

- Editorial The changing landscape of national environmental reporting
- Norman Taylor Lecturer announced



August 2015

# **New Zealand Soil News**



Newsletter of the New Zealand Society of Soil Science

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

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# Deadline...... for the December issue of Soil News is Friday 11<sup>th</sup> December 2015

#### Visit our website: http://nzsss.science.org.nz/

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# Editorial:– The changing landscape of national environmental reporting – Haydon Jones

Over recent years, national environmental reporting in New Zealand has been undergoing a substantial overhaul. The changes focus on developing a system that will deliver accurate, consistent, regular, and independent reporting of environmental information. Robust and high quality information is needed to underpin improved environmental and economic decision making and to keep the public informed as to the state and trends in the condition of the environment<sup>1,2</sup>.

With the development of the 'Our Land and Water' National Science Challenge, together with other pan-sector or multi-agency initiatives currently underway in the land and soil space, I thought it timely to highlight and raise awareness of this aspect of the wider national context (i.e. national environmental reporting) that I see as relevant to these initiatives.

A review of environmental reporting in New Zealand undertaken by the Parliamentary Commissioner for the Environment in 2010 outlined the need for change<sup>3</sup>. In the following year, a proposal for change, involving the introduction of an Environmental Reporting Bill, was put forward by the Ministry for the Environment for consultation<sup>1</sup>. The Environmental Reporting Bill<sup>4</sup> (the Bill), somewhat modified from the original proposal, was subsequently introduced to Parliament in February 2014 (the Bill is still before Parliament at present). During the intervening period, an Environment Domain Plan – which identified sets of 'enduring questions' around the state of the environment for each environmental 'domain' (e.g. Land, Freshwater, etc.), considered the information currently available to answer these questions, and presented initiatives required to address the gaps and limitations in existing information — was developed<sup>5</sup>. A framework for environmental reporting in New Zealand<sup>2</sup>, which describes the proposed new approach to environmental reporting, was developed in-line with the Bill and released in February 2014.

The Bill seeks to improve the way environmental reporting is undertaken in New Zealand and proposes a national environmental reporting system in which mandatory reporting will be undertaken on a regular and predictable basis, and in a way that is seen to be "independent, fair, and accurate"<sup>4</sup>. Another key feature of the Bill is that the Secretary for the Environment & Government Statistician will ultimately be responsible for the reporting so as to ensure that reporting is credible, robust, and at 'arms-length' from the Government of the day<sup>4,6</sup>. The existing role of the Parliamentary Commissioner for the Environment, in providing "independent expert commentary and assurance" in relation to environmental reporting, remains unchanged, and is affirmed, by the Bill<sup>6</sup>.

The environmental reporting framework uses a domain-topic-indicator structure with five environmental domains defined (Land, Freshwater, Marine, Atmosphere and Climate, and Air). Topics are the key areas of interest within a domain, and the indicators are the measures for the topics. When the Bill is enacted, the topics for future reporting will be set in regulation following public consultation. The framework employs a pressure-state-impact indicator model which means that pressures on the environment and the impacts of changes in the state of the environment will be encompassed, in addition to the state of the environment, by the reporting. A set of design principles for the development of the environmental reporting system and a set of criteria for selecting indicators for national reporting are set-out in the framework. The regular national domain reporting cycle (a three year reporting frequency) will involve the production of a different domain report every six months and a synthesis report every three years<sup>2</sup>. The new reporting cycle is already underway "in the spirit of the Bill" with the Air

domain report published and the first synthesis expected to be delivered in October 2015<sup>6,7</sup>. The topics and provisional statistics associated with the 2015 synthesis report were released earlier this year<sup>7</sup>.

Change at the national level has been a driver for changes and improvements to environmental monitoring and reporting at the regional level. The Environmental Monitoring and Reporting (EMaR) initiative is a partnership between the Local Government New Zealand Regional Sector and the Ministry for the Environment. EMaR seeks to provide integrated regional/national environmental data collection networks and widely accessible reporting platforms and is seen as the main mechanism by which the long-term aims of the Ministry for the Environment's Environmental Reporting programme of work will be realised<sup>6</sup>. The development of National Environmental Monitoring Standards (NEMS) is an important aspect of EMaR work programmes and the Land Air Water Aotearoa (LAWA) website will be an important delivery platform<sup>6</sup>.

Why is it important for the soil science community to be aware of the recent and on-going changes to environmental reporting in New Zealand? The answer to this, is, that we will need to work together to continue to improve the quality, consistency, and representativeness of the land and soil datasets available for improved environmental reporting in relation to the Land and other domains (e.g. Freshwater). This will require collaboration and co-ordination across all sectors including research providers, industry, and central and regional government.

- <sup>1</sup> Ministry for the Environment, 2011. Measuring up: Environmental Reporting A Discussion Document. Wellington: Ministry for the Environment. <u>http://www.mfe.govt.nz/sites/default/files/measuring-up-environmental-reporting.pdf</u>
- <sup>2</sup> Ministry for the Environment, 2014. A Framework for Environmental Reporting in New Zealand. Wellington: Ministry for the Environment. <u>http://www.mfe.govt.nz/sites/default/files/media/Environmental%20reporting/framewo</u> rk-for-environmental-reporting-final.pdf
- <sup>3</sup> Parliamentary Commissioner for the Environment, 2010. How clean is New Zealand? Measuring and reporting on the health of our environment. Wellington: Parliamentary Commissioner for the Environment.
- http://www.pce.parliament.nz/assets/Uploads/How-clean-is-New-Zealand.pdf <sup>4</sup> Environmental Reporting Bill, 2014. Retrieved from:
- http://www.legislation.govt.nz/bill/government/2014/0189/9.0/DLM5941105.html <sup>5</sup> Statistics New Zealand, Ministry for the Environment, Department of Conservation, 2013.
- Environment domain plan 2013: Initiatives to address our environmental information needs. Available from <u>www.stats.govt.nz</u>
- <sup>6</sup> Ministry for the Environment, 2015. Statement of Intent 2015 2019. ME 1201. Wellington: Ministry for the Environment. https://www.mfe.govt.nz/sites/default/files/media/About/soi-2015-final.pdf
- <sup>7</sup> Ministry for the Environment and Statistics New Zealand, 2015. New Zealand's Environmental Reporting Series: 2015 topics and provisional statistics. Available from <u>www.stats.govt.nz</u>

# FROM THE LATEST IUSS ALERT:

#### Why You Can't Have Organic Food Without Soil

Hydroponic farming is missing one very important ingredient, and a whole way of thinking that goes along with it.

