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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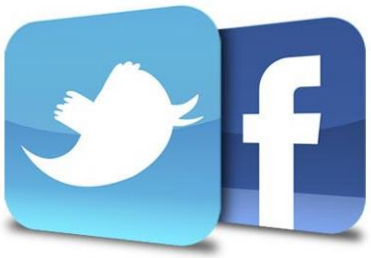


Have you liked us on Facebook? The NZSSS has a Facebook page and Twitter handle (@NZ_Soil_Soc). If you are already a user, please follow us. You can also keep an eye out for new NZSSS posts by checking the feed from our website

Officers of the NZSSS December 2022-2024

President: Sam Carrick (Manaaki Whenua-Landcare Research)
Vice President: Diana Selbie (AgResearch)
Past President: Tim Clough (Lincoln University)
Secretary: Wei Hu (Plant and Food Research)
Treasurer: Natalie Bartlett (AgResearch)

Council: Chris Anderson (Massey University); Kirstin Deuss (Manaaki Whenua-Landcare Research; Early Career Researcher); Brendon Malcolm (Plant and Food Research; Awards); Tanya O'Neill (Waikato University); Pierre Roudier (Manaaki Whenua-Landcare Research); Haydon Jones (Waikato Regional Council; Policy)

From the Editor

Welcome to this issue of Soil News.

This issue features the successful recipients of the NZSSS Awards for 2022, plus the recipients of the Science New Zealand Awards. Congratulations to the award winners who have made significant contributions to soil science.

Many thanks to Gina Lucci who has been a Soil News correspondent for AgResearch for 10 years, and our previous editor. The new correspondent replacing Gina is temporarily Natalie Bartlett.

Soil News is your newsletter – if you would like the opportunity to publish an article, contact the editor.

John Drewry

Past President's report

Over the last two years I have had the privilege of being president of the NZSSS. I have had the pleasure of working on the council with Megan Balks, Sam Carrick, Diana Selbie, Haydon Jones, Chris Anderson, Brendon Malcolm, Paul Johnstone, Pierre Roudier, Tanya O'Neill, Natalie Bartlett, and Kirstin Deuss. Many of whom return to council for another two years. For those standing down, my sincere thanks for your efforts on behalf of the NZSSS. Other non-council roles have been handled by John Drewry (Soil News), Trish Fraser (website support), and Lea Boodee (On Cue). Lea and her team have worked hard behind the scenes providing secretariat and conference support and have become indispensable members of the NZSSS team.

The support of OnCue (Lea Boodee) has allowed the streamlining of membership, communicating reminders for annual subscriptions, and payment of subscriptions. This has facilitated an update of the NZSSS website which, while always a work in progress, is a vast improvement on earlier years. The new NZSSS website was developed by OnCue Conferences, and is now live. It contains a range of helpful resources including Soil News publications, conference details, promotional activities, soil-related events, and a facility to purchase well-known soil books. Our membership remains healthy at ca. 320 members.

The National Policy Statement for Highly Productive Land (NPS-HPL) was released on 20 September 2022. The Society was active in the preparation, promotion, and review of the drafts. The intent is to improve the way highly productive land is managed under the Resource Management Act 1991. The Society will continue to promote the NPS-HPL to protect our valuable soil resource.

It was highly gratifying to see NZSSS members support the recent conference in Blenheim. Other events besides this have included the Joint SSSA-NZSSS conference originally planned for December 2019 in Cairns, Australia; this was finally held on 27 June – 2 July 2021, due to delays related to the Covid-19 pandemic. The conference was held in Cairns, online, and in Hamilton. The conference theme was "Soils, Investing in Our Future" and included a Norman Taylor Memorial Lecture by Associate Professor Carol Smith.

A key feature of the NZSSS conferences is the presentation of the awards, which in Blenheim again highlighted the incredible talent and dedication that NZSSS members (new and old!) have made and continue to make in the arena of soil science.

The annual Farmed Landscapes Research Centre (FLRC; previously Fertilizer and Lime Research Centre) held a special webinar in February 2021 and a face to face meeting in 2022 at Massey University with the themes:

- 2021: Webinar "How do we get more out of our FEPs?", and
- 2022: "Adaptive Strategies for Future Farming".

The biennial WaiBoP Soils Event took place at Waikato University, and a Special General Meeting of the NZSSS was held on 6 December 2021 at Lincoln University

and online and hosted the Norman H. Taylor Memorial Lecture by Professor Leo Condron.

The NZSSS continues to liaise with other societies (Soil Science Society of Australia, Royal Society of New Zealand, International Union of Soil Science). A survey of NZSSS membership was developed and released in 2021. It is intended that this will be a regular survey to track the interests, concerns, and demographics of Society members. An initial outcome of this survey is the early career researcher award and early career member on NZSSS council.

Soil News is now shared via the website with members accessing it using a password shared via email. This quarterly newsletter continues to be the main forum for sharing soil-related information and community activity. The cycle is still four issues per year in approximately February, May, August and November. While 'Soils in the New Zealand Landscape' continues to be available in individual chapters on the NZSSS website and free to download. Some additional hard copies have been printed and are available for sale on the NZSSS website.

A big thankyou to all members of the NZSSS for your support and enthusiasm over recent years and I look forward to the years ahead.

Tim Clough
Past President

Celebrating success – recipients of the NZSSS Awards for 2022

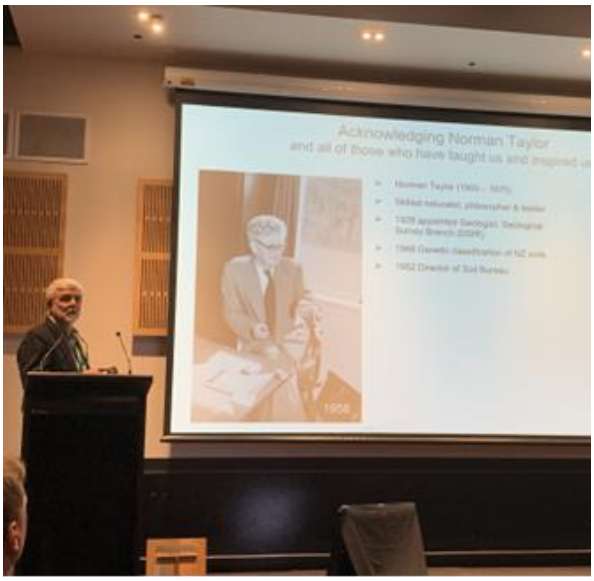
Compiled by Dr Brendon Malcolm, NZSSS Awards Convenor (2017-present)

The 2022 biennial NZSSS conference held in Blenheim was an excellent opportunity for the Society to honour and celebrate the success of those who have made significant contributions to soil science. On behalf of Council, congratulations to all those who received awards.

The awards presented, and the recipients of those awards, are briefly profiled below.

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 recipient of the Norman Taylor Memorial Award for 2022 was **Dr Mike Beare**. Mike gave an excellent talk to conference delegates that summarised some of the fascinating science discoveries over the course of his prolific research career. The title of his lecture was: "Soil Organic Matter and Soil Structure: From Molecules to Mechanisms to Management".



Photos: Brendon Malcolm

Mike is a Principal Scientist in the Sustainable Production Portfolio at Plant & Food Research and an Adjunct Professor in the Faculty of Agriculture and Life Sciences at Lincoln University. He completed BSc (1980) and MSc (1983) degrees in Ecology at the University of Oklahoma and a PhD in Agroecology at the University of Georgia (1989) in the USA, before moving to New Zealand in 1993 to take up a position as soil scientist at Crop & Food Research (now Plant & Food Research). Mike's Research interests have centred on the composition and function of soil organic matter and soil structure and their role in soil fertility, soil C sequestration and greenhouse gas emissions and the management of agricultural production systems to sustain productivity and mitigate adverse environmental impacts. He is Fellow of the NZ Society of Soil Science, the Soil Science Society of America, and the American Society of Agronomy. Mike has served on the editorial board of three international journals and as the Co-vice Chairman for Commission V (Soil Biology) of the International Union of Soil Science (1998-2002). He has authored/co-authored more than 190 peer-reviewed scientific publications.

Life Membership of the Society

Life Membership of the Society recognises outstanding service to the New Zealand Society of Soil Science. Our very deserving recipient for 2022 was **Dr Megan Balks**.

Photo: Brendon Malcolm

Megan is a Fellow of the New Zealand Society of Soil Science, and was honoured as the NZSSS Norman Taylor Memorial lecturer in 2008 (the first women to achieve either of those awards). Having formerly served on Council from 1991-1997, Megan returned to the NZSSS Council (in c. 2012) after a break of 15 years and has just finished her stand as Immediate Past President of the Society. She has also served two terms on the Waikato Conservation Board (including one as chair) and two terms on the Board of the QEII National Trust. She convened one of the Wai-BOP Soils regional meetings

and the NZ part of the hybrid joint NZ-OZ soils conference in 2021. In 2019 she convened SouthCOP, an international conference on Cryosols in Queenstown. In 2021, she co-authored (with Allan Hewitt and David Lowe) a new text book on the soils of New Zealand ("The soils of Aotearoa New Zealand"), the first such book to be published in more than 30 years.

Megan taught soil and environmental sciences at the University of Waikato for 30 years, particularly focussing on large first year classes, and was Chairperson of the Department of Earth and Ocean Sciences for two terms (6 years). She retired from the university in early 2018. Megan has supervised (as chief supervisor) over 50 successfully completed graduate theses, on a wide range of soil-related topics, many in collaboration with CRIs and regional councils. Megan currently serves on the Intergovernmental Technical Panel for Soils where she represents New Zealand, Australia, and the Southwest Pacific.

Megan has been an outstanding and generous advocate and leader for soil and environmental science in both university and public communities, and in the NZ Society of Soil Science.

The L.I. Grange Medal

The L.I. Grange Medal is awarded for outstanding service to New Zealand soil science and commemorates Dr Leslie I. Grange's extraordinary leadership and service to New Zealand soil science. In 2022, the Grange Medal was awarded to **Emeritus Professor Keith Cameron**.

Photo: Carol Smith

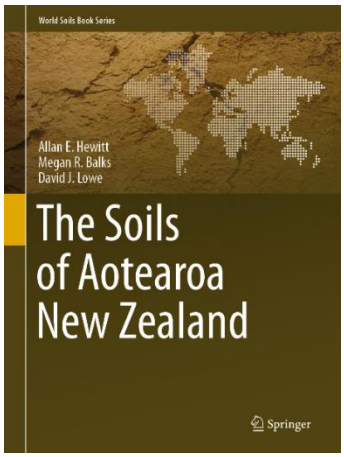
Keith has made an extraordinary contribution to the promotion and advocacy of soil science through his outstanding publications, outreach/extension activities, advocacy

of sustainable land use practices, mentorship of students and staff, outstanding research management and development of research facilities, as well as promoting soil science in the media. Founder and former Head of 'Centre for Soil & Environmental Research' at Lincoln University, Keith was President of New Zealand Society of Soil Science from 1992 to 1994 and Member of NZSSS Council from 1988 to 1996. He is a Fellow of several of NZ's leading primary sector Society's, and in 2008 he was appointed by Her Majesty the Queen as an Officer of the New Zealand Order of Merit for 'Services to Agricultural Research'. Keith has been a strong advocate for sustainable land use practices, which has been the focus of his research and teaching for the past 40 years at Lincoln University. For example, with Emeritus Professor Ron McLaren he wrote the soil science textbook "Soil Science – Sustainable Production and Environmental Protection".

