Welcome to the Soil News

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In this issue...

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

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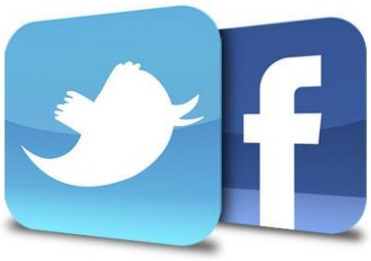

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Officers of the NZSSS December 2022-2024

President: Sam Carrick (Manaaki Whenua-Landcare Research)
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Past President: Tim Clough (Lincoln University)
Secretary: Wei Hu (Plant and Food Research)
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From the Editor

Welcome to this issue of Soil News.

As I started to collate this issue of Soil News, it was the one-year anniversary of Cyclone Gabrielle.

Some facts dated March 2023 (taken direct from MFAT website):

- Cyclone Gabrielle caused significant damage to homes, infrastructure, and livelihoods across northern and eastern regions of the North Island. The cyclone is New Zealand's costliest non-earthquake natural disaster, with economic losses expected to exceed the $2bn-$4bn of losses of the 2016 Kaikōura earthquake.
- Primary sector exports will be largely unaffected, with the exception of apple exports, where orchards were hit hard as Gabrielle struck the Hawke's Bay during a key harvest period. Damage to orchards and farms is also likely to see some lost primary production beyond 2023 too.
- Cyclone Gabrielle tracked south and struck Aotearoa between February 12 and 16, 2023. The devastation caused, including the loss of life, homes, possessions, and livelihoods, has been heart breaking. Gabrielle was felt over a wide area, including Northland, Auckland, the Coromandel, Waikato, Bay of Plenty, Gisborne/Tairāwhiti and Hawke's Bay. However, damaging rainfall, winds and flooding hit the Hawke's Bay and Gisborne/Tairāwhiti regions the hardest. The cyclone came close on the heels of Ex-Cyclone Hale and the Auckland Anniversary Weekend flood. A national state of emergency was announced for only the third time in New Zealand's history.

There is much more information available on the widespread impacts and extensive damage, and above is only a very brief summary, soon after that time. Efforts have been made to start to fill the science knowledge gap on many aspects. Some soil-related ones include those summarised in Soil News (in May 2023), sediment deposits and characteristics of impacted sites (Dickson et al. 2023), erosion (MWLR 2024), and no doubt many other sources.

References or further information

Dickson A, Bloomer D, Mackay A, Palmer A, Anderson S. 2023. Cyclone Gabrielle baseline sampling 2023. LandWISE Inc. https://www.landwise.org.nz/projects/soil-repair-after-cyclone-gabrielle/
MFAT 2023. 'Cyclone Gabrielle's impact on the New Zealand economy and exports - March 2023'. https://www.mfat.govt.nz/en/trade/mfat-market-reports/cyclone-gabrielles-impact-on-the-new-zealand-economy-and-exports-march-2023/
MWLR 2024. Pūtaiao. February 2024. Manaaki Whenua – Landcare Research. https://www.landcareresearch.co.nz/publications/putaiao/
Soil News 2023. 'Helping Hawkes Bay growers recover following Cyclone Gabriel – March 2023'. Soil News, May 2023.

Celebrating Success – Recipients of the NZSSS Awards for 2023

Compiled by Dr Brendon Malcolm, NZSSS Awards Convenor (2017-present)

Our Societies regional forums in December 2023, which included “Expanding Horizons” in conjunction with the Norman Taylor Lecture at Lincoln University, along with Norman Taylor Lecture’s in Palmerston North and Hamilton, were an opportunity to honour and celebrate the success of those who have made significant contributions to soil science through our Societies long-established awards portfolio. The awards presented, and the recipients of those awards, are briefly profiled below. On behalf of Council, **congratulations** to all those who received awards.

The Norman Taylor Memorial Award

The Norman Taylor Memorial Award (Lecture) is awarded by the President of the NZSSS in recognition of outstanding contributions to soil science in New Zealand. The 2023 recipient of the Norman Taylor Memorial Award was **Professor Hong Di**. Professor Di gave an informing and engaging talk on his extensive work on mitigation technologies to reduce nitrogen leaching. His lecture was titled “Mitigation of environmental impacts of grazed grassland”.

Professor Di is Head of the Centre for Soil and Environmental Research at Lincoln University, and Director of the New Zealand - China Water Research Centre. His main research areas include nitrous oxide emissions and nitrate leaching from soil, nitrification inhibitors, wastewater treatment and management, and nutrient management.

Professor Di’s research has significantly improved knowledge and understanding of the role of ammonia oxidising bacteria and archaea in nitrogen cycling, and their relationships with nitrate leaching and nitrous oxide emissions. He has made significant advances in developing mitigation tools and technologies to help reduce nitrate leaching and nitrous oxide emissions in grazed pasture systems.

Professor Di is highly regarded by students as an outstanding lecturer in soil science and has inspired many students to continue their studies onto Masters and PhD level in soil science. He is also recognised by government officials, industry personnel and farmers as an expert in the challenging interface between agriculture and the environment. Professor Di was made an Officer of the New Zealand Order of Merit (ONZM) in the Queen's Birthday Honours for services to agricultural research, elected Fellow of the Royal Society of New Zealand (FRSNZ), Fellow of the New Zealand Institute of Agricultural and Horticultural Science (FNZIAHS), and Fellow of the New Zealand Society of Soil Science (FNZSSS).

Fellowship of the New Zealand Society of Soil Science

Fellowship of the New Zealand Society of Soil Science is an honour conferred for distinction in any or all of the following areas; research, technology, teaching, extension, and/or the advancement of soil science. In 2023, the Society had great pleasure in appointing **Dr Jiafa Luo** as Fellow of the Society.

Jiafa is a well published scientist with an excellent track record in science delivery, collaboration and impact. Jiafa has proven to be a strong leader of large-scale projects and is world renown for delivering high quality research outcomes. This is evident by his strong publication records and national and international recognition. Jiafa is regarded as one of New Zealand's most knowledgeable practitioners and is world renown for his expertise in soil and animal excreta derived GHG emissions. Through his recognition and relationships, he collaborates on multiple projects and is regularly invited as a keynote speaker at conferences and to speak to research groups and government departments (both nationally and internationally). Jiafa also has a great record for supervising PhD candidates, Master's students and summer students.

Three key research areas of research that Jiafa has been involved in that have advanced NZ soil and agricultural sciences are:

1. New Zealand Greenhouse gas inventory, where Jiafa has played a significant role in developing and leading several research programmes investigating country-specific nitrous oxide emission factors for deposited excreta in grazed pasture systems.
2. Greenhouse gas mitigation, where Jiafa has led several research projects investigating mitigation technologies and practices for reducing nitrous oxide and ammonia emissions from grazed pasture systems.
3. Environmental technology development, where Jiafa has led several research programmes on improving dairy cow off-pasture facilities and associated manure and effluent management practices.

The Fertiliser Association Award

The Fertiliser Association award (Postgraduate Bursary) recognizes the efforts and present, or likely, contribution to New Zealand soil science arising from a Doctorate study. Eligible candidates for this award must be 3rd year PhD students working on the properties, productivity or sustainability of NZ's soil and land resources.

The recipient of The Fertiliser Association award for 2023 went to **Max Nightingale** of University of Canterbury.

In his third year of research in Environmental Science, Max's research addresses the application of winery wastewater to land and the implications for soil quality and carbon sequestration.

During his PhD programme, Max has sought to determine the likely effects, both in the short and long term, of irrigating winery wastewater to soil at rates whereby water and nutrients contained therein may be beneficially used by plants. Winery wastewater is an unavoidable, high-volume byproduct of the winemaking process, generated from grape processing and cleaning operations within each of the wineries.

Prior to commencing his PhD, Max spent six years working as an environmental scientist, specialising in land contamination and remediation. His work experience not only helped his practical knowledge working in the New Zealand industry, it also encouraged his interest in environmental planning and how the implementation of policy affects New Zealand soils.

His goals following his PhD are to continue into New Zealand's soil sector, working with or for policy makers, in order to retain and improve New Zealand's soil quality for future generations.

The Society is hugely grateful to the Fertiliser Association of New Zealand for sponsoring this award.

The Morice Fieldes Memorial Award

The Morice Fields Memorial Award recognises a PhD thesis from the previous calendar year of exceptional merit. In 2023 the Society awarded this to **Hadee Thompson-Morrison** of University of Canterbury for her thesis *"Elemental fluxes in Elaeis guineensis (oil palm) production: Implications for environmental quality"*.

Judges noted that the thesis was well written, was unique in that it spanned a broad range of different areas related to the central topic around trace elements and oil palm plantations, and, demonstrated a good understanding of the whole production system and the wider social and economic interactions and implications.

The Sir Theodore Rigg Memorial Award

The Sir Theodore Rigg Memorial Award recognises a Masterate thesis of exceptional merit from the previous calendar year. **Seager Ray**, University of Waikato, was our recipient of the award for 2023, for his thesis *"Differentiating the Temperature Response of Soil Fungi and Bacteria"*.

Judges noted the thesis was well written, demonstrated a good understanding of the basis of the experimentation, and addressed the limitations of methodologies used and the possible impact on results.

Undergraduate prizes

Each year the Society awards the best performing third year undergraduate student in each of the three major Universities (Lincoln University, Massey University and University of Waikato). For 2023, the recipients of the undergraduate prizes were **Meila Picard** (Lincoln University), **Oliver Arnold** (Massey University), and **Ethan Morgan** (University of Waikato).

Congratulations to all our deserving award winners!

New Zealand Society of Soil Science Awards 2024

Nominations for the following awards open **1 March 2024** (with the exception of the US/NZ Exchange Award, for which nominations open 25 January). Key details regarding nomination requirements are provided in the table below. Note the recently established *Early Career Researcher* award and *Soil Judging Stipend* on offer this year as part of the awards portfolio. Please contact the NZSSS Awards Convenor for full award details (Brendon.Malcolm@plantandfood.co.nz).