Read more at http://civileats.com/2015/04/13/why-youcant-have-organic-food-without-soil/

#### Restoring our soils by learning from history

Most of our ideas about soils ignore the millions of years before mankind started farming. But what happened during the 99.9% of a soil's history contains very important lessons. So let us celebrate the International Year of Soils by looking at what that history can tell us – and build on those lessons for the future. <u>http://www.agriculturesnetwork.org/magazines/global/soils-for-life/conservation-agriculture</u>

#### We're treating soil like dirt. It's a fatal mistake, as our lives depend on it

To keep up with global food demand, the UN estimates, 6m hectares (14.8m acres) of new farmland will be needed every year. Instead, 12m hectares a year are lost through soil degradation. According to the UN's Food and Agriculture Organisation, the world on average has just 60 more years of growing crops. The intensification of farming over the last century has increased the rate of soil erosion 60-fold. Among the solutions suggested are zero-tillage (also known as conservation agriculture) and permaculture, which means working with complex natural systems. Read more <a href="http://www.theguardian.com/commentisfree/2015/mar/25/treating-soil-like-dirt-fatal-mistake-human-life">http://www.theguardian.com/commentisfree/2015/mar/25/treating-soil-like-dirt-fatal-mistake-human-life</a>

#### **Understanding Vineyard Soils**

by Robert E. White, second edition, hardcover, 280 pages, March 2015, Oxford University Press. This new edition of Robert White's influential book presents the latest updates on topics such as measuring soil variability, managing soil water, the possible effects of climate change, rootstock breeding and selection, monitoring sustainability, and improving grape quality. The promotion of organic and biodynamic practices has raised a general awareness of 'soil health', often associated with a soil's biology, but which to be properly assessed must be based on a soil's physical, chemical, and biological properties.

This book is a practical guide for winegrowers, and the lay reader who is interested in the concept of *terroir* and wants to discover more about the influence of different soil types on vine performance and wine character.

# New Zealand soil treasures...



Dr Allan Hewitt recently unearthed (from storage boxes retrieved from a condemned building at Lincoln University) a field trowel belonging to Norman Taylor. In Allan's words "It is a beauty and labelled as Taylor's trowel used in the Northland soil survey".

It is a great piece of New Zealand soil science history and we are keen to find out more about it and preserve and recognise its significance. If you know anything of its history we would like

to hear from you. Also, as part of IYS celebrations the Council are keen for your ideas on how we may recognise its importance to New Zealand soil science, maybe part of a new or existing award, or in any other way. So, please contact us with your ideas.

# International year of Soils



### http://ilovesoil.kiwi/

Our new website is now live - do check it out and forward links to anyone who may be interested. It has some great info about NZ soils and suggestions for soil activities that will inform and entertain.

#### IYS posters, brochures and stickers:

See the NZ Society of Soil Sciences website <u>http://nzsss.science.org.nz/</u> to download kiwi style "Ilovesoils" logos and our IYS poster and brochures. Copies of stickers, posters and brochures are still available free from Megan Balks <u>m.balks@waikato.ac.nz</u>

The importance of soil science research in New Zealand is amply demonstrated by the wide range of soils related research that is currently being carried out at various institutions in the Canterbury region.

This series of 10 weekly seminars in September, October and November this year seeks to highlight the scope and quality of this research.

Location:	Commerce Lecture Room 1 (C1) – Lincoln University
<u>Time:</u>	Fridays 3.00-4.00pm [11 September to 20 November]

## Schedule:

11 September: Steve Wakelin [AgResearch]	
Soils: a key reservoir of life on Earth - what we know and don't know.	
<u>18 September:</u> Jen Owens [AGLS Lincoln University]	
Evaluating soil oxygen as a determining factor in nitrous oxide emissions	·•
25 September: David Hawke [CPIT]	
Mobilisation of selenium on the South Island West Coast.	
<u>02 October:</u> Simeon Smaill [SCION]	
Supporting sustainable intensification in the New Zealand forestry indust	ry.
<u>09 October:</u> Andre Eger [Landcare Research]	
Extending the vertical perspective on Earth's skin – soils within the Critic	cal Zone
framework.	
<u>16 October:</u> Ian Dickie [BPRC Lincoln University]	
Plants, soil biota, and ecosystem development.	
23 October: Gwen Grelet [Landcare Research]	
Ericoid root symbioses and soil carbon cycling.	
<u>30 October:</u> Brendon Malcolm [Plant and Food Research]	
Options to reduce nitrate leaching losses from agricultural soils.	
<u>06 November:</u> Amy Whitely [AGLS Lincoln University]	
Soil acidity and aluminium toxicity in New Zealand soils.	2015
20 November: Nicole Schon [AgResearch]	International
Earthworms and soil function.	Year of Soils

# Norman Taylor Lecture



I am very pleased to announce Professor Richard McDowell as the presenter of the Norman Taylor Memorial Lecture for 2015. This lecture series will form a key activity of the New Zealand Society of Soil Sciences activity related to the 2015 International Year of Soil Science.

Professor Richard (Rich) McDowell is a Principal Scientist at AgResearch, Invermay, a Professor at Lincoln University, and a Fellow of the New Zealand Society of Soil Science. He was educated at Lincoln and Cambridge Universities before working for the United States Department

of Agriculture – Agricultural Research Service and subsequently joining AgResearch in 2001.

Professor McDowell has produced ground-breaking research contributing to more than 300 well-cited publications. He has displayed exemplary national and international leadership of research into the quantification, impact, and management of contaminant loss from land to freshwater (especially phosphorus). His work informs and underpins policy within New Zealand (e.g. Industry guidelines, Regional Council limits, and New Zealand's National Policy Statement on Freshwater Management) and overseas.

Professor McDowell will be presenting his Norman Taylor Memorial Lecture throughout New Zealand from November 2015 at Lincoln, Palmerston North, Hamilton, and Dunedin. Look out for more details and confirmed dates soon.

#### Stop Press:

Lincoln lecture to be held Friday 27<sup>th</sup> November at Lincoln University – Room S1. Ruakura – Friday December 4<sup>th</sup> at S1.05 University of Waikato

# WaiBoP - Waikato, Bay of Plenty soil science

Our 2015 meeting will be in room \$1.05 at the University of Waikato on Friday December 4th 2015.

Keeping with our tradition of an easy to attend, fun, and up to the minute meeting all will be welcome to attend with no cost for participants - thanks to sponsors including Waikato Regional Council and University of Waikato.

We will feature:

- International Year of Soils
- World soils day
- Norman Taylor Memorial Lecture
- Updates on the latest soil science being undertaken in the Waikato Region.

For further information please contact Megan Balks (m.balks@waikato.ac.nz)

If you want to make a presentation please forward a title to Megan Balks by Friday 6 November.



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

This time, a collection of links:

## Home grown soil love: http://ilovesoil.kiwi/

This website is a labour of love and has topics covering Soil Basics; Life underground; Maori Soil Science and Careers in Soil Science (to name just a few).

## Phenomenal fungi:

http://steveaxford.smugmug.com/Livingthings

A collection of beautiful photos taken by Steve Axford of some of obscure fungi from around Australia (see photo on right for a taste).