Keith is a strong advocate for the protection of highly productive soils for food production, especially against expansion of urban development, but one of Keith's greatest contributions to soil science is that he has supervised over 50 soil science postgraduate students.

The Leamy Award

The M.L. Leamy Award commemorates the outstanding ability and contributions to New Zealand soil science of Michael Lucas Leamy, and recognises meritorious contemporary work. The award is made to the author or authors of the most meritorious New Zealand contribution to soil science, published in the past three years.



In 2022 the Society had pleasure in presenting the Leamy award to the authors of the book "The Soils of Aotearoa New Zealand" – the late **Dr Allan Hewitt**, **Dr Megan Balks** and **Dr David Lowe**.

The book, published by Springer as part of the World Soils Book Series (WSBS), and about ten years in the writing, is the first general text on the soils of New Zealand to be published in a generation. The book disseminates a vast array of information synthesised in a well organised way that is very well written and presented. It provides an up-to-date overview of the soils of New Zealand structured according to the New Zealand Soil Classification (NZSC) that has been in use in New Zealand since 1992. The book includes equivalent terms for NZSC classes using the international soil classification systems, Soil Taxonomy and World Reference Base.

Left to right: Dr Allan Hewitt (Photo: David Lowe); Dr Megan Balks (Photo: Errol Balks); Prof. David Lowe (Photo: Victor Baskin Coffey)

The Society would also like to sincerely congratulate the authors on the book winning the Soil Science Australia's JK Taylor award, announced at their Society's AGM in December. See below for a brief report on this award.

SOIL SCIENCE AUSTRALIA

Letter from SSA (7 Dec 2022) to co-authors Hewitt, Balks, and Lowe

"On behalf of Soil Science Australia, I would like to congratulate all three authors of "The Soils of Aotearoa New Zealand" for winning the JK Taylor medal. The award was announced yesterday [6 Dec 2022] at the Soil Science Australia AGM.

The judging committee commented that this book is a resource that will be invaluable for all who want to know more about New Zealand soils. It is incredibly well written and easy to read. There is a lack of jargon, and the book is very accessible to farmers, students, extension workers, and the public. Having only three individual authors, it has a consistent writing style through the entire text, good editing for the length of text for each sub-topic and thoughtfully chosen diagrams and photos, including hand-[drawn] artwork by Allan Hewitt."

2016 winner: Dr Jock Churchman (expat NZer) for book "The Soils Underfoot"
1992 winner: Dr Les Molloy (NZer) for book "Soils in the NZ Landscape"

JK Taylor OBE Medal

The JK Taylor OBE Gold Medal in Soil Science is awarded for excellence in both research and the reporting of that research by publication. The award recognises the most meritorious research publication(s) in any form including papers, books, maps, videos, films, and other forms acceptable to the Taylor Medal Committee. The award winner receives a medal and certificate.

The award is open to soil scientists who have worked in Australia and New Zealand. Eligible research publications are normally those published in any format from January onwards in the year following the previous award of a JK Taylor Medal. The research communication subject must deal with soil research related to Australian and/or New Zealand soils and must reflect the results of a soil scientist's own work in the field of soil science.

Previous medal winners

2020	Vinod Phogat
2018	Peter Kopittke
2016	Gordon (Jock) Churchman
2014	J. Tisdalll and M. Oades
2010	R.E. White
2008	A. McBratney and B. Minasny
2006	S.E. (Sally) Smith
2002	D.R.Strong
1998	O.T. Denmead
1996	P.M.Chalk and C.J. Smith
1992	L.F. Molloy
1988	N.J. Barrow
1984	R.J. Coventry

The L.C. Blakemore Award

The L.C. Blakemore Award honours the outstanding ability and contributions to New Zealand soil science of Les Blakemore and recognises meritorious contemporary work by technicians. The recipient of the Blakemore award for 2022 was **John Dando** from Manaaki Whenua – Landcare Research.

Photo: John Drewry

John has made a significant contribution to soil science during the last two years, and over his 29 years in soil physics. He has contributed to field and laboratory analyses on soil structure, tillage, soil compaction, soil water retention and water movement in agricultural soils, soil properties of urban landscapes and engineering, and physical properties of exotic and native forest soils. Recent activities include analysing soils for soil physical properties for advancing 'S-map next generation', 'Soil Health and Resilience', nitrous oxide, and many commercial needs.

John has an undisputed leading reputation for excellence in soil physics technical support in New Zealand, and contributes greatly to post-graduate student research. In the last two years he mentored a new technician to assist with a challenging year due to covid, and commenced mentoring new full- and part-time laboratory technicians. Passing some of his many soil physics skills on during this year has been critical to the future of soil science research.

The Fertiliser Association Award

Photo: Brendon Malcolm

The Fertiliser Association award 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 PhD students entering their 3rd year of study, working on the properties, productivity or sustainability of NZ's soil and land resources.

The recipient of The Fertiliser Association award for 2022 went to **Chris Chisholm** of Lincoln University.

Chris is currently completing his PhD under the supervision of Professor's Hong Di and Keith Cameron, studying the abundance and activity of complete ammonia oxidiser bacteria in New Zealand soils. Since starting his PhD Chris has submitted a paper to Science of the Total Environment, and a second paper is in draft form. Chris is considered by his supervisors as someone who has the right motivation, the intellect and the right attitude to become a successful research scientist who will make a major contribution to advancing soil science and agriculture in general.

This award is sponsored by the Fertiliser Association of New Zealand, with a stipend of $5,000. We are hugely grateful to the Fertiliser Association of New Zealand for sponsoring this award.

The Morice Fieldes Memorial Award

Photo: Brendon Malcolm

The Morice Fields Memorial Award recognises a PhD theses from the previous calendar year of exceptional merit. In 2022 the Society awarded this to **Balin Robertson** of Lincoln University for his thesis *'The effect of rock fragments on the water retention properties of New Zealand stony soils'*. Judges noted that the thesis followed a good scientific investigative process and demonstrated a strong application of soil physics and pedology with good links to implications for nitrogen leaching and land use policy.

The Sir Theodore Rigg Memorial Award

Photo: Brendon Malcolm

The Sir Theodore Rigg Memorial Award recognises a Masterate theses of exceptional merit from the previous calendar year. **Allycia van de Laar**, University of Waikato, was our recipient of the award for 2022, for her thesis *'Limited Changes in Microbial Respiration along a Geothermal Gradient'*. Judges noted an excellent writing style with good clarity, demonstration of a deep understanding of the subject area, and conceptually a very relevant topic given the potential feedback loops of global soil warming on soil respiration and soil carbon storage.

The TW Walker Prizes

The TW Walker prizes are presented to students who deliver the best oral and poster presentations at the NZSSS biennial conference. This year, award winners were **Helena Ruffell** and **Chris Chisolm** for best oral and best poster presentation, respectively.

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 2022, the recipients of the undergraduate prizes were **Marion Dumaine** (Lincoln University), **Baylee Deacon** (Massey University), and **Holly Hay** (University of Waikato).

Soil Judging

During the weekend prior to the conference, the 2nd New Zealand National soil judging competition was held near Okaramio, south of Havelock. The soil judging competition had previously been for students only, but new categories for working professionals (team and individuals) were introduced into the competition and proved to be a real success. 23 people participated across 7 teams (4 working professionals, 3 student), and individual entrees included 14 working professionals and 9 students. The competition consisted of 1 ½ training days where participants experienced 5 different pits, representing the range of soils on the farm. The competition day opened with drizzle that fortunately cleared to sunny conditions, allowing everyone to complete 2 team pits and one individual pit.

The results from the various categories are given below.

Working Professional Team

1st Place: "***Sore Loesses"*** – Tapuwa Marapara (ORC), Courtney Wright-Watson (UC), Alice Weatley-Wilson (Waikato RC), Hadee Thompson-Morrison (ECan)

2nd Place: ***"Dirt Bags"*** – Lauren O'Brien (MWLR), Jason Barry (OP)

3rd Place: "***Ploughing the midnight oil"*** – Ann Baker, Stewart Field, Glen Kirkwood (Te Pukenga), Junqi Zhu (PFR)

Student Team

1st Place: ***"Soils are our JAM"*** (Lincoln University) – Julie Gillespie, Amy Wells, Meila Picard
2nd Place: "***Pit stains"*** (Lincoln University) – Louisa Hall, Lara Noelte, Kaitlin Watson, Heidi Allan
3rd Place: ***"Pedologeniuses"*** (Lincoln University) – Lucy Bell, Sherry Che, Carys Luke

Individual Working Professional
1st Place: Hadee Thompson-Morrison
2nd Place: Stewart Field
3rd Place: Matt Oliver

Individual Student
1st Place: Louisa Hall
2nd Place: Heidi Allan
3rd Place: Kaitlin Watson

The first two placegetters in each individual category received a copy of "Soils of Aotearoa New Zealand". Thank you to David Lowe for sponsoring this wonderful prize.

A special thanks also to the following people for organising and running the event: Carol Smith, Matt Oliver, Veronica Penny, Josh Nelson, Josie Mazzetto, Roger McLenaghen, Kirstin Deuss, Shana Dooley and Jessie Ross.

Thank you to the sponsors of the event: Tony and Joy Redwood (property owners), Landsystems (Reece Hill), Manaaki Whenua – Landcare Research, Lincoln University and Marlborough District Council. And finally, thank you to Sarah Cowan and her Boost cart for the coffees and ice creams during the event.

Pit monitor Kristin Deuss (MWLR) helping out "Soils are our JAM" student team

Photo: Carol Smith

Team "Sore Loesses"

Photo: Carol Smith

Josh Nelson (Lincoln University) briefing the participants on competition morning

Photo: Carol Smith

Congratulations again to all our deserving award winners for 2022!

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

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

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

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

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)

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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
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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

K Tate
B Clothier
G Rys
M Hedley
F Curran-Cournane
K Cameron

NZSSS Awards 2023

New Zealand Society of Soil Science Awards 2023

Nominations for the following awards open **1 March 2023** (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. 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 2023	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 Fertiliser Association Award	Annually	31 July 2023	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	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.

			department that nominates them.	
The Morice Fieldes Award	Annually	31 July 2023	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 2023	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 2023	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 2023 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 2023	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

Science New Zealand Awards

In December 2022, the Science New Zealand Awards were held in Wellington. This year's annual awards, hosted by Minister Verrall, celebrated 24 awardees across three award categories - Early Career Researcher, Individual / Lifetime Achievement and Team. A Supreme Award winner was chosen from the 24 awardees.