Award	Presented	Nominations close	Nominee eligibility	Nominator eligibility
NZSSS Fellowship	Annually	31 July 2024	Nominees must be active members of the Society at the time of nomination.	Nominations must be made by two Full Members, or Life Members of the Society.
The Grange Medal	Biennially (conference year)	31 July 2024	Open to both non-members of the Society as well as members, fellows, or life members of the NZSSS.	Nominations must be made by two or more active members of the Society.
The Blakemore Award	Biennially (conference year)	31 July 2024	Open to technicians/support staff who have been employed in the field of science for at least three years.	Any two active members of the NZSSS can nominate an eligible candidate from a university, CRI, or other organisation (e.g. a Regional Council).
The Leamy Award	Biennially (conference year)	31 July 2024	Open to the author or authors of the most meritorious New Zealand contribution to soil science, published in the previous three calendar years.	Any two active members of the NZSSS can nominate an eligible candidate(s) from a university, CRI, or other organisation (e.g. a Regional Council).
The Postgraduate Bursary	Annually	31 July 2024	Open to postgraduate (PhD) students in soil science about to enter their third year of study. Candidates must be either student or full members of the NZSSS and should not be on the academic or technical staff of the department that nominates them.	Nominations must be received in writing from the Head of the Soil or Earth Science Department/Group at a New Zealand University. Only one nomination will be accepted from each University Department/Group.

The Morice Fieldes Award	Annually	31 July 2024	A PhD thesis submitted within the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate the best PhD thesis from their department/group.
The Rigg Award	Annually	31 July 2024	A Masterate thesis submitted within the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate the best Masterate thesis from their department/group.
Early Career Researcher (ECR) Award	Biennially (conference year)	31 July 2024	Open to ECR's within eight years of completing their highest research qualification (Masterate or Doctorate).	No more than 2-page written nomination by any two active members of the NZSSS.
Undergraduate Prizes	Annually	31 December 2024	A third-year student in Soil or Earth Sciences.	The Head of the Soil or Earth Science Department/Group at Massey, Lincoln, and Waikato University may each nominate the best third-year student from their department/group.
The US/NZ Exchange Award	Annually	15 April 2024 for initial submission (18 April for final submission)	Nominees are required to have at least seven years of membership in SSSA or the NZSSS. Former recipients of this Award are not eligible.	This award allows self-nominations.
Soil Judging Stipend ($2,000)	Annually	31 July 2024	Open to student teams for attendance at a conference-related soil judging competition in New Zealand or Australia. Priority will be given to the highest performing team from the previous calendar year.	The Head of the Soil or Earth Science Department/Group at a New Zealand University may nominate a team from their department/group.

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

Dr Brendon Malcolm
NZSSS Awards Convenor
C/O Plant & Food Research
Private Bag 4704, Christchurch Mail Centre, Christchurch 8140 (normal post), or
Canterbury Agriculture & Science Centre, Gerald St, Lincoln 7608 (courier)
New Zealand

Email: Brendon.Malcolm@plantandfood.co.nz

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
2015 R McDowell
2016 L Schipper
2017 T Clough
2018 A Roberts
2019 M Camps
2020 C Smith
2021 L Condron
2022 M Beare
2023 H Di

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
2015 B Welten
2016 D Huang
2017 S McNally & J Owens
2018 M Bucci
2019 C Gardiner
2020 F Rambags
2021 J Ratcliffe
2022 B Robertson
2023 H Thompson-Morrison

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
2015 T Norris
2016 N Laubscher
2017 J Robinson
2018 O Petrie
2019 J Millar
2020 M Kokiri Huirama
2021 K Numa
2022 A van de Laar
2023 S Ray

Fertiliser Association Award 2019
Was Bert Quin Award 2014
Was Summit Quinphos Bursary (renamed Altum Award 2012)

1993 J Luo
1994 W J Morrell
1995 I Vogeler
1996 C W Gray
1997 B Robinson & B Miller
1998 A Mitchell
1999 A Khan
2000 Chengrong Chen
2001 Suman Mishra
2002 S Gaw
2003 D Houlbrooke & R Bhandral
2004 D Palmer
2005 J Singh
2006 S Khan
2007 B Kusomo
2008 S Carrick

2009 P Jeyakumar
2010 G Lucci
2011 N Wells
2012 R Dodd
2013 No award
2014 S McNally
2016 J Pronger
2018 T Geretharan
2019 A Wecking
2020 T Corbett
2021 K Deuss
2022 C Chisholm
2023 M Nightingale

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
2016 J Jiao
2018 B Moorhead
2020 R Cresswell
2022 J Dando

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
2016 D Selbie, L Buckthought, M Shepherd (jointly)
2018 J Luo
2020 D Curtin, M Beare (jointly)
2022 A Hewitt, M Balks, D Lowe (jointly)

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
2016 (oral paper) – R Woods
(poster) – A Carlton2018
2018 (oral paper) – A Tumbure
(poster) – K Deuss
2020 -none-
2022 (oral paper) – H Ruffell
(poster) – C Chisholm

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)
J Winters – (Massey)
S Rayner – (Lincoln)
2015 T Leabourn (Massey)

	B Robertson (Lincoln)
	F Garrity (Waikato)
2016	M O'Grady (Waikato)
	H Jensen (Lincoln)
	SA Whiteman (Massey)
2017	C Tomlinson (Waikato)
	S Pike (Massey)
	I Setiawan (Lincoln)
2018	M Hall (Waikato)
	M Van Baarle
	C Chisholm
2019	E Kitchen (Waikato)
	S Earl-Goulet (Lincoln)
2020	A Carrington (Waikato)
	P Chapman (Lincoln)
2021	R Brodnax (Waikato)
	E Stubbs (Massey)
	A Wells (Lincoln)
2022	H Hay (Waikato)
	B Deacon (Massey)
	M Dumaine (Lincoln)
2023	E Morgan (Waikato)
	O Arnold (Massey)
	M Picard (Lincoln)

Fellows of the NZ Society of Soil Science

L C Blakemore	R Naidu
M R Balks	V E Neall
N Bolan	R L Parfitt
K C Cameron	J A Pollock
I B Campbell	AHC Roberts
C W Childs	S Saggar
J Churchman	A G Sinclair
B E Clothier	G Sparling
I S Cornforth	T W Speir
H J Di	J K Syers
K M Goh	K R Tate
P Gregg	B K G Theng
R J Haynes	P J Tonkin
S F Ledgard	T W Walker
D J Lowe	J H Watkinson
J D McCraw	G W Yeates
A Mackay	A Hewitt
L Schipper	M Beare
L Condron	M Hedley
D Ross	C De Klein
T Clough	R Monaghan
R McDowell	D Curtin
R G McLaren	D Houlbrooke
P Fraser	C Hedley
J Luo	

Honorary Fellow

B Miller

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

L C Blakemore
I B Campbell
C W Childs
R J Furkert
R Lee
R B Miller
V Orchard
W M H Saunders
J K Syers
P J Tonkin
T W Walker
J P C Watt
J Adams
R McLaren
P Gregg
A Mackay
P Fraser
B Quin
D Lowe
M Balks

Grange Medal

(Biennial award)

2012	K Tate
2014	B Clothier
2016	G Rys
2018	M Hedley
2020	F Curran-Cournane
2022	K Cameron

The New Zealand Antarctic Medal

New Year Honours List 2024 - Citation for the New Zealand Antarctic Medal

BALKS, Dr Megan Ruby

For services to Antarctic soil science

Dr Megan Balks is a leading New Zealand soil scientist, contributing significantly to Antarctic soil research.

In 1990, Dr Balks joined other soil scientists beginning research into permafrost and human environmental impacts in Antarctica, going on to complete 19 Antarctic expeditions, 12 as field leader. Through this research, a series of Antarctic soil climate monitoring stations were established that contribute to an international programme (CALM) to monitor the effects of climate change in polar regions. Among her numerous publications, she co-authored the award-winning textbook ‘The Soils of Aotearoa New Zealand’ (2021), which includes coverage of the Ross Sea Region. She lectured at the University of Waikato from 1988 to 2018, supporting 10 graduate students in Antarctic soils research. She helped develop links with the international scientific community in the subjects of Cryosols (soil in very cold environments) and permafrost (frozen ground), furthering scientific collaboration and recognition of research undertaken by New Zealand soil scientists in Antarctica. She was a member of the Crysol Working Group of the International Union of Soil Sciences from 2000 until 2023, with two years as co-Chair. She represented New Zealand on the Council of International Permafrost Association (IPA) from 2008 to 2022. She organised the first Southern Hemisphere IPA Regional Conference on Permafrost in 2019. She was a founding member and secretary of ANTPAS (Antarctic Permafrost and Soils), a working group of the Scientific Committee on Antarctic Research. Dr Balks has been a member of the Royal Society of New Zealand’s Committee on Antarctic Research, the New Zealand Geographic Board Committee of Place Naming in the Ross Sea Region of Antarctica, and President of the New Zealand Society of Soil Science from 2018 to 2020.

Waikato soil scientist Dr Megan Balks NZAM investigating local soil near the banks of the Waikato River. Photo / Suzy Brown

Wright Valley, Antarctica, where much of Megan Balks' work was undertaken.

For more: https://www.nzherald.co.nz/nz/new-year-honours-2024-dr-megan-balks-recognised-for-services-to-antarctic-soil-science/YYB5OI7YLRD6VNAJMYWIUBWSNY/

Science New Zealand 2023 Awards

This year's annual awards celebrated 24 awardees across three award categories - Early Career Researcher, Individual / Lifetime Achievement and Team. For full details see:
https://sciencenewzealand.org/news-and-events/awards-2023/

Below are several soil-related award winners. Congratulations!