# Take soil with you:



http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=nrcseprd370020

The USDA has put together a collection of podcasts, 3-4 mins) by farmers, ranchers and researchers about soil health ("Soil Health To-Go").



## I [Heart] SOIL:

https://www.soils.org/iys/stickers Go to this site to download the ubiquitous SSSA stickers (they even have Klingon!) and have a look through the delegates from the latest SSSA General Meeting, you might see some familiar faces...

Research + cake = Bloody Brilliant!

http://www.theguardian.com/science/brain-flapping/gallery/2015/aug/12/the-cakes-of-science and http://waiber.com/research-cake/

We're not exactly sure where, or when, this all started but it was a stroke of genius. These cakes really make you want to up your game next time it's your time to shout a morning tea.

# "Celebrating Soils in The Hub"

# Save the date!

In recognition of 2015 being International Year of Soils, we are planning to hold a one day workshop focused on the opportunities currently facing soil research - in room S1 at Lincoln University on Friday 27<sup>th</sup> November 2015.

A tentative agenda for the day will include punchy and inspiring presentations from the following:

- Representatives from Lincoln University and each of the CRI's on exciting soil related research opportunities.
- Major Canterbury stakeholders on their opinions of soil research needs.
- Selected local students about their current soils research.
- The Norman Taylor Memorial Lecturer, 2015.

We will also include reference to the International Year of Soils 2015 and World Soils Day (5<sup>th</sup> December 2015) during the workshop.

Invitations will shortly be circulated to relevant organisations and stakeholders based at or near the Lincoln Hub – asking them to each nominate one presenter for this soils celebration. Following afternoon tea, the day will culminate with the presentation of the prestigious Norman Taylor Memorial Lecture. This lecture is given annually in recognition of outstanding contributions to soil science in New Zealand and this year the lecture will be presented (on 3 different occasions including this one) by Professor Richard McDowell of AgResearch, Invermay.

For further queries please contact **Trish Fraser** (<u>trish.fraser@plantandfood.co.nz</u>) or **Sam Carrick** (<u>carricks@landcareresearch.co.nz</u>).

Meanwhile please put this date into your diaries and further information about the workshop will be circulated in due course.



# News from the Regions

# Waikato/Bay of Plenty

## Landcare Research

**Sharn Hainsworth, David Palmer, Scott Fraser, Tom Cuthill, Linda Lilburne and James Barringer** from Landcare Research and James Linehan and Hannah Julian, students from the University of Waikato, have completed a 3yr project to produce a district scale (1:50,000) soil map for 485,000ha of land in the Southern Hawke's Bay, including the Tukituki Catchment, home of the Ruataniwha Water Storage Scheme. The map and associated soil reports are available to the public through S-map Online (<u>http://dx.doi.org/10.7931/L1WC7</u>). Amongst other things, this information was needed to assist in managing phosphorus, nitrogen and sediment flows through catchments in the area, and for associated hydrological research. Existing soil maps are insufficient in quality and coverage.

Digital Soil Mapping (DSM) techniques were used to assist in the soil mapping process, in combination with the use of landform elements information. The resultant soil map balances the need for information quality and the need for the mapping work to be fast and cheap. The map traversed 13 different soil modelling regions. Different combinations of soil mapping methods were effective in each soil modelling region. Some of the soil mapping methods used are: land systems theory, classical soil-landform modelling using landform elements, and Digital Soil Mapping techniques (such as Random Forests. It is important to develop prior knowledge before undertaking soil sampling for a DSM-based map. If a rock type map is required (they often are), then it's important to get a map of sufficient detail, showing the differences in rock type that are important for the mapping exercise. Where high resolutions LiDAR or photogrammetry-derived Digital Elevation Models (DEMs) are not available, it is important that terrain attribute layers derived from flow algorithms, such as Topographic Wetness Index, are not used where the land is flat.

The types of people that are likely to use this information include:

Scientists Modellers Policy development Consents planners Economic development projects Land managers Farmers Banks Valuers Insurance actuaries Fertiliser companies Consultants servicing the primary production sector Developers involved in subdivision

They are now embarking on a 3 years project to produce a soil map for the remainder of pastoral land in the Hawke's Bay region, north of the Ngaruroro River.

### **AgResearch Ruakura**



**Stewart Ledgard** visited Uruguay (pictured) as part of a NZ-linked Family Farms project looking at beef cattle intensification on the 'campo natural' or natural grassland systems [an extremely diverse grassland farmed for centuries with no inputs and with C4 and C3 species and little/no legume]. He worked with researchers and extension people discussing soil fertility evaluation and determination of fertiliser requirements when legumes are introduced into these grasslands, while also considering environmental implications. A soil Olsen P above 5 is high (!) and hence most discussion was on P – reactive phosphate rock is the main P fertiliser used. Back in NZ, he finished a large

joint project on effects of intensification of pasture farm systems on the environment (strong GHG focus in view of the funding source). However, some practical lessons from that project are now flowing through to a new SFF project, with dairy farmers that supply Tatua, to understand the implications of dairy farm systems with high use of brought-in feeds on nutrient losses to waterways and other environmental emissions. Stewart was also the 2014 winner of the Ray Brougham Award from the New Zealand Grassland Association, and presented an open lecture to a packed McMeekan Centre at Ruakura entitled: 'Nitrogen efficiency and carbon footprinting'.



**Moira Dexter, Diana Selbie** and **Dave Houlbrooke** have been collaborating with colleagues at Plant and Food Research (**Paul Johnstone**, **Matt Norris** and **Jo Sharp**) as part of the Forages for Reduced Nitrate Leaching MBIE programme to understand the N release rates from a range of different dairy effluent products and the implications for fertiliser supply following land application. The team set up an enormous incubation study (over 1000 samples) during June which will run for five months. The incubation looks at 12 different types of solid or slurry products typically found on New Zealand dairy farms and their release of N from mineralisation when mixed with either a Horotiu or Lismore soil. This is the second incubation study following which the work will scaled up to ultimately plot scale field evaluation before determining key information to provide a farmer decision support tool.

**Mark Shepherd** gave a presentation at the Rotorua Lakes Conference entitled 'Principles from the P21 research project into lower N input dairy systems'. There were a number of other relevant papers presented around mitigating N leaching losses. **Chris Glassey** (DairyNZ) presented on the Waikato farmlet study from P21, **Brendon Welton** (AgResearch) presented on the use of salt to dilute urinary N concentration. **Grant Edwards** (Lincoln University) presented data from the Forages for Reduced Nitrate Leaching research programme. An interesting observation, based on the discussion sessions during the day, was that the farmers and advisors in the audience tended to favour presentations reporting 'silver bullets' for mitigating N loss that fitted into their system, rather than having to modify their system.