Supreme Award winner: agricultural greenhouse emissions project takes out top science award

A research team whose work has significantly lifted the accuracy of measuring and reporting greenhouse gases, to better track progress and help find solutions, has won the Supreme Award at this year's Science New Zealand Awards.

AgResearch's Agricultural Greenhouse Gas Inventory Development Team has produced "excellent and significant science on an important topic for New Zealand", according to the judges for the annual awards, which include entries from New Zealand's seven crown research institutes and Callaghan Innovation.

"What is particularly impressive is that between the team members they have made a sustained contribution over a number of years," the judges said. "There is also a very high level of engagement with a broad range of stakeholders across New Zealand and internationally which is ensuring their results are being used for policy design and monitoring."

The team - led by senior scientists Cecile de Klein, Tony van der Weerden, Jiafa Luo, Stefan Muetzel and Arjan Jonker - has been able to show through its work that estimates of nitrous oxide and methane emissions should be significantly adjusted, compared to previous calculations using former standard methods from the Intergovernmental Panel on Climate Change (IPCC).

With support of partners, the AgResearch scientists guided the development of what is known as country-specific “emission factors” to improve the accuracy of calculating New Zealand’s agricultural greenhouse gas emissions estimates. Emission factors relate the quantity of an emitted greenhouse gas to a specific activity, such as fertiliser application. This is critical for New Zealand given methane and nitrous oxide from agriculture make up approximately half of the country’s greenhouse gas emissions, compared to about only 10 per cent in other developed countries. The IPCC prepared guidelines in 2006 for assessing national greenhouse gas emissions, however many of the IPCC’s default values were based on Northern Hemisphere research, where farming systems are different to those in New Zealand.

The NZ-specific emission factors developed by the team were incorporated into the Ministry for Primary Industries’ national agricultural inventory, which is now considered one of the best inventories in the world. And with every new update, the accuracy of the estimates has been improved by the research from the team.
“It is fantastic to have the work of the team recognised like this,” says senior scientist Tony van der Weerden. “But the biggest thrill of all for us is knowing that the research is making a real and measurable difference for New Zealand. We all know the challenge of climate change confronting us, and that agriculture is New Zealand’s single biggest contributor, so we all need to act. By better understanding the challenge and the extent of these greenhouse gases, we can not only better understand how we are tracking as a country, but also what tools and approaches could be most effective in reducing emissions.”

“This award is truly the result of a team effort from people across AgResearch, supported by our collaborators at Manaaki Whenua – Landcare Research, Plant & Food Research and Lincoln University.”

This the second consecutive year that AgResearch has won the Supreme Award in the Science New Zealand Awards, both recognising cutting edge and globally relevant research in the climate change area. The full list of Science New Zealand Award winners for 2022 can be found at: https://sciencenewzealand.org/news-and-events/awards/

(Much of the information above was from an AgResearch Media Release 7 December 2022)

Individual /Lifetime Achievement Award: Surinder Saggar

Professor Surinder Saggar was awarded an Individual/Lifetime Achievement award. For over 50 years Professor Saggar has built an international research reputation in agricultural greenhouse gas sources and sinks, and the microbial processes regulating the loss of agricultural nitrogen to the atmosphere. He has contributed widely to the understanding of the environmental chemistry of national and global agricultural systems and has a long track record in engagement with end-users. With 156 peer-reviewed papers, over 9,000 citations, 15 books/book chapters, and 108 conference proceedings to his name, Professor Saggar is among the world’s top 1% of scientists for career-long citation impact in agronomy and agriculture.

He is a truly international scientist, with worldwide collaborative research contacts and many international guest academic posts, including guest/visiting professorships at the Chinese Academy of Agricultural Science, the Universidad De La Frontera, Chile, and the Japanese Society for the Promotion of Science. He is currently a Senior Researcher at Manaaki Whenua and Adjunct Professor at Massey University.

Further information on all award winners:
https://sciencenewzealand.org/news-and-events/awards-2022/

Professor Surinder Saggar (second from left) receiving the Individual/Lifetime Achievement award.

In recognition of Mike Hedley: fate of fertiliser in soil

A special issue from the journal 'Nutrient Cycling in Agroecosystems' has been published. It's in recognition of Mike Hedley's extensive contribution to nutrient research.

The article brings together papers that examine topics studied during his career. Professor Mike Hedley, a soil scientist is now retired and living on the shores of Lake Taupo. In 1975 Mike undertook a PhD on the biological availability of particulate phase phosphorus, at Massey University in Palmerston North. After a post-doc, he returned to Massey University and spent the next few decades researching fertiliser quality, the properties of reactive phosphate rock, resin soils tests, and P, S and K cycling in pasture soils.

The article states, “Mike’s role in research on nutrient loss in intensive pasture systems and associated mitigation options such as effluent management, duration-controlled grazing, the use of new pasture species and opportunities for N attenuation in soil and groundwater has had a fundamental impact on New Zealand’s agricultural industry”.

The full article is available below. See also the other papers in that journal issue: McDowell, R.W., Burkitt, L.L. In recognition of Mike Hedley: fate of fertiliser in soil and mobilisation of recalcitrant nutrients. Nutrient Cycling in Agroecosystems 124, 131–134 (2022). https://doi.org/10.1007/s10705-022-10243-z

Influence land and water data accessibility – in 4 minutes

Our Land and Water has produced a short survey on land and water data accessibility.

Your voice matters in shaping the future of land and water data accessibility. Take just 4 minutes to complete the Our Land and Water survey and identify the tools you use to obtain land and water information. Your important contribution will help us prioritise which of the many datasets are linked from a new digital gateway, ensuring this information is easily accessible to all.

Your participation will have a direct impact on the development of this crucial resource. Click now to complete the survey and help us create a more informed future for land and water management. www.finddata.co.nz/#Survey

Brewing a climate change solution: does the answer lie in the soil?

Jock Churchman
jockandjan@gmail.com

Mention soils and action on climate change and most think immediately of carbon sequestration[1-3]. The jury is still out on its particular usefulness, with many[1-3] questioning both its likely contribution to the mounting climate crisis and also its practicality, not to mention the measurement challenges it poses.

As the world just passes a human population of 8 billion, the challenge of giving them all enough food for life remains. We have come close to being capable of feeding the planet[4], even though unequal distribution still leaves about a billion people perpetually hungry and probably millions unhealthily overfed at the same time. But the noble aim is greatly frustrated by increasing climate trends and disasters.

Given all that, I was both surprised and encouraged by a recent book "Regenesis" by George Monbiot[5]. The author is well-known as an environmental writer for *The Guardian.* He has strong views, many of the "we're all going to hell in a handbasket" ilk. I once heard him speak, at a Festival of Ideas in Adelaide, about 20 years ago, and was impressed, and also chastened. I knew he came from Conservative stock in the UK but did not know until this book, subtitled "Feeding the world without devouring the planet", that he is a graduate in zoology from Oxford. And it shows in this book. Not only that, this book offers hope of the type I did not expect from him.

It turns out that he is very keen on soils and particularly on their biology. In a few early pages, in Chapter 1, "What lies beneath" he outlines the biology of soils in a quite poetic voice. He also draws parallels between microbial life in soils and those in the human gut. He believes that largely unexplored soil bacteria in the rhizosphere of plants may even help replace antibiotics used in medicine that are becoming resistant to current treatments. But that is by-the-by. And also, probably not surprising to those readers schooled in soil biology. But I wasn't. My 40 or more years in soil research were mainly spent on the mineral soil skeleton, only latterly coming to appreciate biology through my supervision of students investigating the possibility of the sequestration of carbon emissions is soil[6].

To Monbiot, the defining aspect of life in the soil is their complexity. "Like all complex systems, it seeks its own equilibrium", he writes. In farming it, we disturb that equilibrium. He is so impressed with the self-sustaining web of life in soils that he uses it as a model for the discussion of other complex systems. These include the world food system. As it exists today, it not only fails to provide food for all but it also contributes greatly to many environmental woes, including above all to continuing climate change and diminishing biodiversity.

One third of the world's greenhouse gas emissions are produced by the food system, we are told by Monbiot. Our battle to mitigate climate change tends to concentrate

instead on energy generation methods and means of transport. Monbiot insists that we look to land use to correct our climate course. To him, farming is a major villain.

The effect of farming on biodiversity becomes clear when we hear that, by 2050, the extra farm animals on the planet will weigh 400 million tonnes. This is massive even compared with that of the extra humans, which will weigh about 100 million tonnes in the same time. The number of farm animals are growing more than twice as fast as that of even us fast proliferating humans. There is little room, food or water left for other animals. And plants, especially trees, don't do too well, either.

The main solution proposed by Monbiot is in the use of microbial fermentation to produce our food. In other words, our food can come by a brewing process, in tanks (see Figure 1). He cites a Finnish scientist Dr Pasi Vainaki whose website https://solarfoods.com describes the process used for producing Solein, meaning "protein out of thin air" using "a technology that uses electricity to produce hydrogen which is combined with carbon dioxide, water, vitamins and minerals to feed and grow a microbial biomass that can be used as edible protein"[7]. As Monbiot writes "the species Vanaika uses draws its energy neither from photosysnthesis nor from the products created by other organisms, but from hydrogen". The electricity should come from renewables, of course and it is noteworthy that carbon dioxide, of which we are accumulating a great deal, is one of the reactants.

Figure 1. Brewing equipment. For beer in this case, but could be used for microbial fermentation

The solution is farm-free food. It is radical, albeit simple. As an example of its efficiency, he cites Tomas Linder, a Swedish agricultural scientist, who compared the area growing soybeans in the US, 36.5 million hectares, with the land area required to obtain the same amount of protein by growing bacteria, which is just 21,000 hectares[8]. This is 1,700 times less area that is required for growing soybeans.

So here is Monbiot on the outcome of applying this radical method of producing food (p. 188): "While crop plants take months to grow, the bacteria in these tanks double every three hours. So, if you maintain good growth conditions, you can harvest them eight times a day, every day of the year. *This technology could release almost all of*

the land currently needed to produce protein, whether it comes in the form of plants or animals."

And further (p. 189): "We could withdraw our dire impacts from great tracts of the planet that we have ploughed and fenced and grazed and doused with toxins. Indigenous people could reclaim and restore their lands; ecosystems could rebound. *This transition could be our best hope of stopping the sixth great extinction.*"
So, does this mean that we give up on soil and soil science? No, not at all, as we shall see. First of all, let's be realistic. This technology is quite new. It is promising, for all of the reasons given by Monbiot. So, some farming would continue as well, albeit without a frenetic economics-driven aim of maximizing annual yield, as is currently the case. It could actually continue with respect for the soil, and for the inherent values of the land, whether articulated by indigenous people or by urban conservationists.

Farming could continue using approaches that conserve and even build up soils. These approaches, originally mooted as organic agriculture, but now developed with more sophistication as "regenerative agriculture", are contrasted with "industrial agriculture", the current paradigm, even if it has been altered from colonial times by such modifications as minimum or no tillage.