Dr Brendon Malcolm - Plant & Food Research (Early Career Researcher)

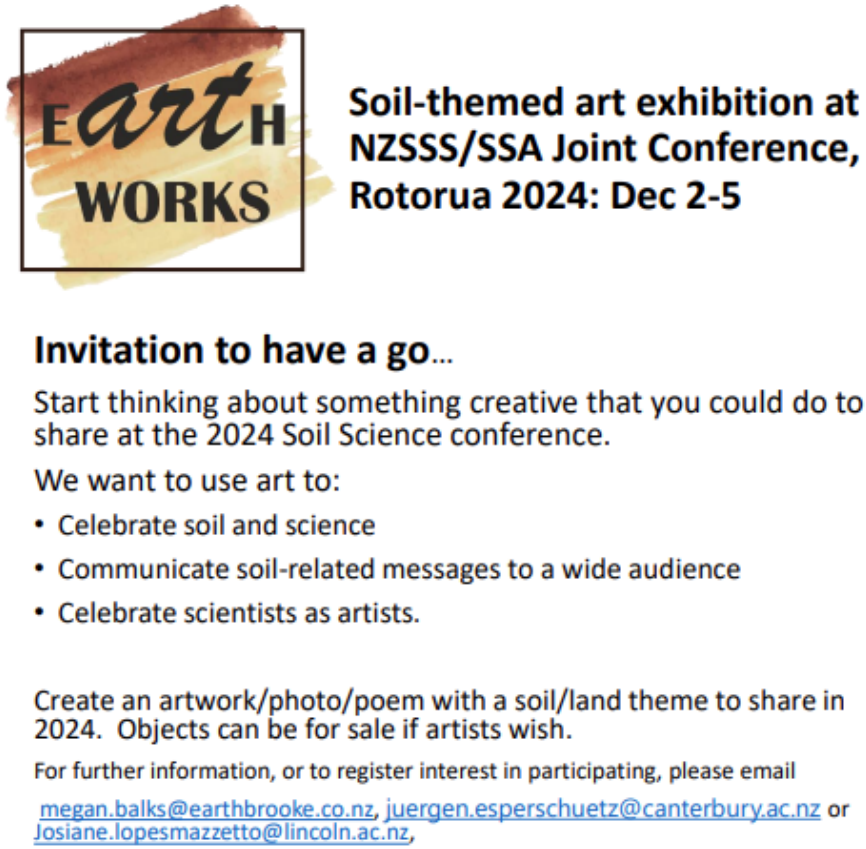
Brendon is a soil scientist at Plant & Food Research who works with farmers to develop tools that lead to better environmental outcomes and improved profitability. Over the past eight years he has led research which has proven sowing a catch crop after winter forage grazing can reduce nitrogen leaching by up to 60 percent. He has a strong focus on creating readily adoptable practices and communicates across multiple channels, including social media, to share his science with farmers, and the wider public.

Dr Chris Phillips – Manaaki Whenua – Landcare Research (Individual / Lifetime Achievement Awards)

Chris is a Senior Researcher in Erosion Processes at Manaaki Whenua – Landcare Research with professional expertise in erosion research and integrated catchment management. His scientific knowledge on soil bioengineering and its application to erosion and sediment control has informed central and regional government policy development, including sustainable land management policy.

Soil-themed art exhibition

At NZSSS/SSA joint conference, Rotorua 2024: December 2-5



For further information, or to register interest in participating, please email megan.balks@earthbrooke.co.nz, juergen.esperschuetz@canterbury.ac.nz or Josiane.lopesmazzetto@lincoln.ac.nz

PhD opportunities in soil ecology and global change research

Note the deadline on the PhD advert "Review of applicants will begin on 1st March".

News from the Regions

Waikato/Bay of Plenty

AgResearch

To facilitate the continued growth of the dairy industry and offer scientific and technical support for its sustainable and healthy development, Hunan Chengbu Miao Autonomous County, China, hosted a delegation of experts including **Drs Jiafa Luo**, Warren King and David Stevens in September 2023. The delegation undertook visits to Nanshan Pasture and Hunan Nanshan Animal Husbandry Co., Ltd, involving on-site collection of soil and pasture samples, along with engaging discussions with local farmers. The visit also included an inspection of standardised dairy cow breeding and an observation of the company's mechanised milking process. During a symposium, representatives from the People's Government of Chengbu Miao Autonomous County, Nanshan Pasture, County Animal Husbandry, Forestry, Agriculture, Water, and other units engaged in in-depth discussions with Drs Luo and Stevens. The topics covered included enhancing dairy cattle feeding methods, improving soil and pasture planting, and refining dairy cattle breeds. A combination of centralised feeding and scientific rotation grazing was proposed to improve both the quantity and quality of milk produced by dairy cows. Further recommendations from Drs Luo, King and Stevens included improving dairy cow breeds, shortening lactation periods, and enhancing the overall production efficiency of dairy cows. These measures are crucial for supporting the high-quality and sustainable development of the Chengbu dairy industry.

University of Waikato

Aaron Wall and **Louis Schipper** attended the annual AGU meeting in San Francisco. With their colleague Rachael Murphy (Teagac) they ran an oral and poster session: Carbon Balances of Agricultural Ecosystems and Their Management: Measurements at Hectare to Farm Scale. Along with colleagues from Australia, Canada, and Switzerland they are developing AgFlux, a currently informal group that focusses on the use of eddy covariance and other techniques to determine carbon balances and nitrous oxide fluxes at paddock to farm scales.

Figure 1 Aaron Wall and Louis Schipper out for dinner with AgFlux colleagues at AGU conference

Before the conference Aaron, Louis and Rachael also visited with Michael Schuppenhauer, Lawrence Berkeley National Laboratory, who is measuring all greenhouse gases from fields irrigated with effluent from a housed dairy operation. A very intensive system (stocking rate of ~10 cows ha^{-1}) not really seen in New Zealand with year-round housing of animals and cropping of the land for feed production.

Figure 2 Aaron and Rachael check out a heavily instrumented eddy covariance tower on a Californian dairy farm

Joining the WaiBER team on a Summer Research Scholarship is **Kelly Chow** who has just completed her 2nd year of a BSc. Kelly is measuring changes in carbon stocks along temperature gradient spanning 18 to 40°C at two geothermal sites.

Figure 3 Kelly Chow (summer student) and soil cores collected to determine deep carbon stocks

Manawatu

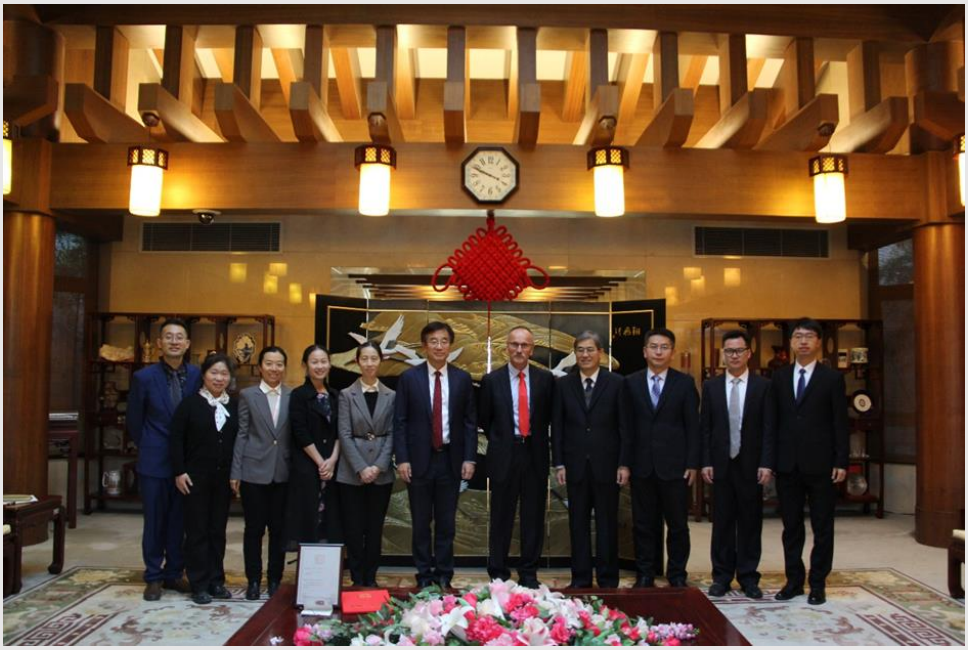
Plant & Food

Brent Clothier Inducted into the Chinese Academy of Engineering

In late November 2019, Brent Clothier was elected as an Academician (Foreign Member) of the Chinese Academy of Engineering (CAE). The Biennial Inauguration Ceremony for all new 2019 Academicians was slated for May 2020. Unfortunately, Covid-19 intervened, and that never happened!

In late November 2023, some four years' later, Brent Clothier was in China for contracted work between Plant & Food Research (PFR) and Wuhan University, Beijing Forestry University (BJFU) and China Agricultural University (CAU). The CAE decided to take this opportunity to hold an induction ceremony to present Brent with his Academician's certificate. The induction took place in Beijing on 27th November. Brent is the first New Zealander to become a Foreign Member of the Chinese Academy of Engineering.

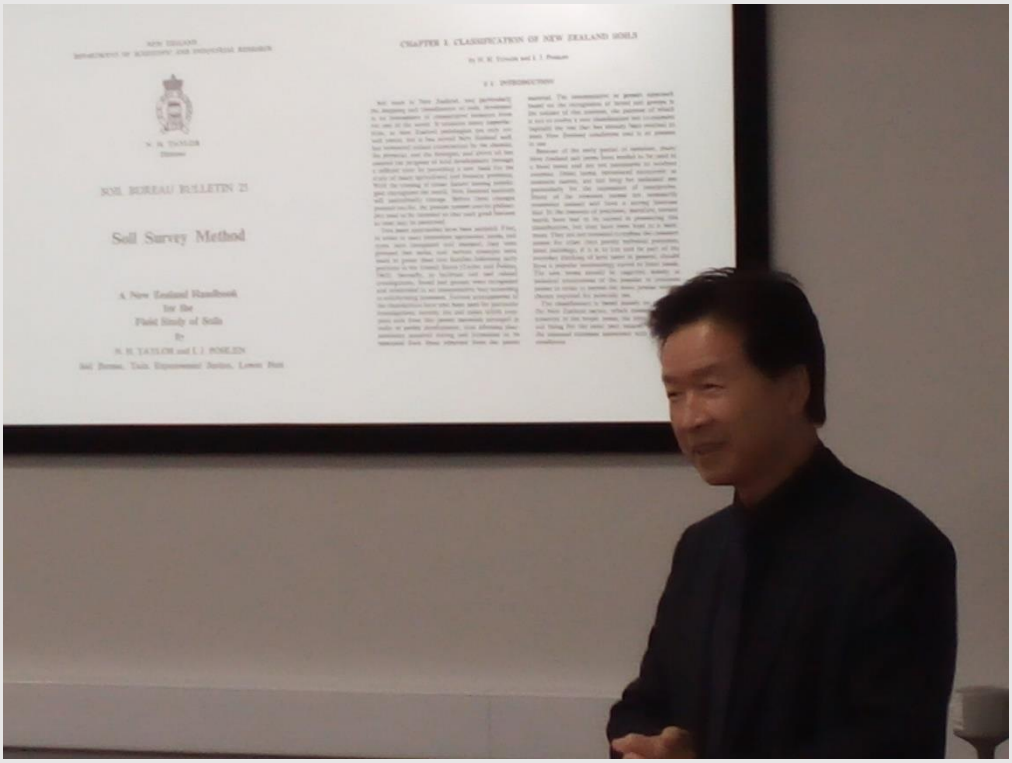
Brent has been working in China on projects for nearly 25 years. PFR has an even longer connection with China that was initiated by (the late) Dr Lairong Li who was appointed in 1941 to the DSIR, PFR's antecedent. Dr Li left New Zealand in 1944, and eventually returned to China, after a stint in a Japanese POW camp as his ship got torpedoed. Dr Li was elected an Honorary Fellow of the Royal Society Te Apārangi in 1979. Brent has been in contact with Dr Li's granddaughter Stella Si, and the Society will now provide her with a re-issued Fellowship Certificate, as the original got 'lost'. He will be able to sign this re-issued certificate as the current Royal Society President. Brent is honoured to be able to reconnect the 'circle' of Chinese-New Zealand Academies.