A SLMACC-funded project has been awarded to a consortium comprising AgResearch, Scion, Plant & Food, MOTU and Landcare: **Climate mitigation co-benefits arising from the Freshwater Reforms.** The project is led by **Mark Shepherd** (AgResearch) and **Suzi Kerr** (MOTU). It aims to assess whether there are co-benefits or additional risks for GHG emissions arising from these freshwater reforms. It will provide information to MPI and other stakeholders (such as the primary sector industries) on the size of the benefit (or cost) and how that might be realised, identify situations where emissions may increase in response to water limits, and where actions may need to be taken to reduce any increase in emissions that may arise from the Freshwater Reforms.

In late June, the Rhizosphere4 conference (http://www.rhizo4.org/) was held in Maastricht, the Netherlands. Attendees from AgResearch included **Nigel Bell**, **Jana Monk**, **Katharine Adam** (Soil Biology), **Richard Johnson**, **Jim Crush** and **Shirley Nichols** (Forage Improvement). The first four of these attendees were presenting work from the Microbes from Inner Space MBIE Smart Ideas project while Jim and Shirley presented work on clover P use efficiency. The conference attracted approx. 600 delegates from around the world and covered a broad range of topics related to this important soil compartment: Rhizosphere microbiome; nutrient acquisition and cycling; root development; rhizosphere and climate change; metabolomics; and root endophytes, amongst others. This was a really stimulating meeting with some world-class researchers presenting. Field trips included a hop across the border to visit Jülich Research Centre in Germany where techniques such as MRI are being used to visualise plant root growth in situ, and at large lab scale. Impressive technology, but also very heavily booked and therefore difficult to access without a collaboration inside Jülich or the EU at least.

As part of the trip Nigel also visited nematology colleagues in Belgium (Gent University and The Institute for Agricultural and Fisheries Research (ILVO)) to discuss on-going work describing some of New Zealand's lesion nematodes (Pratylenchus sp) for which the Belgians have some of the best molecular techniques anywhere and are able to have students carry out parts of the work.



An especially tasty treat was concocted by casual employee **Olivia Jordan**. This cake (#sciencecake) was inspired by the many hours spent "urine spotting" at Scott Farm. Sadly this cake was also a farewell cake as Olivia is taking up a research technician roll at DairyNZ -Best of luck Olivia!

And finally, congratulations and salutations to **Mike Rollo** who has just celebrated 30 years of working at AgResearch (and its predecessors) with a well-attended and delicious morning tea.

# Manawatu/Hawke's Bay

# Plant & Food Research – Palmerston North & Hamilton

We welcome **Elena Kondrlova** from the Slovakian University of Agriculture at Nitra. Elena will be spending a month with our team in Palmerston North working on soil and water research. She is funded by the fellowship from the EU project "Support for improving the quality of education at the Horticulture and Landscape Engineering Faculty, SUA in Nitra".

**Brent Clothier** was an invited keynote speaker at a workshop under the Chinese 111 Plan on *High-efficient Water Use in Agriculture*. The "111 Plan" is jointly organized by Ministry of Education and State Administration of Foreign Expert Affairs, and it is designed to introduce to China about **1,000** overseas talents from the top **100** universities and research institutes worldwide, and to create **100** innovation centers in Chinese Universities. The plan aims to upgrade the scientific research capabilities of Chinese top universities by attracting high-level experts worldwide. This Beijing workshop was led by Academician Shaozhang Kang.



The workshop was called *Water and Food Security under Changing Environments*, and was held over June 1-4, 2015 at the China Agricultural University in Beijing. Brent's paper was entitled "Measuring and Modelling the Water Use of Tree Crops: Drought – Impacts & Solutions"

**Karin Müller, Brent Clothier** and **Steve Green** have been invited into a new international network called 'PROTINUS' (PROviding new insighT into INteractions between soil fUnctions and Structure), which is funded by H2020 Marie Sklodowska-Curie Research and Innovation staff exchange. The project assembles a multi-disciplinary team from the EU and three associated countries, namely France, Italy, Denmark, New Zealand, Mexico and Japan,

coming from Research Institutes and Universities as well as private companies. These teams combine advanced, experimental and theoretical research expertise in soil physics and chemistry, microbiology, image analysis, computer sciences, and systems. The objective of the project is to create a new standard in imaging, analysing, modelling and predicting the interactions between soil structure and soil functions. More information can be found on the project's webpage: http://www.protinus.ird.fr/. Plant & Food Research have now received counterpart funding from the Royal Society of New Zealand for participating in this project. In July, Karin attended the first international PROTINUS workshop "How to unravel the interactions between soil structure and soil functions" in Grenoble, France. About 30 experts came together, presented their work and discussed current approaches applied for experimentally investigating soil functions, imaging and image processing, and modeling of soil functions. The project's next workshop is going to be held in New Zealand in January 2016. Watch this space.



Participants at the PROTINUS workshop in Grenoble, France.

# AgResearch Grasslands

### **A French Connection**

A recent visit from new French Ambassador Florence Jean-blanc Risler to the Grasslands campus presented the opportunity for **Saman Bowatte** and **Coby Hoogendoorn** to showcase their trial investigating different pasture plant species and cultivar effects on nitrogen transformations processes and nitrous oxide emissions. Unfortunately **Paul Newton**, who is also involved in this project, was away when the ambassador visited.

This NZAGRC-funded trial is in its second year and some exciting results have been obtained to date. The study is designed to investigate whether there were differences in  $N_2O$  emissions among pasture species and cultivars and to explore potential mechanisms responsible for any differences. A winter application of dairy cow urine targeting 9 pasture plant species is nearing completion, so it has been a busy time for the technical team of **Phil Theobald**, **Shona Brock**, **Frances Miller**, **Des Costall and Barry Rolle**.



Estelle Dominati (right) introduces Ambassador Risler (centre) to Saman Bowatte and Coby Hoogendoorn

Saman Bowatte explains the trial to Ambassador Risler



# Landcare Research, Palmerston North

In mid-August, **Surinder Saggar**, **Peter Berben**, **Kevin Tate and Thilak Palmada** (all Landcare Research Palmerston North and Mike Hedley, Marta Camps, Roberto Calvelo-Pereira, Jonathan Otene and Ainul Mahmud; Massey University) hosted delegates from Botswana, Ghana, South Africa and Canada as a part of 'African Inventory Workshop' organised by MPI and NZAGRC under the Global Research Alliance (GRA). This visit opens opportunities for future collaboration with African Countries in greenhouse gas inventory and sustainable agriculture system research.

Workshop objectives:

- 1. Support African countries in their development of a robust system to manage inventory data and ensure that all available agricultural data is considered in the development of inventories.
- 2. Engage in dialogue with New Zealand inventory experts in Wellington.
- 3. Travel to New Zealand research centres to develop an understanding of how scientific research supports inventory improvements.
- 4. Develop a network to support African Global Research Alliance (GRA) activity including participation in the FAO-GRA Global Livestock Environmental Assessment Model (GLEAM) project.

