoxic heavy metal that can be absorbed by soils and plants. The amount of cadmium in New Zealand soils is increasing as a result of phosphate fertiliser use. The main question of this research is "does the distribution of Cd differ between contrasting soil types?" The concentration and distribution of Cd in three different soil types: Te Kowhai, Horotiu and Bruntwood will be determined. All three soils often occur in the same paddock, so have the same fertiliser history. However, they have contrasting drainage and mineralogical characteristics. An initial pilot study for the first major experiment has been completed. Two paddocks from a dairy farm near Hamilton (Scott Farm) were sampled to a depth of 60 cm and the concentration of Cd in three soils within each paddock, with varying depth to slowly permeable layer, and varying allophane contents, was determined. Initial results suggested that the total Cd in the poorly drained Te Kowhai soil was higher than in Bruntwood/Horotiu soil. In some topsoil samples the concentration of cadmium was higher than 1 ppm, and therefore according to the Tiered Fertiliser Management System, Cd application is required to be managed by a Cd balance programme to ensure that Cd will not exceed an acceptable threshold in the next 50 years. Cd and P correlated strongly, which supports the assumption that Cd was mainly derived from phosphate fertilisers.

Use of Biochar to Reduce Soil Acidity and Ameliorate Aluminium Phytotoxicity

*Qinhua Shen **(Presenter)**, Massey University*
Marta Camps, Massey University
Mike Hedley, Soil and Earth Sciences, Institute of Agriculture and Environment, Massey University

Biochars have recently been classified based on their liming equivalence into four classes: (i) Class 0 ($CaCO_3$-eq < 1%), (ii) Class 1 (1 ≤ $CaCO_3$-eq < 10%), (iii) Class 2 (10 ≤ $CaCO_3$- eq < 20%), and (iv) Class 3 ($CaCO_3$-eq ≥ 20%)[1]. The change in soil pH with biochar addition will depend not only on the liming value of the biochar used, but also on the pH-buffering capacity of the specific soil. Moreover, biochar have the potential to store acidity on surface functional groups, but this may have been underestimated when determining the liming value following the commonly rapid titration procedure. In this study, we determined the liming effect of different biochars on two acidic soils that greatly differ in pH-buffering capacities − (1) a Hautere soil (typic Dystrochrept) and (2) a Ramiha soil (andic Haplumbrept). The studied biochars were made from (1) chipped pine (Pinus radiata D.Don) branches and (2) chipped weeping willow (Salix babylonica L.) branches at 550 °C, and referred to as BP550 and BW550, respectively. The BP550 biochar had no liming value (Class 0), whereas the BW550 biochar had a liming equivalence of 18.2% $CaCO_3$-eq (Class 2). Biochars were mixed with soils at various doses (and equilibrated for 10 days) to obtain a specific pH (5.4, 5.6, 5.8 and 6.4). Two chemical reagents with liming properties, NaOH and $Ca(OH)_2$, were also used for comparison purposes. Once the desired pH values were attained, a radicle elongation bioassay using alfalfa (Medicago sativa L.) was conducted. Concentration of dominant species in solution is currently being determined and Al being fractionated. The speciation of Al will be carried out using Visual MINTEQ geochemical equilibrium program.

[1]Camps Arbestain et al. 2014. A biochar classification system and associated test methods. In: Biochar for Environmental Management: Science and Technology (Academic Press).

N dynamics associated with soil microbial community along a chronosequence of Chinese fir plantation in subtropical China

*Minhuang Wang **(Presenter)**, Zhiqun Huang, Jianming Xue, Scion*

The change of soil microbial community composition with forest succession and its impact on soil N availability and the plant-microbe-soil interactions are not fully understood, especially in subtropical forest ecosystems. To determine the importance of microbial community structure in regulating the ecosystem N cycling along with forest stand maturation, $\delta^{15}N$ in the soils, needles and roots, soil potentially mineralizable N and microbial phospholipid fatty acid profiles were analysed in a 46-year chronosequence of Chinese fir plantation in subtropical China. The ^{15}N in all age class needles were significantly higher at the youngest stand (3 years) than mature (21 and 46 years) stands. The potential N mineralization rates were not statistically different among the stands, while the 28-day nitrification rates generally deceased with stand age. The principal response curve indicates microbial community transitions from slow-growing to fast-growing. For instance, the arbuscular mycorrhizal fungi (16:1 ω5c) strikingly increased as stands developed, which was consistent with the significant decrease of ^{15}N in roots and lower residual NO_3^--N. The results indicate higher ^{15}N discrimination in roots and microbial assimilation in mature stands. The higher foliar ^{15}N and top-soil ^{15}N values in younger stands might be due to higher leaching loss and less plant-microbial immobilization, while inputs of low quality coniferous litter might decrease the N availability from forest floor to mineral soil and then cause a microbial starvation for NH_4^+-N and a depletion of ^{15}N in top-soil. These led to a subsequent decrease of potential nitrification rates in mature stands. We concluded that increasingly robust microbial functioning emerged as the accumulation of soil organic matter (SOM) in Chinese fir plantation along stand ages in combination with the unchanged total mineralizable N and accumulated recalcitrant residues, and therefore resulted in the lower nitrification rates, decreases of ^{15}N in top-soil and SOM retention in mature stands.