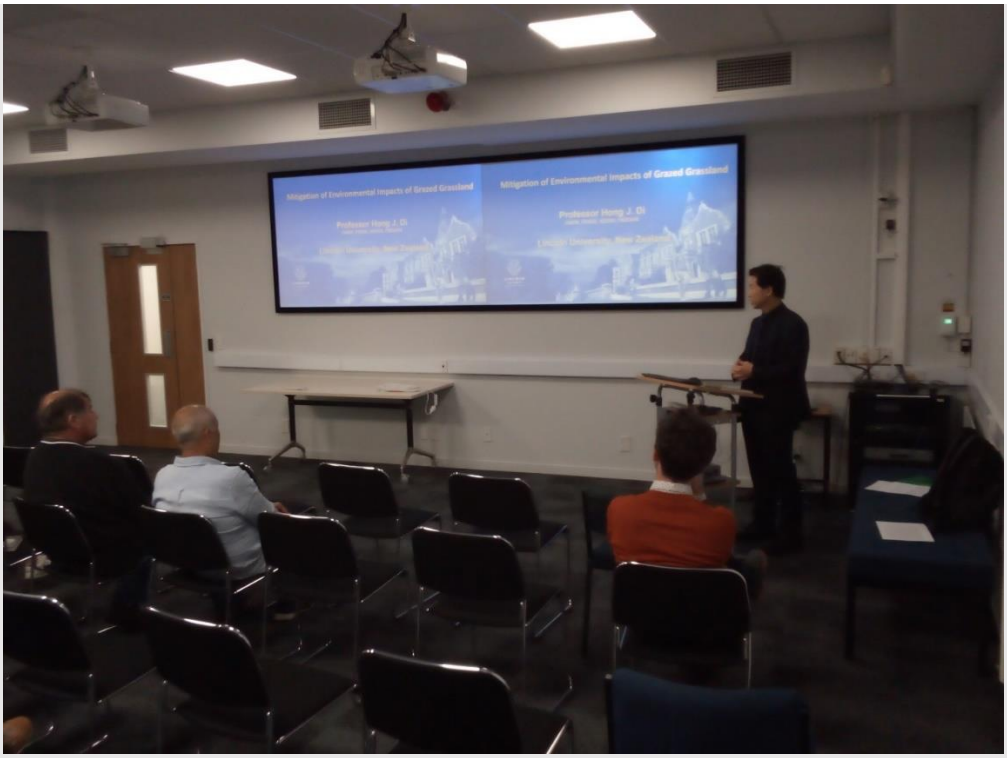


The photo shows Brent encircled by Chen Wang, Vice President of the CAE on his right, and Lin Huang, Director General of International Cooperation CAE, second right, and next to her Chang (Cathy) Liu, Director International Cooperation CAE, along with colleagues from two Universities in Beijing that he collaborates with. Academician Shaozhong Kang, CAU, is on Brent's left. Dr Wei Hu from Plant & Food Research is on the extreme left of the photo. Second from right in the photo is Prof. Xi Benye of Beijing Forestry University. Xi has many connections with New Zealand and Kiwi scientists.

Manaaki Whenua – Landcare Research

Professor Hong Di from Lincoln University presented the NZSSS Norman Taylor lecture in our Palmerston North office. His presentation on 'Mitigation of environmental impacts of grazed grassland' sparked a lot of interest. See awards section for more information.





Hong Di from Lincoln University presenting the NZSSS Norman Taylor lecture

Congratulations to Yuxin Ma, who was awarded the 2023 Margaret Oliver Award by the Pedometrics Commission of the International Union of Soil Sciences.

The Margaret Oliver Award is made biennially by the Pedometrics Commission of the International Union of Soil Sciences. The award is named in honour of Professor Margaret Oliver, and to mark her particular commitment to developing and supporting young pedometricians. The award is made to an early-career scientist, active in pedometrics and in promoting and supporting the discipline who, at the time of nomination had held the degree of PhD for less than six years.

Dr. Yuxin Ma, a distinguished researcher at Manaaki Whenua – Landcare Research, has been recognised for her outstanding contributions to the field of pedometrics, demonstrating leadership and service. With a PhD from the University of Sydney in 2020, Dr. Ma has made significant strides in integrating pedology and digital soil mapping. Her innovative use of mechanistic models to decipher soil formation in multiple dimensions showcases her versatility and creative approach in pedometrics. Dr. Ma's impactful career, spanning various academic and institutional environments in the People's Republic of China, Australia, and New Zealand, has established her as a respected colleague and integral team member. Her dedication and active involvement in the Pedometrics Commission highlight her commitment to advancing soil science. Further information:
http://pedometrics.org/the-margaret-oliver-award-2023/

Paul Mudge and Pierre Roudier gave a seminar at MPI, Wellington, ‘Celebrating World Soils Day 2023: How much carbon is in our soils and what is it doing there?’. Pierre and Paul provided an overview of the wonder of soils and their importance in our lives, and of how much soil carbon we have and what it does. Carbon plays a crucial role in the soil ecosystem – but not all soil carbon is equal!

Kamal Adhikari left our Palmerston North office to join the Department of Energy, Environment and Climate Action, Horsham, Victoria, Australia as a Research Scientist. Kamal was a Post-Doctoral Fellow (Agricultural Greenhouse Gases) with Manaaki Whenua, and previously completed his PhD on reducing ammonia emissions from dairy-grazed pasture at Massey University.

Recent Manaaki Whenua stakeholder publication on our soil research

Issue 17 of Pūtaiao ('science' in te reo Māori), our quarterly publication showcasing the work of Manaaki Whenua. This issue is focussed on soil and land research, and includes:
Soil mapping in Marlborough
S-map expands – Northland, Banks Peninsula, Taranaki, Bay of Plenty
Scouting out soil data - Wairau Valley
Smarter Targeting of Erosion Control (STEC)
Fingerprints point to the sediment source
Keeping urban cities spongy
Maximising use of 'surplus' soils and sediments
How farming and changing irrigation affect nitrogen and phosphorus leaching
SedNetNZ supports land and water planning
Linking soil quality indicators to land use pressure and water quality
Antarctic soils uncovered
Connecting data back to the whenua
Farming the 'smart' way

This issue will be available in mid February.
https://www.landcareresearch.co.nz/publications/putaiao/

Massey University

Influence of applying oil and gas waste to recent sandy soils in Taranaki

The Farmed Landscape Research Centre at Massey University is undertaking long-term soil quality monitoring on land that has received oil and gas waste in coastal south Taranaki. Taranaki is home to an oil and gas industry that uses predominantly synthetic-based drilling mud for exploration and production. The mud is used to lubricate and cool the drill bit and contains weighting agents and corrosion inhibitors. One means of disposing of spent mud is to apply it to land in a process called landfarming. This process involves stockpiling topsoil, recontouring the land to create a flat surface, applying a thin layer of waste and working it into the underlying sand before re-applying topsoil. Natural bioremediation then reduces the concentration of petroleum compounds through degradation. This process has been used in south Taranaki to convert erosion-prone, sandy coastal sites into productive pasture.

Our study area is situated on a last interglacial marine cut bench over Pliocene marine sediments. The bench is overlain by a series of marine and terrestrial cover beds, including dunes up to 20m high. Soils include the Castlecliff and Moston sand (Typic Sandy Recent) on dunes and Egmont black loam (Typic Orthic Allophanic) on loess and tephra further inland. From a Land Use Capability perspective, the sand

country is 7e15, rolling to moderately steep sand dunes which are well to excessively well drained and have potential for extreme wind erosion under pasture. Highly productive 2c2 land underlain by Egmont black loam is located further inland where it is dominantly used for dairy.

Recontouring dunes to create flat paddocks with more even and better control of soil moisture and pasture growth has taken place in coastal south Taranaki for over a hundred years. More recently, landfarming has been introduced where mud application is thought to also increase the water and nutrient retention of sandy soils (McFarland et al. 2009) and therefore improve pasture production (Edmeades, 2013). Deep mixing of the waste into the underlying sand is done to encourage deeper pasture rooting depth and greater resilience to dry conditions. Most of the information to date concerning the influence of oil and gas waste on soil properties comes from compliance monitoring reports and a limited number of New Zealand studies (Taranaki Regional Council, 2011; Cavanagh et al. 2014; Cavanagh, 2015). There is very little information on the physical changes to the soil from landfarming and how that relates to soil quality and pasture production.

Our study aims to address this knowledge gap by establishing long-term monitoring sites to assess the physical, chemical and biological properties of landfarmed soils together with natural dune and recontoured dune controls. Sites have been established by Alan Palmer, Callum Rees, and summer student Lyric Tyler (Figure 1). The first round of sampling is taking place this autumn with repeat sampling occurring on an annual basis.