In the morning, the delegates accompanied by MPI staff were shown our 'Dairy Housing Methane Capture and Mitigation by soil' experiment at Massey University. This experiment is investigating 'methane-munching' soil microbes as a potential mitigation strategy. This experiment aims to assess the capacity of pasture soil to mitigate the low concentrations of CH4 produced in dairy housing. This is being achieved by injecting the CH4 -rich air into the soil for oxidation by methanotrophs, and then measuring the potential mitigation by these bacteria, and the influence of changes in soil moisture and aeration conditions. To ensure that the "dairy shed air" is representative of the air in a dairy house; a suitable level of ammonia is also included in the enriched air.



Fig. 1 Surinder, Kevin and Thilak talking to the visitors; Photo taken by Peter Berben

In the afternoon, Surinder demonstrated various practical techniques for collecting and measuring ammonia and greenhouse gases. In Carolyn Hedley's absence, Mike Hedley and Marta Camps (both Massey University) gave talks about vis-NIR spectroscopy for assessing soil organic carbon stocks and biochar research.

Surinder then gave a presentation on quantifying soil greenhouse emissions, advances and challenges in grassland ecosystems.



Fig. 2 Mike Hedley describing the new method, developed by Landcare Research (Pierre Roudier, Leo Valette, Carolyn Hedley) to select representative sampling positions for soil carbon measurements at Tuapaka Massey University Farm; Photo by Hannah Jacobi (MPI)

**Benny Theng** recently gave a short course, entitled "The Chemistry of Clay-Polymer Reactions" in conjunction with two international conferences, namely ISMOM2015 (Soil Interfaces for Sustainable Development) in Montreal, Canada, and Euroclay2015 in Edinburgh, Scotland (5-10 July). Ten people signed up for the course in Montreal (see photo below), while 23 persons attended the course in Edinburgh, the majority of whom were postdoctoral and early-career scientists. The course fees collected paid for Benny's airfares, accommodation, and conference registration. Benny was also a co-author of two oral presentations at Euroclay2015. On the way back to New Zealand, Benny and wife, Judy, made a 15-day stop-over in Indonesia, meeting and making acquaintance with members of Benny's extended family in Jakarta, Bandung, and Bali, revisiting former homes and streets, and tasting a variety of half-forgotten local food and dishes.



Fig. 3 Dr Benny Theng recently gave a short course, entitled "The Chemistry of Clay-Polymer Reactions" in conjunction with two international conferences, namely ISMOM2015 (Soil Interfaces for Sustainable Development) in Montreal, Canada, and Euroclay2015 in Edinburgh, Scotland (5-10 July)

# Massey University, Palmerston North

Massey University held Open Days throughout August on all three of its campuses where prospective students and visitors were engaged with informative and interactive lectures, displays and tours. The following pictures were taken on the Manawatu Campus on 5<sup>th</sup> August:



Dr Lucy Burkitt has been granted funding from the C Alma Baker Trust to support international scientific collaboration. Lucy and Dr Ranvir Singh will use the funds to visit, and develop collaboration with, Professor Phil Jordan who is the Principal Scientist for the Agricultural Catchments Programme (<u>http://www.teagasc.ie/agcatchments/</u>) based at the University of Ulster in Northern Ireland. Phil presented a keynote address at the 2015 Fertilizer and Lime Research Centre (FLRC) Workshop. During a tour of local agricultural catchments and discussion around potential collaboration, Phil offered to lend Massey University a high-frequency nitrate sampler, which Lucy and Ranvir plan to install in the Manawatu River to measure nitrate concentration every 10 minutes. The C Alma Baker funding will also enable Phil to visit New Zealand early in 2016 to help install the nitrate sensor and to develop collaboration in both research and post graduate student supervision.



Phil Jordan, Ranvir Singh and Aldrin Rivas (PhD student) looking over the river at the Manawatu Gorge in February 2015

Lucy Burkitt measuring surface runoff at the Tuapaka Hill-Country research site – one of the sites where FLRC are undertaking catchment-scale research



Manawatu's Muslim community had much more to celebrate than just the end of Ramadan as one couple sprung their wedding on the hundreds attending Eid celebrations. **Emilie Vallee** and **Ahmed Elwan** announced their marriage contract on the morning of the Eid Al-Fitr, the first day of the new month, Shawwal, and the morning of breaking the fast of the month of Ramadan. It is one of the biggest celebrations on the Muslim calendar.

Ahmed Elwan is from Egypt and is undertaking his PhD in Soil & Earth Sciences at Massey University. His research topic is '*Investigating the impact of hydrological settings on the transport and fate of farm nutrients to rivers via groundwater*' with supervisors including Ranvir Singh and **David Horne** (Massey University), Jon Roygard (Horizons Regional Council) and Brent Clothier (Plant & Food Research). Emilie Vallee is a Lecturer in Epidemiology with the Institute of Veterinary, Animal and Biomedical Sciences at Massey University.



Ahmed Elwan and Emilie Vallee celebrating their marriage with fellow Soil & Earth Science students and PhD supervisors

About 200 people attended the marriage celebration at the Palmerston North Community Leisure Centre. The couple are also raising money for a well in Vanuatu, to provide water for a remote village as part of their gift registry and Zakat Al-Fitr. Zakat Al-Fitr is part of the month of Ramadan, which calls for Muslims to be extra charitable. The \$17,000 well is to be installed in the remote village of Ikapau, in Tanna Island by Unicef.

The Institute of Agriculture and Environment in association with the Institute of Education at Massey University are currently hosting a group of 37 Academics sponsored by the Chinese Scholarship Council from the Henan Province, China. The group are undertaking a 12-week course on the 'Pedagogy of Agriculture'. They aim to improve their English and to learn about methods and approaches to improve how they teach agriculture in their homeland. The group are being exposed to methods that improve the way disciplines are taught and to better engage students in their learning. Farm visits provide a chance for participants to get a first-hand perspective of farming in New Zealand, and participation in undergraduate teaching classes provides an opportunity to be emersed in the teaching methods of the University. The aim is that at the end of the course, the Chinese participants will be able to:

- Explore new and innovative teaching pedagogy/methodologies in agriculture.
- Develop self-reflection and observational skills through participation in microteaching and classroom observation.
- Adapt New Zealand teaching methodologies for application in China.
- Enhance their English language skills and increase their proficiency in listening, speaking, reading and writing in English.
- Develop skills and gain experience in presenting information in English.
- Use e-learning tools to support ongoing development of their professional skills.
- Observe and experience New Zealand culture, including Maori culture.



Some of the Chinese delegation participating in a second-year Soil Science practical class

# International Year of Soils - events in the Lower North Island

The Food and Agriculture Organisation of the UN in conjunction with national organisations (like the New Zealand Society of Soil Science) aims to increase awareness and understanding of the importance of soil for food security and essential ecosystem functions. The *International Year of Soils* was highlighted on the 5<sup>th</sup> June at the National Horticultural Field Day in Hastings. The field days held presentations and a panel discussion on 'Sustainable Soils'. Mike Hedley facilitated the event and presented a talk on '**Sustaining the productive capacity of our soils'**. Mike emphasised soils used for agriculture have physical and chemical management needs to sustain their biological activity, to support plant production and to sustain soil and water quality.