The problem with conservation-based regenerative agriculture is that it doesn't generally produce as much growth of "useful" plants as industrial agriculture has done. That matters when we are on the edge of being able to feed the world, if, indeed, we haven't tipped over it. But it matters a whole lot less if we have farm-free methods of producing at least a large part of the world's (or a nation's) food. These includes the microbial fermentation that Monbiot favours and can also include – perhaps for variety and nostalgia, meat cultured directly from animal cells but without their slaughter[9]. In October 2020, there were 46 companies world-wide working on the production of cultured meat. Discussion of that technology is for another place or time, but we can see that the nexus between soils and food production may be different, at least, from it is as present.

Regenerative agriculture is the product of many hands (and brains). These include Allen Savory, Zimbabwe, who is the inspiration behind the excellent Netflix documentary "Kiss the Ground" – see Figure 2). Savory was inspired by wildlife parks to propose "holistic planned grazing", where the ground cover is maintained and animal manures provide the fertilizer for plant growth.

They also include thinkers and farmers from Austria (many will have heard of Rudolf Steiner), the USA (such as Wes Jackson and the Land Institute), and, most particularly, Australia[10] (including Peter Andrews and Bill Mollison, also David Holmgren). Steiner founded "biodynamics", essentially the use of animal manures. Andrews, a horse trainer, saw the need to revegetate the land, retaining even weeds, especially if they were deep-rooting, thereby promoting reeds and reinstating water flow. His method was named "natural sequence farming". Mollison and Holmgren's approach became known as "permaculture". Each have their followers.

Figure 2. Title slide for “Kiss the Ground”, a program on regenerative agriculture (Netflix)

Charles Massy summed up these approaches by suggesting that alternatives to industrial agriculture essentially made use of:

1. Solar-energy (maximizing capture of solar energy)
2. Water cycle (maximizing water infiltration, storage and recycling)
3. Soil-mineral cycle (biologically active soils recycling minerals and chemicals)
4. Dynamic ecosystems (maximum biodiversity at all levels)

In a phrase, Massy saw the need to feed the soil, not the plant.

In the regenerative agriculture approach, the good of the soil is promoted. Instead of regarding the soil as merely a medium for the maximal yield of plants responding to soil disturbance, fertilizer inputs and irrigation, it involves a whole new attitude to the soil and to land generally. It involves a rejection in the countryside of neoliberalism in favour of sustainability. It constitutes a philosophical revolution.

It is an approach and philosophy that should fit well in Australia, a continent that was managed for 60,00 years or more by people who felt they belonged to the earth or the land (generally, ‘country’). Albeit practicing this attitude for far longer than most peoples, they are not unique among indigenous people to profess their place within nature and ecosystems rather than outside them, as creators, developers and exploiters. It is an attitude of sharing, not ownership, of the land. Some would call it stewardship. Simon Winchester in his book “Land”[11] writes: “Sharing the land is by no means a revolutionary idea. The aboriginal Australians, the Maori, the Canadian first nation populations, the Inuit who inhabit the high latitudes from Siberia to Alaska and back again, the North American Indians – to all and each of these, land was a commodity so precious and so life-giving, that it was indeed to be shared by all, and owned by none”.

This attitude is in stark contrast to the individual ownership model now dominant in the Western world. When it comes to agriculture it is expressed by the idea that ‘the land is mine and I’ll do what I like with it’. A stark illustration of this attitude is expressed in a book by Kate Holden[12], which describes the actual events leading to the murder by a landowner of a New South Wales State environment officer, Glen Turner on 29 July 2014. The unrepentant murdering landowner, Ian Turnbull, was so

incensed with laws against clearing native vegetation that he shot Turner just for doing his job of applying these laws.

Philosophical considerations aside, regenerative agriculture nonetheless had an uphill battle for widespread acceptance as long as it delivered lower yields for individual landowners than our common industrial forms of agriculture. However, when the imperative for more food no longer depends on highly intensive forms of land use, gentler uses of land and soil become more alluring. Furthermore, as climate change decreases options for farmers as a result of prohibitive temperatures, droughts, floods and bushfires, it is comforting to know that food can come from sources besides the land.

The land – or at least some of it – can also be released for other purposes. It is not always admitted that action on climate change requires not just reduction of the release of emissions, but also the capture of emissions already in the atmosphere. Carbon dioxide, in particular, can linger in the atmosphere for a very long time, perhaps as long as a thousand years, although some dissolves in oceans[13]. There are few affordable means of extracting carbon dioxide from the air, but plant growth and, particularly, the growth of trees are the natural, relatively inexpensive outstanding method. With at least some land released from the need for annual returns, whether from edible plants or animals and their product, tree planting becomes a viable option with a societal benefit[14,15] (Figure 3). Several societal benefits, in fact, because trees promote greater biodiversity than farmlands.

Figure 3. Trees in a public display in Adelaide showing the relative capacities of three native Australian types of trees for carbon dioxide uptake (given as party balloons filled).

A recent programme on Radio New Zealand “Country Life”[16] featured a farmer on a 200-hectare block near Whanganui, Ian Moore, who has planted a large portion of his block in trees for ecological (and soil-stabilising) purposes. He has planted native trees, including totara, kahikatea, rimu and also native flax, harakeke, as well as exotic varieties such as poplar, eucalypts, oak, ash, pines, cedar, macrocarpa and redwood - quite a range of trees. This farmer has a geological background and has worked in soil science and he matches the varieties of the newly planted vegetation

to the characteristics of the underlying strata. I know people who are also revegetating with trees for their ecological value and I am sure readers will know some as well.

Re-wilding also becomes a suitable land-use beyond farming. In Australia, this may happen naturally, to an extent. Such animals as koalas and kangaroos should gain a freer rein in the countryside. In New Zealand, a land originally without native animals (the tuatara excepted), the iconic native birds may get a better chance to survive and prosper. Indeed, Ian Moore has planted harakeke flax to attract tui[16].

Farming may be judged to be suitable by current practices in some parts of the country. Some pastures could still accommodate ruminant animals, sheep and cattle, although there has to be efforts to minimise their production of the dangerous greenhouse gas, methane. These are currently being researched, and include the use of seaweeds, added to animal feeds to suppress the production of methane in ruminants[17,18]. A seaweed commonly found in both Australia and New Zealand, *Asparagopsis sp*. appears to be particularly useful for the purpose[19]. Especially with reduced methane production, sheep and cattle could continue to be farmed for meat for some.

Mind you, Monbiot, based in the UK, instances New Zealand as a nation needing a new way of raising protein. He writes (p. 78) “If everybody ate the average New Zealander’s diet, which contains plenty of free-range lamb and beef, another planet almost the size of Earth would be needed to sustain us.” So, there is certainly a need for a change (which is happening) if clean, green Aotearoa New Zealand is to be consistent with its labelling and to make a net positive difference to the climate. Even so, sheep may be retained for wool production, of course, and cattle, as dairy cows for dairy products like milk and cheese.

Internationally, the release of land consequent upon alternative sources of food may also provide climate and soil-friendly benefits, as well as righting some of the old wrongs done to indigenous people when their land was forcibly taken by Europeans. Their attitude to land can actually be inspiring, e.g. “In a lifeworld where your great-grandchildren become your parents, you have a vested interest in making sure you’re co-creating a stable system for them to operate in and also ensuring a bit of intergenerational equity”[20]

There should be no barriers to microbial fermentation anywhere. Ultimately, though, the answer does lie in the soil. The bacteria best employed for microbial fermentation originate in the soil[5,7]. Those particular areas of land judged to be suitable for the different possible uses, tree-growing, wilding, farming and others, would be evaluated by soil scientists. For example, peat bogs should not be drained for planting trees[15].They already sequester lots of carbon. And trees don’t grow well in some places. Nor are all species of tree equally effective at sequestering carbon (Figure 3). In Australia, their growth is likely to be limited by a lack of sufficient rainfall. And the areas for planting trees could be compromised by bushfire risks, and not just in Australia, as we have seen last summer in Western North America and even New Zealand. Planning is the key to a successful transformation.

Perhaps the best thing about Monbiot’s idea is that, with a possible solution, it is a positive reaction to climate change. Unfortunately, negative, virtually hopeless,

reactions abound. Let's grasp this attractive plant to help halt humanity's fall down the climate slope.

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IAVCEI Volcanology Conference

Article by David Lowe

The last few days of January and the first few days of February 2023 – unfortunately exactly coincident with the “weather bomb” that wreaked havoc on Auckland and other parts of northern North Island – saw the successful running of the international volcanology conference (“Scientific Assembly”) held in Rotorua under the auspices of IAVCEI (International Association of Volcanology and Chemistry of the Earth's Interior) (Fig. 1).

With the University of Waikato a major sponsor, the conference was originally scheduled to run in February 2021. Planning began ten years earlier in 2014 when the New Zealand volcanology community opted to bid (in 2017) to host the event in 2021 (the previous such event to be held in the country was in 1986 – at that time the volcanology meeting was held at the University of Waikato with the start at Auckland and two days of mid-conference field trips in Rotorua to commemorate the 1886 Tarawera eruption centenary).

Twice postponed because of COVID, it was a relief that the 2023 meeting finally went ahead with 860 in-person registrants and 203 virtual participants despite numerous problems with the wet weather and temporary closure of Auckland Airport that disrupted travel arrangements for scores of participants. Some participants “travelled” for nearly 5 days to get to the meeting and others never made it. Also, three of five mid-conference field trips were cancelled because of very heavy rain and poor visibility. Nevertheless, the conference was a great success overall and many said it was the best they had ever attended. Perhaps the weather difficulties bonded the group firmly, and possibly the infectious excitement of the (staggering fact) that 51% of participants were early career researchers (ECRs) or students, helped make the conference very memorable and enjoyable. Also, it was well organised, everything ran like clockwork, refreshment breaks and meals and local hospitality were outstanding.

Figure 1. The conference venue was the Energy Centre near the Government gardens and buildings. The city centre was festooned with these flags, and a public session “Volcanofest” occupied an entire day (Thursday 2 Feb) with volcano art and photography, experiments and game demonstrations, a Q & A panel, and a “meet a volcanologist” session for families and children. Photo: D.J. Lowe

The conference organising committee was led by co-convenors Adrian Pittari (University of Waikato) and Graham Leonard (GNS Science) (Fig. 2).