Figure 1: Adjunct Associate Professor Alan Palmer with summer student Lyric Tyler undertaking fieldwork along the south Taranaki coastline.

Figure 2: Example of dune blowouts in 7e15 land of south Taranaki.

Figure 3: A recontoured area several years after oil and gas waste application. Topsoil was reapplied and the area has been sown into pasture.

References:

Cavanagh, J.E., Booth, L., Stevenson, B., McGill, A., Campion, M. (2014). Biological response of earthworms and soil microbes associated with drilling mud wastes in the Taranaki Region. Landcare Research Contract Report LC1897 for Taranaki Regional Council. 33 p.

Cavanagh, J. E. (2015). Land application of waste from oil and gas wells. Landcare Research Contract Report LC2161 for Ministry for Primary Industries. 34 p.

Edmeades, D.C. (2013). The Taranaki Landfarms; are they “Fit for Purpose”. Taranaki Regional Council. 24 p.
McFarland, M.L., Feagley, S.E. and Provin, T.L., 2009. Land application of drilling fluids: landowner considerations. Texas Agrilife Extension Service Bulletin SCS-2009-08. 5 p.
Taranaki Regional Council (2011). Land farming of drilling wastes: Impacts on soil biota within sandy soils in Taranaki (year 1 of 3). Taranaki Regional Council Technical Report 2011-35. 41 p.

Background sources of phosphorus in New Zealand hill country streams

The Farmed Landscape Research Centre (FLRC) at Massey University is undertaking research in the upper Rangitīkei catchment to understand possible sources of phosphorus to freshwater, including the influence of catchment geology. State of the Environment (SoE) monitoring and reporting undertaken by Horizons Regional Council has recognised the potential influence of catchment geology on Dissolved Reactive Phosphorus (DRP) in waterways. Rivers draining volcanic terrains such as the Mangawhero and Whangaehu have high natural background DRP attributed to the volcanic-acidic nature of the geology (White, 1982; Snelder et al. 2004). This is thought to have led to high DRP loads at SoE sites that have catchments entirely within National Park (McArthur and Clark, 2007).

North Island sedimentary terrains have also been shown to have naturally high phosphorus, particularly areas underlain by limestone and mudstone (Eden and Parfitt, 1992; Parfitt et al. 2007; Ledein, et al. 2007). The geology of the upper Manawatu and Rangitikei catchments is recognised as having high natural phosphorus, meaning it may not always be possible to lower DRP further than the guideline level (Snelder et al. 2004; Parfitt et al. 2007; Ledein, et al. 2007). This is important information from both a landowner and regulatory standpoint, however, identification and full geochemical characterisation of these potential phosphorus sources has never been completed. Furthermore, previous studies have been unable to separate natural background phosphorus inputs from septic tanks, direct stock access to waterways and leachate from historic rubbish dumps, making estimation of relative contributions difficult.

Massey’s FLRC aims to help address this knowledge gap, provide advice to landowners, and inform science-based policy for sustainably managing our freshwater into the future. This includes collecting geochemical data to support our understanding of background DRP levels and inform catchment-specific targets.

Figure 1: Associate Professor Lucy Burkitt and adjunct Associate Professor Alan Palmer assessing a hill country landscape in the Rangitīkei composed of alternating shellbeds, mudstone and sandstone gently tilted to the south.

References:

Eden, D. N., & Parfitt, R. L. (1992). Amounts and sources of phosphate in hill country rocks, south-eastern North Island, New Zealand. Soil Research, 30(3), 357-370.

Ledein, E., Ausseil, O., Roygard, J. (2007). Identifying Point Source and Non-Point Source Contributions to Nutrient Loadings in Water Ways in Three Catchments in the Manawatu-Wanganui Region : Technical Report to Support Policy Development. Report: 2007/EXT/771. 54 p.

McArthur, K., Clark, M. (2007). Nitrogen and Phosphorus Loads to Rivers in the Manawatu-Wanganui Region: An Analysis of Low Flow State. Report No: 2007/EXT/793. 93 p.

Parfitt, R., Dymond, J., Ausseil, A.G., Clothier, B., Deurer, M., Gillingham, A., Gray, R., Houlbrooke, D., MacKay, A., McDowell, R., (2007). Best practice phosphorus losses from agricultural land. Landcare Research Contract Report: LC0708/012. 37 p.

Parfitt, R. L., Frelat, M., Dymond, J. R., Clark, M., & Roygard, J. (2013). Sources of phosphorus in two subcatchments of the Manawatu River, and discussion of mitigation measures to reduce the phosphorus load. New Zealand journal of agricultural research, 56(3), 187-202.mical Cycles 22: GB1026,

Snelder, T., Biggs, B. and Weatherhead, M. (2004). New Zealand River Environment Classification User Guide. Ministry for the Environment, Wellington, New Zealand. Publication number: ME 1026. 144 p.

White E. (1982). Eutrophication in New Zealand lakes, in Water and New Zealand Future, Institution of Professional Engineers, Royal Society of New Zealand Water Conference, 1982, pp 129-136.

Canterbury and Otago

Manaaki Whenua – Landcare Research

The Soils & Landscapes team kicked off their second week back of 2024, with a trip to Rotorua. Nine MWLR and two Lincoln University staff went to describe and sample some potential sites for the 2024 Moana Oceania Soil Judging Competition.

It was a great opportunity to meet more of the team from other sites, share ideas, and collaborate. Soil description and classification require the evaluation of soil morphological and chemical features, and this was a great chance to start "calibrating" ourselves and discuss what we were observing and interpreting within the various soil profiles.

The volcanic Rotorua Lakes Catchment makes for an interesting landscape, with even more interesting soil profiles. Veronica Penny set up the trip, and expertise from Scott Fraser and Emily McKay, who recently mapped parts of the Bay of Plenty for S-Map, gave the group a background on the events that shaped the area. We can't give too much away, but if you want to know more about these soils, you'll have to come and see for yourself at the 2024 Moana Oceania Soil Judging Competition!

The 2024 Moana Oceania Soil Judging Competition will be held in Rotorua between Nov 29th – Dec 1st, 2024, as part of the 2024 New Zealand Society of Soil Science and Soil Science Australia Joint Conference (2nd - 5th Dec). It is an opportunity for anyone (no soils background necessary) to develop practical skills and knowledge around soil descriptions, classifications, and interpretation of soils information. This year's event is expected to be a big one, with international participants from Australia, Pacific Islands and possibly further abroad too!
For more information, visit Soil Judging Competition | NZSSS Association (soilscience.org.nz)

Discussing soil descriptions as a group gathered around a pit.

The group listening in as Scott gives a rundown of the landscape.

Utes parked up in front of an outcrop while the group have a break.

AgResearch

AgResearch's Environment North and South teams have been busy sampling soil and pasture across 10 farms as part of the project 'Advancing soil health on-farm'. On each farm, both conventional and diverse pastures are being assessed with pastures receiving either standard or low nitrogen applications. As well as investigating changes in soil chemical and physical properties, the team is assessing how the soil biology changes in response to the treatments across the seasons.


Soil sampling on one of the Canterbury farms during summer.

Soils in Climate Change: New advances in thinking

Jock Churchman

When I retired as a soil scientist, i.e. when I was no longer subject to the constraints of managers or funding bodies, I started reading books on climate change. I have read quite a few over those 10 or so years, many more than I've read books on soils. Thus, it was nice to find a new book that focuses on climate change from a soils perspective. This is "Ground Breaking: Soil Security and Climate Change"[1], written by Philip Mulvey, a very experienced Australian soil scientist and consultant, together with his daughter, Freya Mulvey, a lawyer and environmentalist. And it tells us something new, something that is left out of all the other books on climate change I have read.

It tells us that soils have been neglected factor in conversations and calculations about climate change, but that their consideration is essential if we are to see and predict the whole course of the climate change crisis we are all now experiencing. Of course, there is carbon sequestration, once the Holy Grail when it came to showing the usefulness of soils for the mitigation of climate change through the uptake and retention of carbon dioxide by soils. Along with others, I have been sceptical of its prospects on a global scale previously[2]. Instead, carbon retention and build-up is a good thing, as I noted in this previous article. To the Mulveys[1], carbon

as organic matter is the key to good soils, environmentally as well as agriculturally, even if they sometimes refer to its build up as ‘sequestration’, a passive process, rather than increasing storage[2, 3], which provides organic matter as an active component of soil and plant ecology.

But I consider that the Mulveys’ unique contribution to soils in relation to climate change is to emphasize the role of soil-based surfaces as heat reflecting surfaces. Global warming, heating or boiling is occurring because of quantitative changes in the blanket that the atmosphere provides to inhibit the heat reflected off the earth. Heat from the sun passes through the atmosphere and lands on surfaces on the earth. Some is absorbed by the surfaces, raising their temperatures, while the rest is reflected back, as infra-red radiation (see Fig. 1)