Determining the effect of alternative pasture species and gibberellic acid on nitrate leaching

*Roshean Woods **(Presenter)**, Keith Cameron, Grant Edwards, Hong J. Di, Timothy Clough, (all Lincoln University)*

Nitrate (NO_3^-) leaching is a significant environmental concern in intensively grazed NZ pasture-based systems. One mitigation approach is to increase the uptake of nitrogen (N) by pasture, particularly during the cooler seasons where risk of leaching is high. Gibberellic acid is a plant hormone which can be used to accelerate pasture growth during these times. Similarly, plants with higher winter activity or larger root systems have the potential to reduce NO_3^- leaching compared with typical perennial ryegrass-white clover pasture. A review of current literature did not find any studies which investigated the effect of gibberellic acid application on NO_3^- leaching from pasture soils. Emerging research indicates that Italian ryegrass can reduce nitrate leaching losses compared to perennial ryegrass, however more research is required to confirm this and to elucidate the mechanisms involved. Lucerne has been shown to extract water and nitrate from soil at depth, and although some leaching studies have been carried out, no studies were found which measured NO_3^- leaching from lucerne under animal urine patches that are typical of a grazed pasture system. This PhD research programme will be conducted with the following objectives: 1) To quantify the effect that pasture N uptake has on N leaching from urine applied to a range of pasture types; 2) For pasture types which show reduced N leaching, determine the fate of urinary-N and improve understanding of the mechanisms involved; 3) To quantify the effect of gibberellic acid application on N leaching losses beneath urine patches on a selection of different pasture types and improve understanding of the mechanisms involved; 4) To quantify NO_3^- leaching losses from beneath lucerne in a grazed dairy system and compare with leaching losses from perennial ryegrass-white clover pasture.

Conferences and upcoming events:

May 2015

18th International Soil Conservation Organization Conference **May 31 –June 5, 2015** El Paso, Texas http://tucson.ars.ag.gov/isco/index.php

PSS-2015: Sensing soil condition and functions. The 4th Global Workshop on Proximal Soil Sensing (GWPSS2015) will be held in Hangzhou, China on May 12-15, 2015. More info: www.gwpss2015.com

July 2015

3rd International Conference on Water & Society- Spain 15-17 July 2015
http://www.wessex.ac.uk/15-conferences/water-and-society-2015.html

September 2015

LuWQ2015 is an international and interdisciplinary conference on the cutting edge of science, management and policy to minimise effects of agriculture and land use changes on the quality of groundwater and surface waters.

CONFERENCE THEMES
Contributions are solicited according to the following themes, themes A through G.
A.. Increasing system knowledge: research to increase understanding and improving modelling of the hydro(geo)logical, geochemical and biochemical reality
B.. Impact of climate change and hydrological/weather variability: assessment of effect on groundwater and surface water quality and distinguishing from manmade effects
C.. Assessment of national policy: effectiveness of programmes of measures on water quality on a regional and national scale
D.. Field research and data interpretation: research (monitoring and modelling) at plot and field scale for quantifying effects of farming practices and changes in land use
E.. Managing protected areas: risk assessment monitoring and modelling of water quality and quantity, for drinking water supply and ecosystem conservation within Habitat and Species Protection Areas
F and G.. Decision-making and implementation: role of policy, stakeholder and science in decision-making, and social and economic incentives and constraints for implementation (carrots and sticks)
For TOPICS relevant within these themes we refer to http://web.natur.cuni.cz/luwq2015/index.php?id=2.

ABSTRACT SUBMISSION:
Abstracts are due by 1 February 2015, via http://web.natur.cuni.cz/luwq2015/index.php?id=6.

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 Saggar
2002 D J Lowe
2003 P Singleton
2004 G Sparling
2005 R McLaren
2006 G Yeates
2007 A Carran
2008 M. Balks
2009 P Fraser
2010 C de Klein
2011 T Webb
2012 M McLeod
2013 M Hedley
2014 S Ledgard

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
2014 P Mudge

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
2014 A Robinson

Summit Quinphos Bursary (renamed Altum Award 2012. Then Bert Quin Award 2014)

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

The L C Blakemore Award (Biennial award)

1992 N P Smith
1994 H Kettles
1996 No award
1998 L Currie
2000 B Daly
2002 P Theobald
2004 T Hendry
2006 B Toes
2008 C. Smith
2010 M Sprosen
2012 C Tregurtha
2014 M Premaratne

The M L Leamy Award (Biennial award)

1992 B E Clothier
1994 A Hewitt
1996 No award
1998 S Cronin
2000 H J Di
2002 K R Tate

2004 N S Bolan
2006 S Saggar
2008 R. McDowell
2010 Not awarded
2012 D Curtin
2014 L Schipper

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
2012 Not awarded
2014 (oral paper) O Jordan
(poster) J Owens

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 – N Hyslop
N Mesman – (Lincoln)
2014 D Le Lievre – (Waikato)
Massey – J Winters
Lincoln – S Rayner

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P J Tonkin
T W Walker
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J Adams
R McLaren
P. Gregg
A Mackay

Grange Medal

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