Figure 2. Adrian Pittari and Graham Leonard, co-convenors of the conference. Later, Adrian (with Marlena Prentice) ran a post-conference field trip focussed mainly but not entirely on ignimbrites, “In the footsteps of Marshall”, complete with an ascension of Wairere Falls, a visit to the Tapapa tephra-loess-soil sequence (Fig. 9, below), a banquet lunch at Hobbiton, and a bus breakdown in Karangahake Gorge. Photo: D.J. Lowe

One of the pre-conference workshops was tephra-related: “From field apps to data repositories: improving tephra data discoverability, access, and workflows to support next generation research”, organised by Steven Kuehn, Kristi Wallace, Ellen Nelson, Andrei Kurbatov and Kerstin Lehnert. The workshop was the continuation of an ongoing project under the auspices of the Commission on Tephrochronology (COT) entitled “Community established best practice recommendations for tephra studies – from collection through analysis”, with a milestone (open access) paper by the group being published last year (https://www.nature.com/articles/s41597-022-01515-y). At the same time, a history of COT was published (also open access) that highlighted the many developments and personalities of the discipline for the past 60 years and longer, with the role of New Zealand scientists and advancements included (https://hgss.copernicus.org/articles/13/93/2022/hgss-13-93-2022-discussion.html). The COT tephra specialists enjoyed a special ‘tephra dinner’ in town after their business meeting.

For a field visit and a chance to try out the Strabo app for field data collection, David Lowe, Tehnuka Ilanko, and students/seismites team members Josh Hughes and Richard Melchert of the tephra seismites research group at Waikato (see

https://tephra-seismites.com/) arranged an excursion to a tephra outcrop at a nearby pumice quarry on Okareka Loop Rd (Figs. 3 and 4). Our field guide has more details.

Figure 3. Specialist tephra workshop participants (with Waikato assistants Tehnuka, Josh, and Richard at far left) happy and excited to see their first New Zealand tephra layers a mere 10 minutes away from the city. The main bedded unit is Rotorua tephra, c. 15,600 yrs old, within 2-3 km of its source vent now occupied by rhyolite domes just north of Lake Tikitapu. They are also happy that it had stopped raining for about 30 minutes. Photo: D.J. Lowe

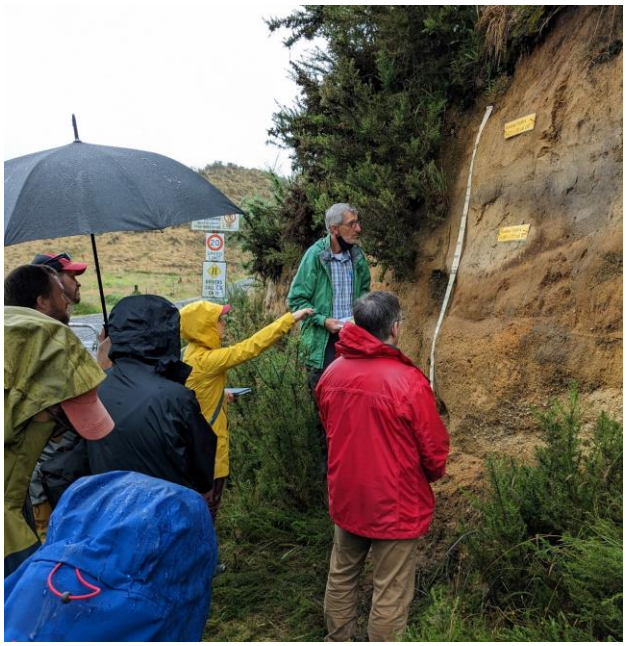

Figure 4. David Lowe (top, face mask out of place) discussing upbuilding pedogenesis at another part of the exposure at Okareka Loop Rd section. From the base, Rotorua, Waiohau (14,000 yrs old), and Rotoma (9500 years old) tephras are exposed, with very thin deposits of Kaharoa tephra (c. 1314 AD) and Rotomahana Mud (10 June 1886) in the top of the profile. Photo: A. Kurbatov.

One of the mid-conference field trips that did run was to Taupo supervolcano. Led by Simon Barker (Victoria University of Wellington), and involving three buses, the trip

began well with a great exposure of the entire post-Oruanui (25,400 years ago) super-eruption sequence on the Taupo Bypass (Fig. 5). That the rain held off made the stop very worthwhile.

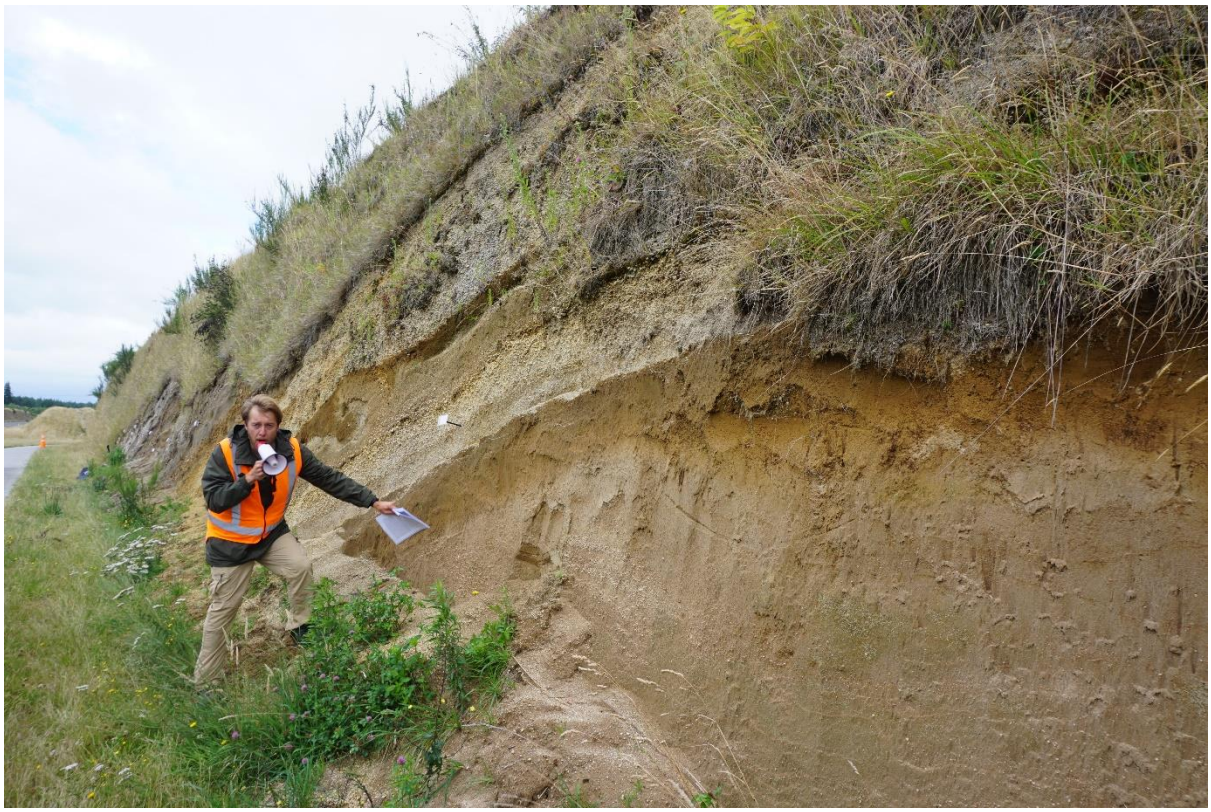

Figure 5. Trip leader Simon Barker, pointing to a buried soil horizon, explaining an early part of the post-Oruanui eruption sequence of Taupo volcano. Loess beds at right. Photo: D.J. Lowe

Presentations were made to the meeting on behalf of the tephra seismites group in the session (co-convened by Britta Jensen, Jenni Hopkins, and David Lowe) “Tephrochronology: new methods and applications for chronostratigraphy and beyond”.

The first was broad overview of the project, covering some of our recently published work, and our work with X-ray CT to identify and characterise tephras and seismites: “Tephra seismites preserved in unconsolidated organic lake sediments in the Hamilton lowlands, New Zealand, indicate paleoearthquake activity since 17.6 ka” (presented by Tehnuka Ilanko) (Fig. 6).

Figure 6. Tehnuka Ilanko giving her presentation. Jenni Hopkins and Maddison Clarke chairing and timekeeping, respectively.

The next talk focused on our work at Rotoroa/Hamilton Lake, and findings from Richard Mechert's MSc thesis: "Using ground-penetrating radar and X-ray computer tomography to survey and characterise distal tephras in lake sediments, Hamilton lowlands, New Zealand" (presented by David Lowe).

Tehnuka Ilanko was also selected as one of only two ECR plenary speakers, and she showed how we can unravel volcanic gas data to understand magmatic and non-magmatic processes at volcanoes (Fig. 7). Another talk, on Waiteariki Ignimbrite from Tauranga Volcanic Centre, was made by Marlena Prentice (Fig. 8).

Figure 7. Tehnuka Ilanko presenting her research as an ECR to the entire conference. Photo: D.J. Lowe

Figure 8. Marlena Prentice of Waikato University presenting her paper on Waiteariki Ignimbrite (from her PhD thesis, which was submitted Friday 27 Feb, the day before the conference started). Marlena has just been appointed to a role as environmental sciences teaching fellow (from 14 Feb 2023) in the School of Science, University of Waikato. Photo: D.J. Lowe


Figure 9. Well-known Tapapa section on lower Mamaku Plateau of tephra deposits, loess, and (buried) soil horizons dating back to the basal unit (not shown) of Mamaku Ignimbrite (aged 230,000 years). For further information about this sequence, see https://www.researchgate.net/publication/261613308_Where_geology_meets_pedology_Late_Quaternary_tephras_loess_and_paleosols_in_the_Mamaku_Plateau_and_Lake_Rerewhakaaitu_areas Photo: A. Pittari

Manaaki Whenua
Landcare Research

Need physical lab-grade soil tests?

Our soil physics laboratories in Palmerston North and Hamilton, provide essential soil testing services.

Our laboratory services include:

- Analysis of particle size (sand/silt/clay and stones)
- Density measurements: dry bulk density, particle density, total porosity, and macroporosity
- Characterisation of water release properties: available water capacities, field capacity, air capacity, and wilting point
- Volumetric water content at varying matric tensions (0–1500 kPa)
- Hydraulic conductivity (saturated and unsaturated at a range of tensions)
- Soil engineering tests: liquid and plastic limits, and miniature compaction tests

Other analyses include potting media analysis, green roof and raingarden substrate analysis, water stability of soil aggregates, aggregate size, and air permeability. Options for field sampling can be discussed if needed.

For more information, visit https://www.landcareresearch.co.nz/partner-with-us/laboratories-and-diagnostics/soil-physics-laboratory/
or contact:

Palmerston North
Shane Cox
Soil Physics Lab Manager
E: coxs@landcareresearch.co.nz

Hamilton
Allycia Van de Laar
Soil Physics Technician
E: vandelaara@landcareresearch.co.nz

News from the regions

Waikato/Bay of Plenty

AgResearch

AgResearch Ruakura had a team of four recently attend the Fertiliser and Lime Research Centre Conference. Our PhD student (**Keren Ding**) presented on her PhD work "The effects of different urinary nitrogen rates on gaseous nitrogen fluxes after synthetic cow urine deposition". Keren is in the final stages of completing her PhD. Keren also filled in for **Dr Jiafa Luo** and presented on some research work recently undertaken on Plantain "The effects of different plantain proportions in pasture on gaseous nitrogen loss after urine depositions on contrasting soil types". Senior Research Technician **Bill Carlson** also presented on Plantain "Comparison of nitrous oxide emissions and soil nitrogen levels from plantain and ryegrass/white clover pastures on a Waikato farm". One of our new technicians **Ryan Barlow** in the Environmental Science Team also attended FLRC and gave a presentation on a Nitrogen leaching trial we have underway in the Bay of Plenty and Taranaki, "Nitrogen leaching in a dairy farmlet grazing study as affected by the use of Spikey". A relatively new Scientist within our team **Lisa Box** also attended the conference.