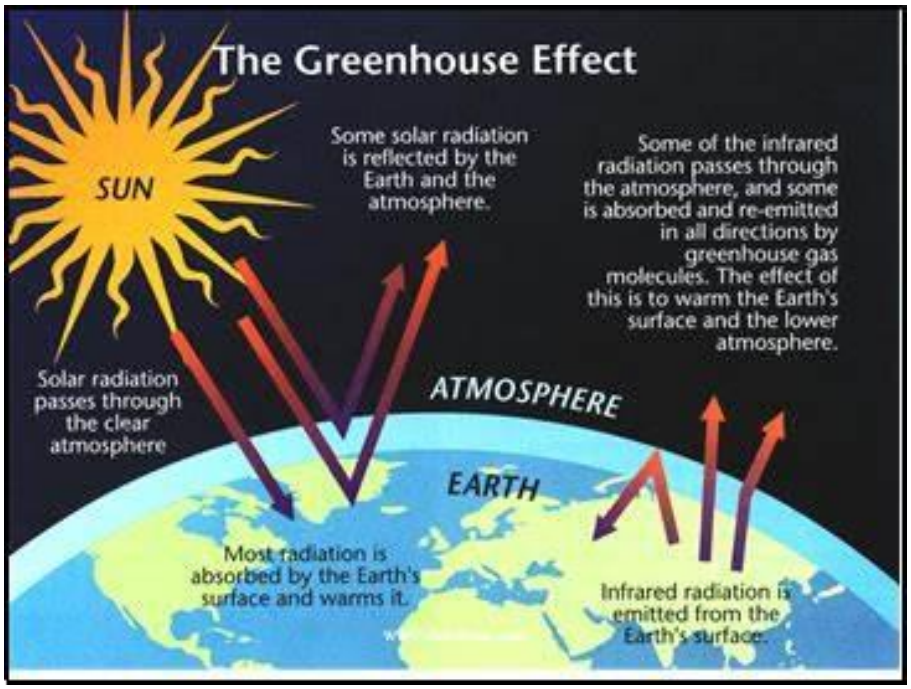


Figure 1. The origin of the Greenhouse Effect

The atmosphere contains a variety of gases, oxygen and nitrogen, which do not inhibit reflected radiation, and the greenhouse gases GHG, principally carbon dioxide, and also water, in the ‘natural’ state. Human activities affect carbon dioxide, which occurs at quite a low concentration in the atmosphere, but is long-lasting (very many years), and also water vapour, albeit that this occurs at quite a high (and varying) concentration, but lasts only a short time (days). Carbon dioxide is normally the main heat-trapping component, but humans have added a number of other heat-inhibiting gases, mainly methane and nitrous oxides. The greenhouse effect actually enables life on earth, but we can have too much of it, which is why we are in a climate crisis, or, at least, heading for one. Prior to that, we had a Goldilocks situation, not too hot and not too cold, so that, for example, humans have been able to survive virtually everywhere on earth.

Rational and informed people in the whole world know this, and are intent on doing something about it, even if only through adaptation to the changes. Most efforts by responsible governments have gone into curbing emissions of GHGs, with pledges in

international forums for dates by which net zero emissions are achieved on their patch. Many companies have done likewise. But the Mulveys point out that they are not tackling a major factor contributing to warming of the atmosphere by curbing emissions alone.

Interestingly, the Mulveys[1] (p. 3) attribute the reluctance of governments to act on the whole problem to a remark by an early modern pioneer on the effect of carbon dioxide on atmospheric warming, Charles Keeling. Charles Keeling (1928–2005) was an American scientist whose recording of carbon dioxide at the Mauna Loa Observatory in Hawaii confirmed the 1896 proposition by Svante Arrhenius[4] of the possibility of anthropogenic contribution to the greenhouse effect and global warming, by documenting the steadily rising carbon dioxide levels4. In 1978, Keeling was asked by President Jimmy Carter to tell him what the government should do about climate change. Keeling replied “the problem was far too complicated for people to understand, so focus on greenhouse emissions”. And they, and other governments, have done so subsequently.

Nonetheless, the earth presents a wide variety of surfaces for the sun to shine upon. These surfaces reflect the sun’s rays to varying extents. And, although there are almost 8 billion people on earth, most of the earth’s land surfaces are empty of people. Some are occupied by large animals, some by mountains, rocks, lakes and rivers, but, even then, the vast majority of the earth surface is land underlain by soil. When the sun’s rays strike the soil and occupying plants, most is split between ‘latent’ heat[1] and ‘sensible’ heat[1], with a small, but important, part being converted to biomass in plants by chlorophyll. Latent heat is used in the phase change of materials from one state to another; in soils, typically, from the ubiquitous water as liquid to water vapour. Sensible heat is that which causes an increase in temperature.

And water is crucial to the reaction of soil to solar radiation. The Mulveys point out the essential role played by the ‘small water cycle’. This is distinct from the hydrologic or water cycle involving water evaporated from the sea evaporating and forming clouds, which lead to precipitation, some of which returns as runoff via rivers to the sea. The small water cycle, by contrast, is driven by water evaporated from land which then can return to the land by mists (in winter), fog, light rain and also thunderstorms (in summer)[1].

Several experiments have identified the factors which affect the reflection of infra-red (i.e. heat) radiation from different natural surfaces (Fig. 2)

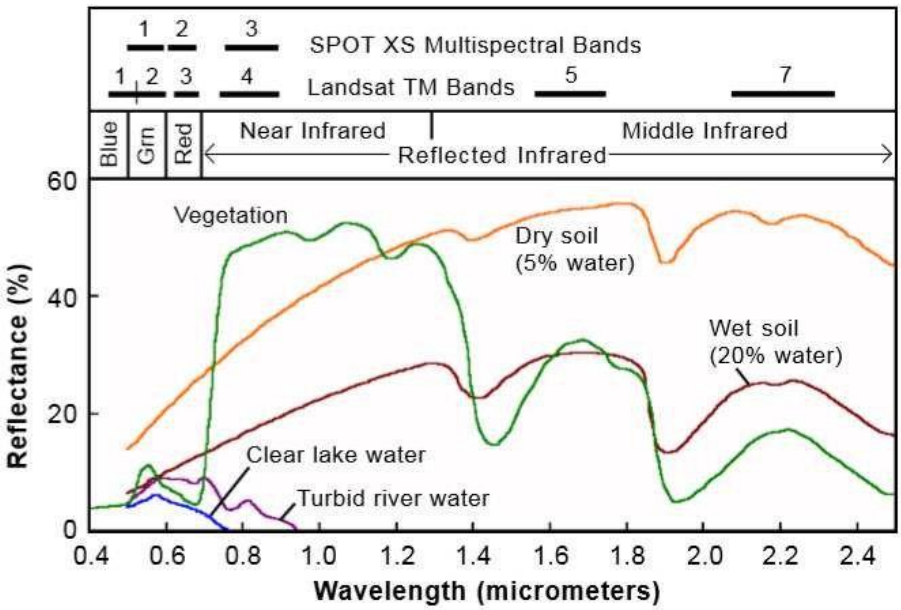


Figure 2. Reflected infrared radiation from different types of natural surfaces.

Broadly, the reflection of infra-red radiation varies with wavelength. Little is reflected from water at all wavelengths, vegetation reflects less than soil over most wavelengths, and dry soil is more reflective than wet soil at all wavelengths. The important effect of water in decreasing reflection of heat is consistent with the role played by the small water cycle in absorbing and using latent heat[1].

A few studies over the years have looked at factors affecting the reflection of radiant energy from soils[5, 6]. Undoubtedly, moisture content was predominant among them. Others were organic matter content and particle size. All of these three factors – and others – can affect the colour of the soil.

The reflectivity of a surface for radiation is known as its albedo. It is the ratio of reflected radiation as a percentage of incoming radiation. Fig. 3 compares the general categories of snow, sand, forest and oceans for their albedo values.

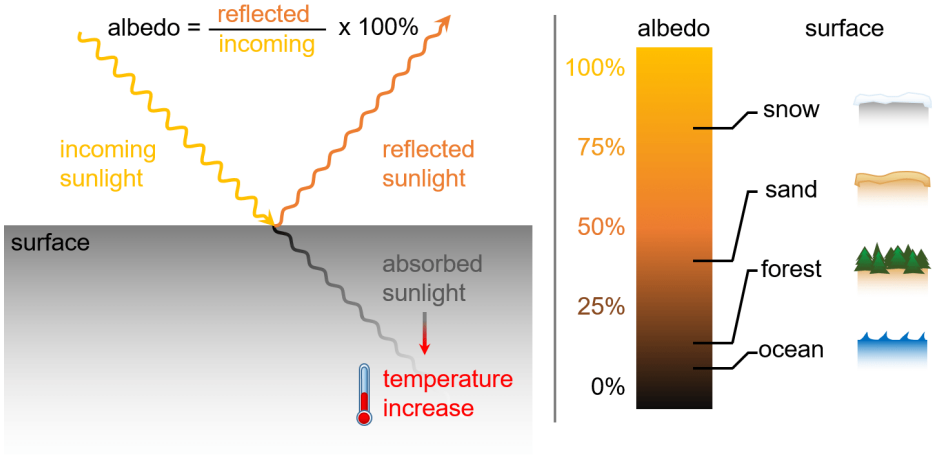


Figure 3. Comparative values of albedos of broad types of natural surfaces.

Of course, providing the landscape with surfaces having optimum albedos is generally ours to manage. A moist landscape is good, albeit if only seasonal. A landscape containing optimum organic matter is also good. And a landscape covered by vegetation is better than a bare one. Even a landscape of native bush is better than one covered by cropland.

This latter point is illustrated most dramatically by an aerial photograph taken above the boundary of the legendary Rabbit Proof Fence[7]in Western Australia. This photograph is shown on the cover of the Mulveys' book[1]. In it, cropland to the west of the fence, i.e. where rabbits can roam freely, is seen to be free of clouds on this particular day. On the eastern side of the fence, where land use is carried on free of rabbits, a complete area of native vegetation is seen to have patches of clouds hovering above. The small water cycle is in operation and the albedo of the area occupied by the native vegetation is lowered.

Of course, the Mulveys' narrative is focussed on Australia, which has a history of poor land-use following unthinking application of farming methods developed in recently glaciated and generally wetter Europe to this ancient land, with soils that are mostly low in organic matter and where the sun shines almost continually for much of the year. Even so, it is even in Europe that 'industrial' farming methods that seek to maximise yields have resulted in depletion and erosion of soils. George Monbiot in the 2022 book "Regenesis"[8] argues that the land everywhere on the planet has been abused and degraded by agriculture. I have discussed Monbiot's radical solution to the problem of obtaining food for the future without wrecking the countryside elsewhere in these pages[9].

At the very worst, it is desertification that is happening in at least parts of Australia. Of course, it is a dynamic system, with warming brought about by increases in GHGs meaning less moisture is retained and organic matter – which helps to hold water - is burnt off, leading to surfaces with increasing albedos, and, ultimately, sand, with its high albedo (Fig. 3). Interestingly, the Mulveys (p. 82) propose moisture as an alternative measure of climate change. They illustrate how formerly reliable rainfall in South Western Western Australia has suffered drops since the 1970s, even continuing into the 2020s.