Mike Hedley talking at the National Horticultural Field Day

**Mike then introduced** Nicole Masters from Integrity Soils, who held the audience's attention talking about 'Amazing roles of soil microbes' not only their activity in soils but illustrating direct linkages to human health. Brendan Powell from Hawkes Bay Regional Council followed - covering 'Policy to sustain soil resources' in which he covered the role of the regional council in sustaining and protecting the soil and water resources.

Finally Scott Lawson of Lawson's Organic Farms Ltd, in a talk entitled 'No free lunches without good soil management', spoke about his passion for 'best soil and crop management practices and how they are the key to safe and high quality food production.



The panel then finished by inviting the audience to join in a discussion on 'Soil the heart of regional economy, health and unique identity', which immediately went off subject as the audience were keen to pursue their own areas of interest in soils and in future regional planning around irrigation. After the "talk fest", Nicole entertained and educated a decent crowd around the 'soil pit' discussing key soil, soil organism and plant rooting properties.

Nicole Masters getting the crowds to think deeply about soil processes.

The feedback from the National Horticultural Field Day event managers was that the attendees of the 'Sustain soils' section had a great time.

Mike is also going to give a version of his talk on 'Sustaining the productive capacity of our soils' to the Manawatu Branch of the Royal Society when they meet on 27<sup>th</sup> August to celebrate the *International Year of Soils*. In this Manawatu Lecture, Mike will talk about the work that he and his co-workers are doing here in the Manawatu to sustain the productive capacity of our soils and the environmental quality of land and water resources.

# Canterbury

# Plant & Food Research, Lincoln

# Visitors

**Trish Fraser, Frank Tabley** showcased the two Lincoln lysimeter facilities, and **Richard Gillespie** and **Steven Dellow** presented the carrot establishment trial to two groups firstly to the Horticulture and Agriculture Teachers Association Conference field trip and then the Process Vegetables NZ executive



Trish Fraser discussing soil N loading after cow urination at the lysimeter facility with the PVNZ executive

**Steve Thomas, Gina Clemens and Richard Gillespie** presented the Winter Forage Trial to a group of African visitors as part of an MPI hosted NZ tour in July.

The focus of the trip was to support African countries in their development of a robust system to manage climate change inventory data and ensure that all available agricultural data is considered in the development of inventories, to engage in dialogue with New Zealand inventory experts in Wellington, to travel to New Zealand research centres to develop an understanding of how scientific research supports inventory improvements, and to develop a network to support African Global Research Alliance (GRA) activity including participation in the FAO-GRA Global Livestock Environmental Assessment Model (GLEAM) project.

Steve discussed the range of  $N_2O$  and N leaching measurements made, crop production, crop diversity etc; demonstrated how targeted measurements inform inventory development and better management practice (even if not all may be captured in inventory; co-benefits between GHG mitigation and other objectives)



Steve Thomas describes the Winter Forage Trial

### Staff

**Tihana Vujinovic** joined the SWE group in June to start a PhD on the role of soluble organic matter in regulating soil C and N mineralization at Lincoln University. Tihana has recently completed a Master's Degree in Agricultural Sciences and Technologies at the University of Udine, Italy focusing on fertilizer nitrogen dynamics associated with humic fractions using stable isotope techniques. She will be supervised by **Mike Beare, Denis Curtin** and Prof **Tim Clough** (Lincoln Univ).

**Dirk Wallace** submitted a PhD proposal to the Lincoln University Academic research committee entitled: Soil amendments to improve water retention and irrigation efficiency of shallow stony soils under arable management. Dirk's PhD is supported by the Maximising Value of Irrigation programme and is co-supervised by Steve Thomas.



**Josie Noble** represented NZ at the LA Special Olympics in July. Josie was very successful winning Gold in the 100m final

Josie Noble celebrates after winning Gold at LA

Recent work by **Craig Anderson** and **Michelle Peterson** shows how dissolved organic matter in soil contributes to nitrogen (N) cycling. Our results suggest that sufficient bioavailable carbon (C) to fuel N-transformations is released simply by manipulating soil pH, but denitrification activity depends on the type of base used to change the pH. Our observations indicate that calcium hydroxide seriously impacts denitrification activity whereas potassium hydroxide does not. This research has implications when considering solubility and stability of soil organic carbon and denitrification rates when liming soils.

During this research we have also identified a number of microorganisms not normally associated with N-cycling that appear to play a greater role than previously thought. Our results suggest that the timescales used for studying denitrification need to be compressed in order to avoid overlooking the short-term microbial community dynamics that follow soil physicochemical change such as rapid pH fluctuations and onset of anaerobic conditions. These experiments have provided a more realistic view of potential field dynamics because we examined denitrification in association with only native C released via realistic physicochemical change - high pH and low oxygen - conditions that are expected under urine patches during and following urease enzyme activity.

Contact <u>Craig.anderson@plantandfood.co.nz</u> for more information

# Indaba

The PFR Sustainable Production Portfolio 'Indaba' was held 30 & 31 July at Lincoln and Methven. The group includes Mike Beare, Paul Johnstone and Brent Clothier. Indaba is a South African term for a gathering or a meeting and was suggested by Warrick Nelson last year for the annual get together of SP Science Group Leaders and business managers. SP are a very diverse portfolio, spread over many sites and the indaba provides an opportunity for the group to meet together, without a day-to-day operational focus. The point of this meeting is very broad, including a bit of navel gazing and crystal ball gazing combined with deeper interactions with invited participants. Day 1 was spent at Lincoln considering opportunities and issues facing us over the coming years. The group discussed and identified some key potential growth areas. Barbara Leppan, PFR's business development manager talked about 'PlantAid' PFR's overseas development programme, and considered how SP might support growth in this area, providing capability to crop, soil and water management in Kenya, Abu Dhabi and Cambodia. Melissa Robson from AgResearch joined Tracy Williams and Jessica Dohmen-Vereijssen to provide the group with an overview of the principles and practice of 'Codevelopment', a fancy term for working with our stakeholders. The day finished with a very candid discussion about the challenges and opportunities of building partnerships in China. Day 2 was spent in Methven learning about Craige and Roz Mackenzie's highly sophisticated seed and grain producing farming operation. The Mackenzie's became interested in precision agriculture approaches during the mid-2000's and are now at the leading edge of putting this into practice on their farm.