AgResearch Palmerston North also had a presence at the FLRC conference, with **Alec Mackay** presenting a key presentation on "The grass is telling us something different" and **Estelle Dominati** presenting on "Farm planning: moving from compliance to strategic planning".

University of Waikato

Congratulations to **Dr Reza Moghaddam** who defended his PhD oral exam (Figure 1). Reza explored options for enhancing rates of nitrate removal in denitrifying bioreactors, specifically looking at the role of added methanol in relieving carbon limitation. Nitrate removal rates were substantially increased with the addition of relatively small amounts of methanol tested at both field and mesocosm scales. He also explored the potential for unwanted adverse effects following dosing but these were all considered manageable. He published three papers summarising his work.

Figure 1. Dr Moghaddam at the end of the exam with Associate Professor Ranvir Singh (examiner, Massey University) and Louis Schipper (Chief Supervisor).

This summer has seen two new additions to the WaiBER team, with the additions of **Seager Ray** and **Holly Hay**. Seager completed his MSc (titled: "Differentiating the Temperature Response of Soil Fungi and Bacteria") in October last year, then following a short break joined us in the role of Technical Officer. Seager will primarily support research on the carbon balances of agricultural systems and the temperature dependence of soil carbon cycling.

Holly has been undertaking a summer research project titled "Importance of dung returns on building soil carbon in pastures" supervised by Louis Schipper and **Aaron Wall**, as a precursor to beginning an MSc thesis later this year. Holly, with support from Aaron and Seager, has taken and analysed soil samples for carbon stocks (to 60 cm) from along fence lines at the teams' Owl Farm research site and compared the results with paired samples in adjacent paddocks (Figure 2). Holly hypothesised that fence lines would have lower soil C stocks due to fewer dung inputs than the adjacent (grazed) paddock, and indeed found lower soil C contents in the top 20 cm of the fence line samples in this preliminary study. Holly intends to expand on this work during her thesis study.

Figure 2. Holly Hay preparing soil cores for sampling at the Owl Farm research site (Photo: Aaron Wall).

Dave Campbell has been busy on the organising committee of the iLEAP-OzFlux joint conference held in Auckland during the last week of January. Unfortunately, the conference coincided with the recent flooding in Auckland, which prevented or delayed many delegates from attending. For those that did make it, Dave also organised a post-conference field trip with stops that overlooked the Kopuatai peat bog and visited the WaiBER team's research sites at Owl Farm and Gamma Farm where they were joined by Aaron Wall and Louis Schipper (Figure 3). An enjoyable day was had by all inspecting the eddy covariance systems, with the highlight being lunch (and ice cream!) at Café Irresistiblue nestled in the blueberry orchard on the drained Moanatuatua peatland.

Figure 3. Dave Campbell describes the functioning of a quantum cascade laser coupled to eddy covariance to determine continuous paddock scale emissions of CO_2, N_2O and CH_4 from a drained peat soil in the Waikato (Photo: Louis Schipper).

Ben Roche joined Pete Wilson (Canterbury University) on the annual Ross Sea region soil climate station trip (Figure 4). This was Ben's first trip to Antarctica and his main objective was to learn how to service and maintain the network. Ben

recalls *"whilst travelling between the stations via helicopter, I was granted a spectacular aerial view of the largest ice-free area on the continent. I was in complete awe of the scale of the landforms and of the striking geology; it truly is a unique landscape. My visit has solidified in my mind the importance and value of the long-term monitoring network, as well as other ongoing research in the area".* The network is supported by Manaaki Whenua Landcare Research, Waikato University, Natural Resource Conservation Service of the United States Department of Agriculture, and Antarctica NZ, and is now the largest longest running continuous soil-permafrost temperature monitoring dataset in Antarctica (Figure 5).

Figure 4. Ben Roche (left), Pete Wilson (middle) and Gordana Kranjec (right, Antarctica NZ) heading into the field to download data from the soil climate stations (Photo: Ben Roche).

Figure 5. Victoria Valley soil climate station. Upper Victoria Glacier in the background (Photo: Ben Roche).

Tanya O'Neill, Madison Farrant, and Trev Rhodes spent close to six weeks in Antarctica this summer conducting work for the Scott Base Redevelopment environmental monitoring project and Tanya's Marsden research. They had two

weeks working around Scott Base including Christmas, followed by three weeks at Cape Bird, home to around 45,000 pairs of Adelie penguins. The Marsden research investigates if penguin mounds/nests act as natural archives for multi-scale anthropogenic events, such as the Industrial Revolution, peak DDT use, or the incursion of microplastics. Penguins inadvertently transfer pollutants from the marine to terrestrial environment via their foraging and nesting. Pits were stratigraphically sampled in 2 cm increments (very challenging as full of rounded "penguin nesting stones") (Figure 6). Samples will be analysed at Canterbury University by PhD student **Megan Reaves**.

Figure 6. Typical soil pit within a penguin mound, Cape Bird, Antarctica (Photo: Tanya O'Neill).

Meanwhile **Madison Farrant** (Antarctica NZ – NZ Post scholarship recipient) completed the fieldwork for her MSc research which investigates the role of meltwater streams in the transfer of nutrients and cont7minants from the penguin mounds to the nearshore marine environment (Figure X). Madison collected water samples, did dilution stream gauging, took physiochemical measurements of stream water, and installed a small climate station (Figure 8).

Figure 7. Erosive meltwater streams at Cape Bird northern colony (Photo: Tanya O'Neill).

Figure 8. Madison Farrant and Trev Rhodes filtering stream samples in the northern colony, Cape Bird, Antarctica (Photo: Tanya O'Neill).

Manawatu
Plant & Food

Irrigating Halophytes with Saline Waters in the Deserts of the Emirates.
During November 2022, Brent Clothier and Steve Green were in the United Arab Emirates again working on their project with Environment Agency-Abu Dhabi (EAD) on "Salt Leachate Mesurement and Risk Modelling". This project supports EAD scientist Mansoor Al Tamimi's PhD with Brent through Massey University. This is the third and final year of experiments with the halophyte *Salicornia* (aka 'sea asparagus') at the International Center for Biosaline Agriculture. The *Salicornia* crop can be grown for food, fodder for animals, or taken through to seed for biofuel. Three saline waters are being used for irrigation: groundwater at 20 dS/m, reject brine from a desalination plant (40 dS/m), and aquabrine from aquaculture tanks growing Tilapia fish in the reject brine from a desalination plant (40 dS/m).

Mansoor has just submitted his first paper which details how time domain reflectometer probes can be modified to work in these highly saline soils, as well as how passive-tension drainage fluxmeters (DFM) can be modified to work in the aridic Torripsamments of the Arabian deserts.

The photo below shows Steve retrofitting a DFM so that it can be used to measure drainage, the salt leaching fraction, salt concentrations, and the loading of salt on the underlying aquifers.

To determine the hydraulic conductivity of these desert sands, Brent and Mansoor (below) used Decgon mini-disc tension permeameters to measure the nead-saturated properties of this Torripsamment.

The *Salicornia* was sown in November, and a recent photo below shows the successful germination and early crop growth. All the gear is working and providing valuable data. Brent and Steve will be back in the Emirates in February 2023.

Manaaki Whenua – Landcare Research

Congratulations to Surinder Saggar, Lauren O'Brien and John Dando who won awards in the Manaaki Whenua – Landcare Research (MWLR) internal annual awards in November 2022, which recognised their expertise and excellence in their endeavours and research. Surinder Saggar received a Science New Zealand

Lifetime Achievement Award – see separate article earlier in this issue of Soil News. Congratulations Surinder!

Lauren O'Brien received her MWLR award for her skills in modelling, coding and software which are creating positive change to develop more systematic approaches for digital soil mapping. She is also frequently called on to mentor and share her knowledge with other staff for queries on R coding and digital mapping. John Dando received his award for his contribution to many soil science programmes, especially in the analyses of soil samples in his soil physics laboratory over many years. Through his work, John's laboratory has enabled a significant increase in the number of national soil reference sites in the National Soil Data Repository.

We also farewelled John Dando, who retired in January 2023, after 29 years with MWLR. John has made an outstanding contribution to many research programmes, through fieldwork and analyses in the soil physics laboratory in Palmerston North. John's analyses on soil structure and soil water retention have greatly improved our understanding for soil management, S-map, GHG emissions, and a range of modelling applications. John has also contributed passing on soil physical skills through mentoring and helping many post-graduate students from around the country.

We welcomed Lena Reifschneider, our new pedologist, working with the pedology and S-map team on a range of soil mapping projects in the lower North Island.

We celebrated John Dymond's 45 years with MWLR and its predecessors. John started with the Ministry of Works, initially involved with hydrology, and as the district hydrologist for Manawatu/Whanganui. He has been involved in many areas of science where he has a leading reputation, including research in remote sensing for environmental monitoring, ecosystem services, and modelling sediment and erosion processes. For example, John and colleagues' research into directional reflectance of vegetation enabled standardisation of satellite imagery, so that sequences of images are then comparable. John and colleagues quantified the link between soil erosion and sediment in rivers, so it is now possible to determine what level of land cover change and soil conservation farm plans are necessary to achieve target reductions in river sediment. Many collaborations have been built over the years, while John's mentoring of scientists during their careers has been greatly appreciated.

Photo: Our local celebration with John Dando cutting a cake in recognition of receiving the Blakemore award.

Massey University

FLRC 35th Annual Workshop 2023

The FLRC workshop was held at Massey University from Wednesday 8th to Friday 10th of February, 2023.

The title of this year's workshop was:

DIVERSE SOLUTIONS FOR EFFICIENT LAND, WATER AND NUTRIENT USE

The conference involved oral presentations under the following general themes:

Agricultural GHG Accounting and Mitigation
Catchment Perspectives
Farm Environment Planning
Nutrient Attenuation; In field and Edge of field practices

Policy Development and Implementation
Smart Tools and Technologies
Soil Conservation and Management
Synergies in Solutions for Climate Change and Water Quality
The Role of Nutrient Budgeting in Farm and Environmental Management
Transformative Landuse for Future Farming

Keynote speakers included Beverley Henry (Queensland University of Technology) who discussed the soil carbon credit system in Australia and Simon Rosendahl Bjorholm (SEGES Innovation) who discussed nitrogen mitigation practices in Denmark.

The workshop proceedings will be published and available online at: https://www.massey.ac.nz/~flrc/publications.html

Thank you to all the speakers, attendees, helpers, and sponsors who made this another successful annual workshop!