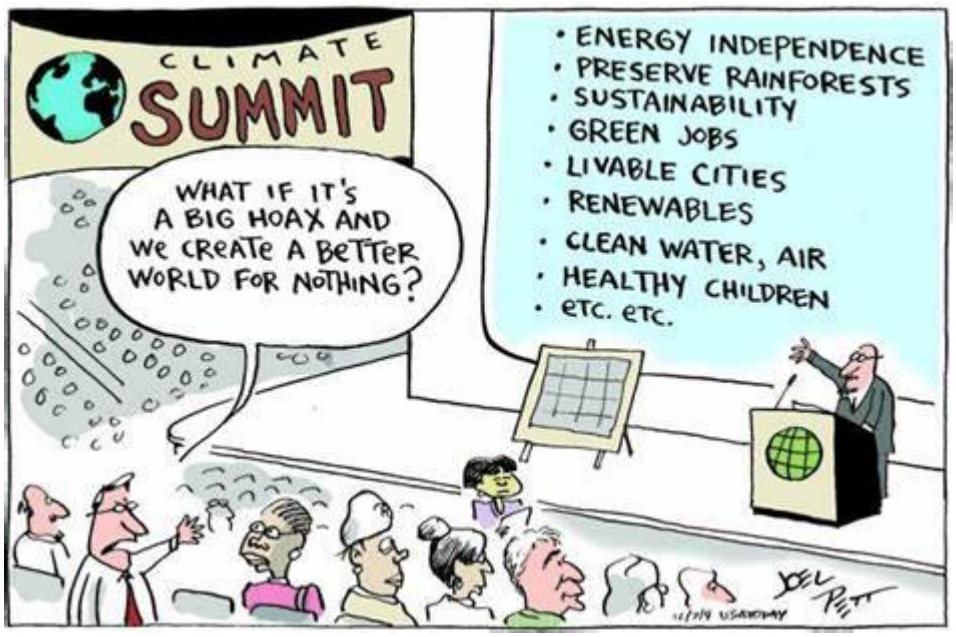
So, what is there to do to about increasing heat reflection off land surfaces? The answer, it seems, lies in more sustainable methods of land use and agriculture. The buzz phrase is 'regenerative agriculture'. I have given a short history of this concept in an earlier piece in Soil News[9]. Australian farmer and scientist (in that chronological order), Charles Massy[10] 'nailed it' by writing of the need to feed the soil, not the plant. In contrast to 'industrial' agriculture where maximising profit is the driver, regenerative agriculture leaves the soil with a higher water holding capacity, a higher organic matter content and generally, darker, so with a decreased albedo. Dry years tend to come and go, of course, with the changes between El Nino and La Nina climate systems. Regenerative agriculture is designed to hold off loss of plant cover in the inevitable droughts. Retention of plant cover is essential for keeping albedos low and minimising reflection of solar radiation, hence heat. Retention of plant cover enhances soil moisture and helps build up organic matter, which itself helps retention of moisture.

The Mulveys hardly mention New Zealand. They give dairy effluent there as an example of an adverse externality of intensive ('industrial') agriculture. On the other side of the ledger, they praise the Resource Management Act of New Zealand as an exemplary way of land managers avoiding adverse effects on the land of others. It seems that land use in Australia is considerably more *laissez faire.* Nonetheless, climate change is happening also in New Zealand and each summer appears to bring more droughts. The effect of these on soil cover and the albedo of the land has to be of continuing concern even in the younger, generally more organic-rich, soils of Aotearoa.

This has certainly not been a review or complete description of the Mulveys' book, which covers more environmental, legal and detailed discussions of 'soil security and climate change', which is its subtitle. I recommend it to you as a good read on the topic.

The message which I have taken from their book is that it is necessary to consider land use and soil conservation or security to give the whole picture on climate change and what we can do about it. That having been said, it is true that the reduction or at least, slowing, of emissions of GHGs is an urgent task that can be achieved through technologically simple but politically and socially difficult measures if the climate is not to go completely out of human control. The land and soils have significant roles to play in providing surfaces for the reflection of solar heat radiation, but our industrial, transport, and, yes also, ruminant animal gaseous emissions are the blanket that keeps getting thicker, faster to trap the reflected heat within our living environment.

It is worth noting that the changes needed to soil and land management to optimise their conditions for mitigating climate change are those recommended in all recipes for sustainable soil management. It is a bit like the cartoon below. If we correct all contributions to climate change, we can't go wrong.



References and Footnotes

1. Mulvey, P. and Mulvey, F. 2023. *Ground Breaking.* Kerr Publishing, Melbourne
2. Churchman, Jock. 2020. New Zealand Soil News 68(3) : 23-29.
3. Chenu, C. *et al.* 2019. Soil & Tillage Research 188: 41-52.
4. *Arrhenius, who won the Chemistry Nobel Prize, thought, as a Swede, that global warming from the combustion of coal would be a good thing in his country's usually cold climate, and also that it would not show for a very long time (centuries). He was only wrong on the latter.*
5. Bowers, S.A. and Hanks, R.J. 1965. Soil Science 100: 130-138.
6. Baumgardner, M.F. *et al.* 1986. Advances in Agronomy 38: 1-44.
7. *Some will have seen the 2002 Australian movie "Rabbit-Proof Fence"*
8. Monbiot, G. 2022. *Regenesis: Feeding the World Without Devouring the Planet.* Allen Lane , London.
9. Churchman, Jock. New Zealand Soil News 71(1): 26-32.
10. Massy, C. 2020. *Call of the Reed Warbler,* revised edition. University of Queensland Press, Brisbane.

Journal of New Zealand Grasslands

The *Journal of New Zealand Grasslands* has recently published its latest edition. Articles often include soil and pastoral research topics of interest to Soil News readers. All articles published are open access, and can be viewed here: https://www.nzgajournal.org.nz/index.php/JoNZG/index

The *Journal of New Zealand Grasslands* publishes peer-reviewed papers with a focus on temperate grassland research. The scope of the journal includes all aspects of pastoral research including agronomy, soils, animals, agricultural extension and farm-systems research. The Journal is owned and published by the New Zealand Grassland Association (NZGA). The Journal has been published since 1932 (prior to 2015 as the Proceedings of the NZ Grassland Association) so provides a long-term resource reflecting agricultural research and innovation.

(Disclaimer: the editor of Soil News is a current member of the New Zealand Grassland Association).

National Soil Action Plan, Australia

Australia's first National Soil Action Plan has been officially launched!

The National Soil Action Plan 2023 to 2028 will address priorities in soil health and long-term soil security or the first 5 years under the 20-year National Soil Strategy.

The National Soil Action Plan 2023 to 2028 for Australia was endorsed by the Minister for Agriculture, Fisheries and Forestry on 28 November 2023 with the support of all state and territory jurisdictions.

The action plan sets out 4 priority actions. These guide the focus and design of support to action on soil by governments at all levels and partners over the next 5 years. All priority actions are linked to the 3 broader goals of the National Soil Strategy:

1. Prioritise soil health
2. Empower soil innovation and stewards
3. Strengthen soil knowledge and capability

Priority 1:
Develop an agreed national framework to support measurement, monitoring, mapping, reporting and sharing of soil state and trend information to inform best practice management, decision-making and future investment.

Priority 2:
Partners to develop a holistic policy and strategy approach where soil function is recognised, valued and protected for the environment, economy, food, infrastructure, health, biodiversity and communities

Priority 3:
Accelerate the adoption of land use and management practices that protect soil and improve soil state and trends.

Priority 4:
Identify and develop the soil workforce and capabilities needed to meet current and future challenges for Australia and the region.

The action plan was developed in partnership with the states and territories, the soil science and research community, non-government organisations, natural resource management organisations and peak industry bodies.

Link to National Soil Action Plan, Australia:
https://www.agriculture.gov.au/agriculture-land/farm-food-drought/natural-resources/soils/national-soil-action-plan

Link to National Soil Strategy, Australia:
https://www.agriculture.gov.au/agriculture-land/farm-food-drought/natural-resources/soils

News from the European Soil Data Centre

Cadmium in topsoils of the European Union
Using the soil samples from the LUCAS soil survey, we estimated the spatial distribution of the concentration of Cd in the European Union (EU) and UK topsoil as documented in the publication (https://doi.org/10.1016/j.scitotenv.2023.168710). Natural factors influencing Cd levels include soil properties (pH, clay), topography,

soil erosion, and leaching. As anthropogenic factors, we identified phosphorus inputs to agricultural lands as the most important for Cd levels.

Global Soil Erodibility
This dataset encompasses global soil erodibility (K) factor maps, with the K factor being estimated through the Wischmeier and Smith (1978) method. The equation incorporates permeability information crudely and indirectly, mainly relying on soil texture details, potentially overlooking factors like vegetation, biopores, and clay minerals. To address this limitation, we incorporated soil hydraulic properties (Ksat) in the K-factor by merging Ksat with soil texture and organic carbon into a modified K-factor dataset. Therefore, we developed K-factor maps of 1 km spatial resolution maps both for the original methodology, the one used in GloSEM and the modified one (Ksat) as documented in the publication (https://doi.org/10.1016/j.scitotenv.2023.168249).

Centennial Celebration & Congress of the International Union of Soil Sciences (19-21 May 2024)
The custodian of soil science will celebrate in 2024 its centennial contribution to the nature and human wellbeing. The event will empower the linkages with different disciplines, policy makers, stakeholders, institutions, and associations to effectively address civil society needs within agriculture, forestry, environment, urban planning, energy, education, and other societal issues. The celebration will occur on May 19th and will be followed by two intense days of congress.