Electro-magnetic mapping of their soils, combined with variable rate irrigation, saves them around 30% of the water that they used previously. Variable rate seeding and fertiliser applications have contributed to a substantial decrease in other input costs. The Mackenzie's have become much more efficient in the use of agrichemical sprays as the preparation of detailed treatment maps now allows them to fill the sprayer with the minimum product needed to complete the job. A knock-on benefit is that they have been able to install a 'bio-bed' to deal with tank washings. The 'bio-bed' is essentially a compost heap formed in a butyl-rubber lined

'pond', through which the spray tank washings are passed slowly three times. Microbes in the bio-bed break down any agrichemical residues into carbon dioxide and the resultant treated water is returned to the environment.



VRI discussion

PFR Sustainable Production Portfolio management group

#### Winter Forage Trial

This large field trial at Lincoln was sown in the autumn to fulfil a range of objectives, co-funded by the Forages for Reduced Nitrate Leaching and Pastoral 21 programmes, and PFR's LUCI core finding. Three crops (forage rape, Italian ryegrass and a mix of Italian ryegrass and forage oats) were established by either no or conventional tillage, into an ex pasture paddock on light, free-draining soil, to investigate the effects of establishment method and crop type on crop growth, gaseous emissions and nitrate leaching.

Measurements of gas emissions were made pre and post establishment and though the growth of the crops. Soil moisture was monitored by TDR and neutron probe, and nitrate leaching losses were made via soil solution sampling following sufficient rainfall. Soil was sampled at regular intervals to monitor mineralisable N content. Soil physical characteristics are measured at regular intervals.

In July, a huge amount of field work was put in by a large team to determine the biomass of the crops, and to then impose further treatments simulating grazing with treading and urine application. The team included **Gina Clemens, Craig, Rebekah and Jennifer Tregurtha, Richard Gillespie, Frank Tabley, Peg Gosden, Chris Dunlop, Frank Liu, Kathryn Lehto, Sarah Glasson, Mike Beare, Tihana Vujinovic and Dirk Wallace**. The edges of each plot was mown by hand, exposing an area that was harvested using a Wintersteiger Cibus forage harvester. That was followed by a grazing simulation by machines dubbed "Hoofinators", which were designed and built by PFR's Bioengineering Group at Ruakura. Following the treading, synthetic urine was applied by hand. And after that work was completed, the field devices were re-installed along with automatic gas sampling chambers, and additional manual gas chambers and thermocouples for soil temperature measurement.

The next phase involves resowing the forage rape plots with Italian ryegrass. All measurements will be made through the spring and summer.



The team preparing the site for biomass measurement



Richard Gillespie operates the Cibus forage harvester for crop yields



*The Winter Forage Trial site after crop harvest, with the Hoofinators simulating treading (left) and synthetic urine being applied (rear)* 



Jennifer Tregurtha on the Hoofinator showing soil damage after treading

Craig Tregurtha gives Mike Beare instructions to operate the Hoofinator



Jennifer Tregurtha, future scientist, has even composed a poem to commemorate all this work...

Hoofy Doofy is my name, Pugging the soil is my aim. I don't fart, I can't go moo, I can't even pee or do a poo.

I'm rather special, with my twenty feet, But there's no bone on me, or any meat. I'm a burly beast, made mostly of steel, I sounds rather odd, but I am very real!

I move along on two straight rails, But not very fast, more like snails. At night they put me to sleep under plastic, It keeps me dry so I think they're fantastic!

This Winter Forage Trial has seen the last of me, But there will be another one, you just wait and see. So this is not "good bye", but rather "see you later", Don't forget me, I'm the HOOFINATOR!

# Biogeography and biophysicochemical traits link N2O emissions, N2O emission potential and microbial communities across New Zealand pasture soils

### Sergio E. Morales <sup>a</sup>, \*, Neha Jha <sup>b, c</sup>, Surinder Saggar <sup>c</sup>

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#### Abstract

The process of denitrification has been studied for decades, with current evidence suggesting that an ecosystem's ability to produce and emit N2O is controlled both by transient 'proximal' regulators (e.g. temperature, moisture, N availability) as well as distal regulators (e.g. soil type, microbial functional diversity, geography). In this study we use New Zealand soils as a model system to test the impact of distal regulators (i.e. geography) on microbial communities and their N2O emission potential. Using gas chromatography, soil chemical analyses, 16S amplicon sequencing, terminal restriction fragment length polymorphism (T-RFLP) and quantitative PCR (qPCR) on three denitrifier functional genes (nirS, nirK and nosZ), we assessed the factors linked to N2O emissions across a latitudinal gradient. Results show that soil drainage class, soil texture class, and latitude were powerful regulators of both emissions and emission end products (N2 vs. N2O). Mixed models demonstrate that a few variables (including latitude, texture class, drainage class and denitrifier community data [abundance and diversity] amongst others) were enough to predict both the amount and type of gas emitted. In addition we show that microbial community composition (based on 16S rRNA gene sequencing) can also be used to predict both the gas species and quantity emitted.

Soil Biology & Biochemistry 82 (2015) 87-98

# Impact of urine and the application of the nitrification inhibitor DCD on microbial communities in dairy-grazed pasture soils

#### Sergio E. Morales <sup>a, \*</sup>, Neha Jha <sup>b, c</sup>, Surinder Saggar <sup>c</sup>

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#### Abstract

Tools to manage the emission of the greenhouse gas nitrous oxide (N2O), an intermediate of both nitrification and denitrification, from soils are limited. To date, the nitrification inhibitor dicyandiamide (DCD) is one of the most effective tools available to livestock farmers for reducing N2O emissions and minimizing leaching of nitrogen in response to increased urine deposition in grazed pasture systems. Despite its effectiveness in decreasing N losses from animal urine by inhibiting N processes in soils, the effect of DCD on the population structure of denitrifiers and overall bacterial community composition is still uncertain. Here we use three New Zealand dairy-grazed pasture soils to determine the effects of DCD application on

microbial community richness and composition at both functional (genes involved in the denitrification process) and phylogenetic (overall bacterial community composition based on 16S rRNA profiling) levels. Results further confirm that the effects on microbial populations are minimal and transient in nature. The impact of DCD on microbial community structure was soil dependent, and a greater effect was attributed to intrinsic soil properties like soil texture, with community response to DCD in combination with urine being comparable to that under urine alone. Addition of DCD to cattle urine also reduced N2O emission between 23 and 67%.