Horizons Regional Council and Massey University IAVCEI field trip

The International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) Scientific Assembly 2023 was held in Rotorua this February. Szabolcs Kosik (Horizons) and Callum Rees (Massey) ran a post-conference field trip between Saturday 4th and Monday 6th of February 2023, hosting 15 participants from around the world to show off some of New Zealand's stunning scenery, volcanic deposits, and soils.

The dominant parent material through this area is the 1.8 ka Taupō Pumice. The Taupō eruption had considerable impact on the landscapes of the central North Island, wiping out large areas of indigenous forest and infilling stream and river valleys with volcanic material. The outlet of Lake Taupō into the Waikato catchment is thought to have been blocked by the eruption, causing the lake to rise over 30 metres above its modern-day level. Eventual breach led to a 20 km^3 breakout flood down the Waikato River, reworking vast quantities of volcaniclastic material and creating stranded terrace deposits of Taupo Pumice up to 30 m thick. Soils developed on Taupō Pumice are generally well-drained, Immature Orthic Pumice soils (MOI) that are quite prone to wind and gully erosion. These soils can be low in Cobalt which is required by nitrogen fixing bacteria in clover nodules and by the microorganisms in sheep and cattle stomachs for making vitamin B12. 'Bush sickness' encountered during the establishment of pastoral farming in this landscape has been attributed to cobalt deficiency.

Szabolcs Kosik pointing out landscape features to participants near Taupō

Massey University Freshwater Farm Plan Courses running in 2023

Massey University has been running intermediate and advanced Farm Environment Planning courses for two years now and is set to continue as they roll out the latest course in 2023. The courses have been developed by School of Agriculture and Environment Associate Professor Lucy Burkitt with the support of the Fertiliser Association of New Zealand (FANZ).

The courses are designed for industry professionals and farmers interested in upskilling in the concepts and components important for the development of freshwater Farm Environment Plans. Students examine the purpose of a freshwater Farm Environment Plan with respect to government policies and acquaint themselves with systems used to classify landscape units, different types of soil and erosion, sources of sediment, nutrient and pathogen loss, and options available to mitigate these losses. Students are introduced to spatial mapping of the relevant physical features and observed erosion, sediment, nutrient and pathogen loss issues before demonstrating their knowledge and skills by producing a freshwater Farm Environment Plan.

The intermediate course is delivered through online distance learning and is intended to facilitate a flexible learning style. It includes a series of presentations, quizzes, virtual farm field trips and case studies.

The advanced course is designed for online and in-person blended delivery. Three days of fieldwork are undertaken on a dairy, arable and sheep and beef farm before the participants return home to develop their freshwater Farm Environment Plan under the guidance of tutors.

Visit the Farmed Landscapes Research Centre website to see what courses are available: https://www.massey.ac.nz/~flrc/courses.html

Cows grazing on one of Masseys case study farms. These flats are underlain by Rangitīkei fine sandy loam a Recent soil that is subject to flooding from the adjacent Manawatū River.

Canterbury and Otago

Manaaki Whenua – Landcare Research

Amy Milnes has recently joined our Lincoln team as a field soil surveyor. She has just finished four years at the University of Canterbury doing a Bachelor of Science, double majoring in Geology and Geography as well as a Postgraduate Diploma in Science in Geology and Disaster Risk and Resilience. Amy will mainly be working in our current S-map expansion scheme, as well as in the National Soil Carbon Monitoring programme.

Congratulations to **Veronica Penny** who won an award in the Manaaki Whenua internal annual awards. Veronica received her award for her strong work ethic and generous sharing of skills with her colleagues.

Photo: Amy with her two brothers Scott (left) and Evan (right).

Shana Dooley left Manaaki Whenua to pursue an exciting opportunity with Waka Kotahi (NZ Transport Agency).

Audio visual

A video has been produced by the Retiring Farmland into Ngahere research project.

The video is: 'OLW The Tīmata Method: A low-cost way to restore land into native forest'

The video link is: https://www.youtube.com/watch?v=E1cnpR2PklY

News from the European Soil Data Centre ESDAC

EU Mission 'A Soil Deal for Europe'
The mission intends to assist Europe's path to sustainable soil management as part of the wider green transition. Some examples are described below, particularly related to soil health:
https://rea.ec.europa.eu/news/eu-mission-soil-deal-europe-nine-new-projects-prepare-ground-transition-towards-healthy-soils-2030-2022-12-05_en

To support a more harmonised reporting on soil health among Member States, the projects BENCHMARKS and AI4SoilHealth will validate and further develop indicators to measure, monitor and assess soil health and functions making use of integrated frameworks and Artificial Intelligence.

SOIL O-LIVE will explore the connection between soil health and nutritional and safe food. The development of new incentives and sustainable business models will be key to supporting soil health. INBESTSOIL will test the incorporation of an economic valuation system of ecosystem services delivered by healthy soils in five business models. NOVASOIL will study four business models that allow the creation of new incentives from healthy soils. The project SOILVALUES is expected to explore financial mechanisms such as equity investment or compensation for risk or cost reduction, to help land managers to make decisions.

To support the establishment of soil health living labs, NATI00NS will act as a messenger of the Mission to national and regional stakeholders. NBSoil project will support the much-needed next generation of soil advisors.

Historical reconstruction of soil erosion in Europe (1860-2018)
This dataset includes the reconstruction of soil erosion rates in Europe (including UK, Switzerland and Western Balkans). The data provided have been aggregated per decade starting from 1860. Data of this research study are available: https://esdac.jrc.ec.europa.eu/content/historical-reconstruction-soil-erosion-europe

Protecting soils - presentations
The Second EUSO Stakeholder Forum confirmed the high level of interest in efforts by the EU and Member States to develop policies to protect soils. The 70 presentations are available: https://esdac.jrc.ec.europa.eu/euso/presentations-2nd-euso-stakeholders-forum

Soil Mapping for a Sustainable Future
This conference takes place in Orleans (France) 7-9 February 2023. Main topics include: Digital Soil Mapping and assessments, Advancing DSM and GlobalSoilMap. Emphasis is given in global, regional and national state of the art DSM products. Also, the conference addresses issues in methodologies, sampling, validation, uncertainties and use of DSM products for decision making. https://www.lestudium-ias.com/events/soil-mapping-sustainable-future

Soil Health dashboard of the EU Soil Observatory
Life on earth depends on healthy soils. Yet the new Soil Health dashboard of the EU Soil Observatory (EUSO) estimates that 61.5% of EU soils are unhealthy, with strong implications for the supply of ecosystem services that keep us alive. With the EUSO Soil Health Dashboard, the JRC provides a spatial assessment of where unhealthy soils may be located in the EU. The EUSO Dashboard shows that the majority of unhealthy soils is in fact to be subject to more than one type of soil degradation, an important finding for the soil restoration agenda. The loss of soil organic carbon (48%), the loss of soil biodiversity (37.5%), and soil erosion by water (32%) are the most prevalent types of soil degradation. The EUSO Soil Health Dashboard will evolve as new scientific data become available (e.g. Horizon Europe's Soil

Mission projects) and with the implementation of EU and national soil policies, in particular the forthcoming EU Soil Health Law
https://esdac.jrc.ec.europa.eu/esdacviewer/euso-dashboard

Global Rainfall Erosivity Database (GloREDa) - call for data
Quantifying rainfall erosivity is challenging as it requires a high temporal resolution. The Global Rainfall Erosivity Database (GloREDa), contains erosivity values estimated as R-factors from 3,625 stations distributed in 63 countries worldwide. At global scale, this is the first time ever that an erosivity database of such dimension is compiled. The EUSO WG on Erosion launches a call for more data following the GloREDa specifications (high resolution, RIST) which will be included in a group data paper. If interested, please send an e-mail: panos.panagos@ec.europa.eu
https://esdac.jrc.ec.europa.eu/content/global-rainfall-erosivity

Call for saturated hydraulic conductivity dataset (Ksat) data
EUSO WG on Erosion is looking for saturated hydraulic conductivity (Ksat) datasets with soil texture and organic carbon. We aim to couple the soil hydraulic properties with soil erosion modelling. Such data should be complementary to the SoilKsatDB (global database of soil saturated hydraulic conductivity measurement). If you have such data and are willing to contribute, please send an e-mail: panos.panagos@ec.europa.eu

Abstracts

Temperature dependency of litter decomposition is not demonstrated under reciprocal transplantation of tussock leaves along an altitudinal gradient

Decomposition rates are an important component of carbon sequestration rates in soils, potentially mitigating future climate change. Here we aim to better understand decomposition's relationship with temperature in natural conditions. In snow-tussock grassland dominated by *Chionochloa rubra* on Mount Tongariro, Tongariro National Park, New Zealand, we measured decomposition of *Chionochloa* leaf litter along an≈ 700 m altitudinal gradient, as a space-for-temperature experiment, representing 4.2 ºC of warming. We examined decomposition rates in a full reciprocal translocation of litter bags between 8 plots as both the origin of 8 litter types and the 8 destinations of plating out of litter bags, over 4 years using 6 replicates, and modelling their relationships to environmental variates. Litter decomposed progressively over time, but at the same rate along the altitudinal gradient. There was no home-field advantage. In terms of litter quality, decomposition rates were related only to litter lignin, or fibre or litter N. Only decomposition at Year 4, and that only when organised by litter destination, showed a relationship to mean annual temperature jointly with soil C, and this was only weak and implausible. When studied across the full reciprocal transplant, there were no significant interactions between Origin and Destination data with or without Years. Therefore, litter from each plot decomposed at the same rate as other plots' litter at all altitudes, allowing for small, often irregular differences in

litter quality and microenvironment. Despite the few modelled differences, decomposition rates show no plausible trends in our altitude-for-temperature substitution. We suggest this may be a universal finding, except perhaps under different moisture regimes. Thus, under projected climate warming scenarios, changes in temperature will not directly affect decomposition rates, and cannot influence C sequestration in nature.

Krna MA, Tate KR, Saggar S, Buckley HL, Rapson J (2023) Temperature dependency of litter decomposition is not demonstrated under reciprocal transplantation of tussock leaves along an altitudinal gradient. Functional Ecology https://doi: 10.1111/1365-2435.14268

A review of research on the molybdenum requirements of New Zealand pastures

The requirement for molybdenum (Mo) for legume and pasture growth on New Zealand soils was first identified in the 1950s and most of the research was carried out up to the 1980s. This resulted in a recommendation to apply 56–70 g/ha of sodium molybdate every 4–5 years that was later modified to 50 g/ha every five years. On most soils, the availability of Mo increased with soil pH but the rates of lime required were uneconomic on hill country pastures so Mo was applied as the most cost-effective option. Measuring available soil Mo was a poor predictor of pasture yield responses to Mo compared with the Mo content of clover. More recent research showed that the Mo content of clover had to be less than 0.1 ppm and nitrogen (N) content less than about 4.5% for a definite response in yield to applied Mo to occur. High natural levels of soil Mo elevating pasture Mo content above 0.5–1 ppm or overuse of fertiliser Mo where pasture copper (Cu) is low (<5 ppm for sheep, <10 ppm for cattle and deer) can cause less Cu to be adsorbed from the rumen and reduce animal growth.