Phosphorus cycle in European agricultural soils
We upscaled the calibrated DayCent model at the European level using data-derived soil properties, advanced input data sets, and representative management practices. Agricultural management scenarios revealed a range of potential changes in the P budget by 2030 and 2050, influenced by the interlink of P with biogeochemical carbon and nitrogen cycles. Paper: https://doi.org/10.1016/j.scitotenv.2023.167143

Abstracts

A global insight on sensitivity of nitrate leaching to drainage in arable cropping systems

Nitrate (NO_3^-) leaching leads to widespread deterioration of water quality. NO_3^- leaching can be regulated by both biochemical and hydrological processes. However, the extent to which drainage accounts for the variation in NO_3^- leaching and the sensitivity of NO_3^- leaching to drainage remain unclear, particularly at the global scale. This raises uncertainties in prioritizing the regulation of hydrological (e.g., drainage) processes for reduced NO_3^- leaching. A global *meta*-analysis was conducted for arable cropping systems to test two hypotheses: (1) Global variations in NO_3^- leaching are explained more by drainage and associated influencing factors (e.g., water input); (2) NO_3^- leaching is more sensitive to the changes in drainage under conditions with lower risks of preferential flow. In this *meta*-analysis, the average NO_3^- leaching loss from arable cropping systems was 22.2 kg N ha^{-1} $year^{-1}$. Water input, followed by N input, were the most influential in explaining global variations in NO_3^- leaching. Compared with NO_3^- concentration, drainage and associated influencing factors explained more of the global variations in NO_3^- leaching losses. NO_3^- leaching was more sensitive to drainage in soils with finer texture and higher

soil organic carbon content, in regions with low to medium mean annual temperature (<15 °C) and medium mean annual precipitation (600–1000 mm), where water input during the measurement period was low (<2 mm day^{-1}), nitrogen fertilizer rates were high (>200 kg N ha^{-1}), and where conservation tillage systems (no-tillage or non-inversion tillage) were adopted. Therefore, more attention should be given to avoiding excessive water application in soils characterized by low risk of preferential flow. Preferential flow reduces the chance for drainage water to interact with NO_3^- in the soil matrix, particularly in areas with high N inputs. While this study has successfully tested our hypotheses, it further highlights the importance of water input management for mitigating global NO_3^- leaching risks, particularly under environments and changing climate conditions more conducive to drainage events.

Li J, Hu W, Beare M, Teixeira E, Cichota R, Chau HW, Di H, Cameron K 2024. A global insight on sensitivity of nitrate leaching to drainage in arable cropping systems. Journal of Hydrology 628: 130516.

Nitrogen and phosphorus leaching losses under cropping and zone-specific variable-rate irrigation

Context. Agricultural land use is intensifying globally. Irrigation and other farm practices associated with intensification, such as cultivation, grazing, and fertiliser application, can increase nutrient losses. Variable rate irrigation (VRI) systems manage irrigation to spatially variable soils and different crops (zones). We lack knowledge on nutrient losses under zone-specific irrigation for mixed cropping systems (combined crop and livestock grazing). Aims. This study evaluated drainage, nitrogen, and phosphorus leaching losses under zone-specific irrigation for a temperate mixed cropping system. Methods. The study site had sheep grazing and crops including peas, beans, wheat, turnips, plantain, and ryegrass-white clover pasture. It had a variable-rate centre-pivot irrigator for two soil zones (free draining Zone 1; poorly drained Zone 2). Drainage flux meters (DFMs) collected drainage leachate, and samples for measurement of nitrogen (N) and phosphorus (P) concentrations. Soil water balance data and statistical modelling evaluated nutrient leaching losses over 5 years. Key results. The mean leaching load of NO_x-N (nitrate + nitrite) across 5 years was 133 (s.d. 77) and 121 (s.d. 97) kg N/ha/year for Zone 1 and Zone 2, respectively. Similarly, the mean leaching load of reactive P across all years was 0.17 (s.d. 0.30) and 0.14 (s.d. 0.14) kg P/ha/year for Zone 1 and Zone 2, respectively. The nitrogen concentrations and loads generally had greater uncertainty in Zone 2. Conclusions. The DFMs worked well for the free draining sandy soil. However, fewer samples were collected in the silt soil, requiring the statistical modelling developed in this study. This study gave a reasonable estimate of annual leaching load means, but the indicators of their within-year variation were not reliable, partly due to differences in sampling frequency. With some exceptions, there was generally more NO_x-N leaching from the free draining Zone 1. VRI provided a system to control irrigation-related drainage and leaching in these soil zones. Implications. Drainage flux meters are more reliable in well-drained than in poorly drained soil. Given the lack of published studies, this study has improved knowledge of nutrient losses under zone-specific irrigated mixed-cropping systems in a temperate climate.

Drewry JJ, Hedley CB, McNeill SJ, El-Naggar AG, Karakkattu KK, Horne DJ. 2024. Nitrogen and phosphorus leaching losses under cropping and zone-specific variable-rate irrigation. Soil Research 62, SR23136 https://doi.org/10.1071/SR23136

Nitrous oxide emission factors for fertiliser ammonium sulphate, diammonium phosphate, and urea

This study determined the nitrous oxide emission factors (EF_1, the percentage of N_2O emitted as a proportion of fertiliser N applied) for fertilisers ammonium sulphate (AS), diammonium phosphate (DAP), and urea under the same field conditions. Trials were conducted on pasture soils across four sites (Waikato, Manawatu, Canterbury and Otago) in New Zealand during late autumn and spring of 2022. The average EF_1 values for urea across all four sites were 0.128% (95% C.I., 0.023% and 0.249%) in late autumn and 0.136% (95% C.I., 0.031% and 0.259%) in spring. The corresponding EF_1 values for AS were 0.125% (95% C.I., - 0.021% and 0.246%) in late autumn and 0.083% (95% C.I., 0.015% and 0.197%) in spring, while for DAP, they were 0.049% (95% C.I., – 0.044% and 0.157%) in late autumn and 0.090% (95% C.I., -0.009% and 0.205%) in spring. The mean EF_1 values across all four sites and two seasons were calculated as 0.132% (95% C.I., 0.016% and 0.269%) for urea, 0.104% (95% C.I., – 0.008% and 0.235%) for AS, and 0.069% (95% C.I., – 0.036 and 0.194) for DAP. No significant differences in EF_1 were observed between the three fertilisers ($P > 0.05$) at individual sites or when considering all four sites collectively.

Luo JF, van der Weerden T, Saggar S, Di HJ, Podolyan A, Adhikari K, Ding K, Lindsey S, Luo DW, Ouyang L, Rutherford A 2023. Nitrous oxide emission factors for fertiliser ammonium sulphate, diammonium phosphate, and urea. New Zealand Journal of Agricultural Research. https://doi.org/10.1080/00288233.2023.2277916

Hand-feel soil texture observations to evaluate the accuracy of digital soil maps for local prediction of soil particle size distribution: A case study in Central France

Digital maps of soil properties are now widely available. End-users now can access several digital soil mapping (DSM) products of soil properties, produced using different models, calibration/training data, and covariates at various spatial scales from global to local. Therefore, there is an urgent need to provide easy-to-understand tools to communicate map uncertainty and help end-users assess the reliability of DSM products for use at local scales. In this study, we used a large amount of hand-feel soil texture (HFST) data to assess the performance of various published DSM products on the prediction of soil particle size distribution in Central France. We tested four DSM products for soil texture prediction developed at various scales (global, continental, national, and regional) by comparing their predictions with approximately 3 200 HFST observations realized on a 1:50 000 soil survey conducted after release of these DSM products. We used both visual comparisons and quantitative indicators to match the DSM predictions and HFST observations. The comparison between the low-cost HFST observations and DSM predictions clearly showed the applicability of various DSM products, with the prediction accuracy increasing from global to regional predictions. This simple evaluation can determine which products can be used at the local scale and if more accurate DSM products are required.

Richer-De-Forges AC, Arrouays D, Poggio L, Chen SC, Lacoste M, Minasny B, Libohova Z, Roudier P, Mulder VL, Nédélec H, Martelet G, Lemercier B, Lagacherie P, Bourennane H 2023. Hand-feel soil texture observations to evaluate the accuracy of digital soil maps for local prediction of soil particle size distribution: A case study in Central France. Pedosphere 33(5): 731-743. https://doi.org/10.1016/j.pedsph.2022.07.009

Bimodal unsaturated hydraulic conductivity derived from water retention parameters by accounting for clay-water interactions: Deriving a plausible set of hydraulic parameters

We developed a novel, lognormal, pore-scale, unsaturated hydraulic conductivity model, K(ψ)Model, which does not require saturated hydraulic conductivity, Ks, as an input parameter. K(ψ)Model is derived solely from hydraulic parameters describing a bimodal,

lognormal, pore-scale, soil water retention curve θ(ψ). The K(ψ)Model is based on the Hagen-Poiseuille equation, which represents the soil as a bundle of parallel, non-intersecting capillary tubes. To improve the modelling of fine-textured soils we introduced a novel model to consider the clay-water interaction. This model assumes that clay-water interaction occurs for soils having more than 30% of clay and an effective matrix porosity greater than 35%. Compared to previously developed models, the K(ψ)Model does not require the use of integrals and can be computed from a spreadsheet and distinguishes between macropore (non-equilibrium) and matrix (equilibrium) flows. The K(ψ)Model gives improved results when the hydraulic parameters are dynamically constrained and when θ(ψ) describes a bimodal, lognormal distribution.

Pollacco JAP, Fernández-Gálvez J, de Jong van Lier Q 2023. Bimodal unsaturated hydraulic conductivity derived from water retention parameters by accounting for clay-water interactions: Deriving a plausible set of hydraulic parameters. Journal of Hydrology 626: 130227. https://doi.org/10.1016/j.jhydrol.2023.130227

Sensitivity analysis of land and water productivities predicted with an empirical and a process-based root water uptake function

Rootzone hydraulic conditions govern root water uptake and transpiration under drought stress. Process-based approaches to predict the soil water status are advocated for an improved simulation of soil hydrology and crop yield. We investigated the sensitivity to system parameters in root water uptake simulation using a process-based function (MFlux) and an empirical function (Feddes) embedded in the SWAP hydrological model, applied to irrigated pasture scenarios in New Zealand. Data from two locations and three soils were used to simulate 42 growing seasons. The sensitivity analysis of both Feddes and MFlux parameters was performed for a rainfed and two irrigated scenarios, one triggering irrigation based on relative evapotranspiration (I-ETr), the other based on common practice using total available water (I-TAW). Results confirm that some parameters of the MFlux function are more sensitive than those from the Feddes function and both functions support the I-ETr criterion to optimize the water use in grazed pastures in New Zealand.

de Melo MLA, van Lier QD, Cichota R, Pollacco JAP, Fernández-Gálvez J, Pahlow M 2023. Sensitivity analysis of land and water productivities predicted with an empirical and a process-based root water uptake function. Journal of Hydrology 626. WOS:001087203600001 https://doi.org/10.1016/j.jhydrol.2023.130241

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