Soil Biology & Biochemistry 88 (2015) 344-353

Estimating direct N2O emissions from sheep, beef, and deer grazed pastures in New Zealand hill country: accounting for the effect of land slope on the N2O emission factors from urine and dung

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#### Abstract

Nearly one-half of New Zealand's ruminant livestock graze on hill country pastures where spatial differences in soil conditions are highly variable and excretal deposition is influenced by pasture production, animal grazing and resting behaviour that impact the nitrous oxide (N2O) emission factor from excreta (EF3). New Zealand currently uses country-specific EF3 values for urine and dung of 0.01 and 0.0025, respectively, to estimate direct N2O emissions from excreta. These values have largely been developed from trials on flat pastoral land. The use of the same EF3 for hill pasture with medium and steep slopes has been recognised as a possible source of overestimation of N2O emissions in New Zealand. The objectives of this study were to develop and describe an approach that takes into account the effects of slope in estimating hill country N2O emissions from the dung and urine of ruminant animals (sheep, beef cattle, and deer) across different slope classes, and then compare these estimates with current New Zealand inventory estimates. We use New Zealand as a case study to determine the direct N2O emissions between 1990 and 2012 from sheep, beef cattle and deer excreta using updated estimates of EF3 for sloping land, the area of land in different slope classes by region and farm type, and a nutrient transfer model to allocate excretal-N to the different slope classes, and compare the changes between these hill pastures-specific and current inventory estimates. Our findings are significant – the proposed new methodology using New Zealand specific EFs calculated from a national series of hill country experiments resulted in 52% lower N2O estimates relative to using current inventory emission factors, for the period between 1990 and 2012 and reduces New Zealand's total national agricultural N2O greenhouse inventory estimates by 16%. The improved methodology is transparent, and complete, and has improved accuracy of emission estimates. On this basis, the improved methodology of estimating N2O emission is recommended for adoption where hill land grasslands are grazed by sheep, beef cattle and deer.

Agriculture, Ecosystems and Environment 205 (2015) 70–78

## Advances towards more quantitative assessments of soil profile properties

#### Pierre Roudier, Andrew Manderson, Carolyn Hedley

Presented to the First Inaugural Global Workshop on Digital Soil Morphometrics, 2-4 June, 2015, Madison, Wisconsin, USA.

In this paper, we present some recent advances in digital soil morphometrics techniques in New Zealand. A soil monolith extractor has been developed in-house to speed up access to the soil profile and facilitate the application of digital soil morphometrics techniques. A set of 3 distinct soil profiles have been sampled using the monolith extractor to test new ways to collect information from the soil profile. Digital images have been collected from these soil monoliths, and calibrated using a set of reference colour chips. The spectral resolution of these images have then been enhanced by combining the spatial resolution of the CCD images (1 mm) with the spectral resolution and range of an ASD FieldSpec 3 visible NIR pectrometer (1 nm between 350 and 2500 nm). A processing chain combining image processing methods such as principal components analysis and image segmentation has been developed to support the determination of horizons, and collect information about the soil structure.

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# The effects of spatial variability of nitrous oxide emissions from grazed pastures on the sampling distribution of chamber measurements

#### D.L Giltrap and A. J. R. Godfrey

Chamber sampling is a common method for measuring nitrous oxide (N2O) emissions from agricultural soils. However, for grazed pastures, the patchy nature of urine deposition results in very high levels of spatial variability in N2O emissions. In the present study, the behaviour of the sample mean was examined by simulating a large number (9999) of random N2O chamber samples under different assumptions regarding the underlying N2O distribution. Using sample sizes of up to 100 chambers, the Central Limit Theorem did not apply. The distribution of the sample mean was always right-skewed with a standard deviation varying between 12.5 and 135% of the true mean. However, the arithmetic mean was an unbiased estimator and the mean of the sample mean distribution was close to the true mean of the simulated N2O distribution. The properties of the sample mean distribution (variance, skewness) were affected significantly by the assumed distribution of the emission factor, but not by distribution of the urine patch concentration. The geometric mean was also investigated as a potential alternative estimator. However, although its distribution had lower variance, it was also biased. Two methods for bias correcting the mean were investigated. These methods reduced the bias, but at the cost of increasing the variance. Neither of the bias-corrected estimators were consistently better than the arithmetic mean in terms of skewness and variance. To improve the estimation of N2O emissions from a grazed pasture using chambers, techniques need to be developed to identify urine patch and non-urine patch areas before sampling.

Journal of Agricultural Science (2015). doi:10.1017/S0021859615000519

# Conferences

#### September 2015

20th International Soil Tillage Research Organization Conference in Nanjing China **14-18 September 2015**. <u>http://istro2015.csp.escience.cn/dct/page/1</u>

Pedometrics and Soil-Landscape Modelling Conference, University of Cordoba, Spain 14-18 September 2015.

Cordobahttps://sites.google.com/site/pedometrics2015/registration-and-abstract-submission

LuWQ2015 2nd International Interdisciplinary Conference on Land Use and Water Quality: Agricultural Production and the Environment. Vienna Australia **21-24 September 2015** <u>http://web.natur.cuni.cz/luwq2015/</u>

5th International Symposium on SOIL ORGANIC MATTER. September 20-24, 2015, Göttingen, Germany.www.som2015.org

IUSS Conference to celebrate the International Year of Soils and the 350th Anniversary of Christian Albrechts University. Soil functions and climate change- do we underestimate the consequences of new disequilibria in soil properties? SUSTAIN Christian Albrechts University, Kiel, Germany, **23-26.Sept. 2015**. <u>http://www.soils.unikiel.de/de/sustain-2015</u>

#### October 2015

**20th – 22nd October** - NZ Association of Resource Management 61<sup>ST</sup> ANNUAL CONFERENCE Waikato. Early Bird registrations close 4 September. Details at: http://www.nzarm.org.nz/conference-2015-details/

International Symposium on Forest Soils 2015 (ISFS2015) Fuzhou, China, **October 24-28, 2015**. The theme of the Symposium is 'Linking Soil Processes to Forest Productivity and Water Protection under Global Change'. The major objective of this symposium is to facilitate the development of international cooperations, scientific exchanges and strategic alliances in forest soil issues, leading to fully realised, collaborative research programmes that face the realities of the effects of forest management and climate change on forest productivity and water supply. Abstract submission deadline: June 4, 2015. For more details visit <u>http://isfs2015.com/index.asp</u> or contact <u>Zhiqunhuang@fjnu.edu.cn</u>

#### November 2015

November 10 -12th - Groundwater Modelling for Beginners - Auckland NZ http://www.srit.com.au/course\_details.php?id=114

Soils Education and Outreach Division of the Soil Science Society of America symposium "Embedding Soils in STEM Education" Minneapolis **November 15-18**. Ryo Fujinuma and Laura Wendling UQ have volunteered to organise this symposium and are interested in hearing from university and K-12 educators who use soils in their teaching. Email l.wendling@uq.edu.au

28th Bi-annual Conference of the Soil Science Society of East Africa (SSSEA) & African Celebration Meeting of the International Year of Soil, Morogoro, Tanzania, **November 23-27, 2015**. Theme: Soils and Land Use for Climate Smart Agriculture. Deadline for abstract submission: 30 July, 2015; full papers in electronic version to be submitted by 30th October 2015. For further information contact the Organizing Committee SSSEA at <u>amurnyambilila@yahoo.com</u>

#### www.nzhsconference.co.nz



2016

# Joint New Zealand and Australian Soil Science Conference

Queenstown, New Zealand

# Hold the date: week beginning 12 December 2016

#### 'Soil, a balancing act down-under'

#### What does this mean to you?

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

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



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