Morton JD (2022) A review of research on the molybdenum requirements of New Zealand pastures, New Zealand Journal of Agricultural Research, DOI: 10.1080/00288233.2022.2132963

The longevity of cultivation in decreasing the potential for phosphorus loss in runoff

Phosphorus (P) loss from highly fertilised grazed pastures can impair surface water quality. High P concentrations in grazed pastures are maintained to boost legume production, but systems that use monocultures of grass and clover can be more profitable and decrease P losses by lowering soil P in grassed areas. In contrast with using a direct drill to establish new pastures, conventional cultivation can lower topsoil P quickly and can be used as part of a farm re-grassing programme every six years. We tested if the potential for low P losses (measured by water extractable P; WEP) could be maintained over six years in pastures (ryegrass and white clover monocultures and a ryegrass and clover mixed sward) despite being fertilised (10, 35 and 100 kg P ha^{-1}) and grazed. Cultivation (0–20 cm) decreased

WEP and Olsen P in all three pastures and P rates by 30–50 % compared to direct drill and maintained this decrease for six years. A threshold in Olsen P (22 mg L^{-1}) was noted where WEP concentrations increased at a greater rate relative to Olsen P than below. This threshold was like the critical point in Olsen P for 97 % relative yield in the pastures (22–28 mg L^{-1}) and could be used to advise on cultivation and P fertiliser strategies to help avoid the potential for P loss without significantly compromising yield. The data indicated that cultivation could be used to quickly establish and maintain lower soil P concentrations as part of a strategy to decrease P losses and improve profit by using a split grass-clover system.

McDowell RW, Smith LC 2023. The longevity of cultivation in decreasing the potential for phosphorus loss in runoff. Soil and Tillage Research 227: 105618.

Phosphorus and iron-oxide transport from a hydrologically isolated grassland hillslope

Dissolved reactive phosphorus (DRP) loss from agricultural soils can negatively affect water quality. Shallow subsurface pathways can dominate P losses in grassland soils, especially in wetter months when waterlogging is common. This study investigated the processes controlling intra- and inter-event and seasonal DRP losses from poorly drained permanent grassland hillslope plots. Temporal flow related water samples were taken from surface runoff and subsurface (in-field pipe) discharge, analysed, and related to the likelihood of anaerobic conditions and redoximorphic species including nitrate (NO_3^-) over time. Subsurface drainage accounted for 89% of total losses. Simple linear regression and correlation matrices showed positive relationships between DRP and iron and soil moisture deficit; and negative relationships between these three factors and NO_3^- concentrations in drainage. These data indicate that waterlogging and low NO_3^- concentrations control the release of P in drainage, potentially via reductive dissolution. The relationship between DRP and metal release was less obvious in surface runoff, as nutrients gathered from P-rich topsoil camoflaged redox reactions. The data suggest a threshold in NO_3^- concentrations that could exacerbate P losses, even in low P soils. Knowledge of how nutrients interact with soil drainage throughout the year can be used to better time soil N and P inputs via, for example, fertiliser or grazing to avoid to excessive P loss that could harm water quality.

Smith GJ, McDowell RW, Condron LM, Daly K, Ó hUallacháin D, Fenton O 2023. Phosphorus and iron-oxide transport from a hydrologically isolated grassland hillslope. Journal of Environmental Management 329: 117008.

Soil structural vulnerability: methodological review and conceptual development

Soil structure affects a range of soil functions (e.g., water, air, heat, and nutrient transport) and ecosystem services (e.g., production, climate regulation).

Agricultural intensification is a dominant factor in global soil structural degradation. Understanding the vulnerability of soils to structural degradation may be important to land use planning and identifying management practices that mitigate the risk of degradation. We review the current methods for assessing soil structural vulnerability and the influencing factors, focussing on soil compaction and aggregate breakdown as two key measures of structural degradation. Methods for assessing risk of soil structural degradation and management practices affecting the risk are also discussed. Critical research gaps are identified, including the lack of studies that demonstrate the link between soil structural vulnerability and loss of soil functions or ecosystem services. Our review of the literature identified that the terms susceptibility, vulnerability, and risk are often used interchangeably. We propose definitions that can be used to distinguish these terms. Soil properties (relatively static), soil wetness, and land use stress (e.g., climate and management practices) are progressively included in the assessments of soil structural susceptibility, vulnerability, and risk. Existing indicators for assessing soil structural vulnerability may not be suitable to predict potential effects on ecosystem services. We highlight that soil structural vulnerability assessments should focus on key soil structural indicators (e.g., pore network-based hydraulic properties) affecting soil functions and ecosystem services. Both the state (i.e., condition) of soil structure and its vulnerability should be included for assessing soil structural degradation. To overcome the limitations of previous assessments, we developed a conceptual model linking soil structural vulnerability assessment to loss of soil functions and ecosystem services. Our review provides insights on assessment metrics and frameworks to develop management practices that improve soil structure and delivery of ecosystem services.

Hu W, Cichota R, Beare M, Müller K, Drewry J, Eger A. 2023. Soil structural vulnerability: methodological review and conceptual development. Geoderma 430: 116346. https://doi.org/10.1016/j.geoderma.2023.116346

Long-term effects of fertilizer application and irrigation on soils under pasture land use

Soil studies on land use effects have tended to focus on dynamic soil properties such as organic carbon. More slowly changing soil properties like mineralogy have been less studied. However, such properties are important as they constitute important physical and chemical boundary conditions under which dynamic properties change. To investigate changes of soil properties deemed more resistant to change, we selected pasture soils from the 60-year Winchmore fertilizer and irrigation experiment, and soils from irrigated/un-irrigated treatment pairs (> 80 years of treatment) under a more arid climate in New Zealand.
We assessed if chemical properties (total and acid-soluble elements, cation exchange capacity, exchangeable bases, pH), and qualitative clay mineralogy by X-ray diffraction differed between control and amended soils. Under superphosphate fertilizer application, acidity increased, while exchangeable magnesium declined, and chlorite-layer and vermiculite-layer minerals increased.

We also detected consistent increases of poorly crystalline iron and aluminum oxides relative to the control. Under a more humid climate with limited periods of seasonal water deficit (i.e., Winchmore), irrigation drove a decline of exchangeable potassium and calcium, while also potentially enhancing clay formation in the subsoil. Under stronger aridity, irrigated soils showed a decline of exchangeable and acid-soluble bases, soil pH, base saturation, and electrical conductivity; illite in the topsoil also declined. By contrast, the content of poorly crystalline iron oxides increased. The observed differences are likely driven by enhanced pasture production, and thus higher nutrient uptake under fertilization and irrigation, as well as weathering and leaching due to fertilizer-derived acidity and increased soil drainage.

Eger, A., Stevenson, B.A., Theng, B. *et al.* Long-term effects of fertilizer application and irrigation on soils under pasture land use. *J Soil Sci Plant Nutr* (2022). https://doi.org/10.1007/s42729-022-01084-4

Development of a systems model for assessing pathways to resilient, sustainable, and profitable agriculture in New Zealand

There is a clear research gap in understanding how future pathways and disruptions to the New Zealand (NZ) agricultural system will have an impact on the environment and productivity. Agriculture is in a period of significant change due to market disruptions, climate change, increasingly stringent environmental regulations, and emerging technologies. In NZ, agriculture is a key sector of the economy, therefore government and industry need to develop policies and strategies to respond to the risks and opportunities associated with these disruptors. To address this gap, there is a need to develop an assessment tool to explore pathways and interventions for increasing agricultural profitability, resilience, and sustainability over the next 5–30 years. A decision support tool was developed through Stella Architect, bringing together production, market values, land use, water use, energy, fertiliser consumption, and emissions from agricultural sectors (dairy, beef, sheep, cereals, horticulture, and forests). The parameters are customisable by the user for scenario building. Two future trend scenarios (Business as usual, Optimisation and technology) and two breakaway scenarios (Carbon farming, Reduction in dairy demand) were simulated and all met carbon emissions goals, but profitability differed. Future environmental regulations can be met by adjusting levers associated with technology, carbon offsets, and land use. The model supports the development and assessment of pathways to achieve NZ's national agriculture goals and has the potential to be scaled globally.

Clémence Vannier, Thomas A. Cochrane, Peyman Zawar-Reza, Larry Bellamy (2023): Development of a systems model for assessing pathways to resilient, sustainable, and profitable agriculture in New Zealand. Land 2022, 11, 2334. https://doi.org/10.3390/land11122334

Montmorillonite-hydrochar nanocomposites as examples of clay-organic interactions delivering ecosystem services

The clay-organic interaction is an important natural process that underpins soil ecosystem services. This process can also be tailored to produce clay-organic nanocomposites for industrial and environmental applications. The organic moiety of the nanocomposites, typically represented by a toxic surfactant, could be replaced by hydrochar formed from biomolecules (e.g., glucose) via hydrothermal carbonization. The effect of montmorillonite (Mnt) and glucose dosage on hydrochar formation, however, has not been clarified. In addition, the mechanisms by which Mnt-hydrochar nanocomposites (CMnt) can detoxify and remove carcinogenic Cr(VI) from aqueous solution are not well understood. In the current study, research milestones in terms of clay-organic interactions are summarized, following which the synthesis and characterization of CMnt for Cr(VI) adsorption are outlined. Briefly, 1 g of Mnt was reacted with 75 mL of glucose solution (0.1, 0.2, 0.3, 0.4, 0.5, and 0.6 mol L^{-1}) by hydrothermal carbonization at 200 °C for 16 h. The resultant CMnt samples were analyzed for chemical composition, functional groups, morphological features, and Cr(VI) adsorptive properties. Mnt promoted the conversion of glucose to hydrochars, the particle size of which (~80 nm) was appreciably smaller than that formed in the absence of Mnt (control). Furthermore, the hydrochars in CMnt had an aromatic structure with low hydrogen substitution and high stability (C/H atomic ratio 0.34–0.99). The weakened OH (from hydrochar) and Si-O-Si stretching peaks in the Fourier-transform infrared (FTIR) spectra of CMnt are indicative of chemical bonding between Mnt and hydrochar. The CMnt samples were effective at removing toxic Cr(VI) from acidic aqueous solutions. Several processes were involved, including direct reduction of Cr(VI) to Cr(III), complexation of Cr(III) with carboxyl and phenolic groups of hydrochar, electrostatic attraction between Cr(VI) and positively charged CMnt at pH 2 followed by indirect reduction of Cr(VI) to Cr(III), and Cr(III) precipitation.

Guodong Yuan, Jing Wei, Benny K.G. Theng. 2021. Examples of clay-organic interactions delivering ecosystem services. *Clays and Clay Minerals* 69: 406–415 (2021)

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