Welcome to the Soil News

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In this issue...

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

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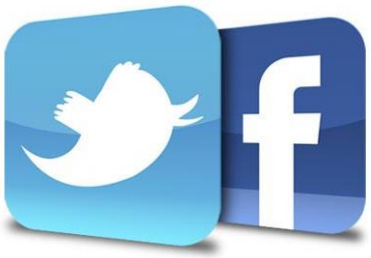

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Officers of the NZSSS December 2022-2024

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Editorial – From small beginnings: land use change and career paths

Welcome to this issue of Soil News.

Recently, on a flight I spotted an Air New Zealand in-flight magazine article which mentioned 'soil scientist', which sparked interest and surprise! Not a common sight in such a magazine!

The article was about Martinborough area vineyards and referred to Derek Milne, a soil scientist, and reported about a 1979 report comparing similarities in climate in the Martinborough area to premium French wine areas, which helped to open-up the region to its potential for vineyards and wine production on free-draining terraces (Campbell 2024).

Derek's name will be familiar to some soil scientists – he co-authored the 'Soil Description Handbook' (Milne et al. 1995). Another article reports, "Derek himself went on to found Martinborough Vineyard, one of the first five Martinborough wineries alongside Dry River, Ata Rangi, Chifney and Te Kairanga" (Dry River Wines 2024). Similarly, Martinborough Vineyard (2024) reports "Martinborough Vineyard founders conducted a DSIR survey to reveal the closest New Zealand climactic analogue to Burgundy, the birthplace of Pinot Noir. The survey determined the optimal location was within a small rain shadow centered on the township of Martinborough".

The topic invites similar but new questions for research and land use opportunities, 'where is the next area of land use change likely, and why'. Today, we would also be asking, 'what are the impacts?'.

The above shows aspects of a career path of one soil scientist. In recent discussions in Manaaki Whenua–Landcare Research, some of our early career soil scientists are looking at building their career pathways, and how they can be enhanced or adapted within constraints, or by building opportunities. The Soils and Landscapes team at Manaaki Whenua attended a team retreat for several days in February. We were fortunate to have Megan Balks as our guest speaker, talking about her career, people, 'forks in the road', and decisions that influenced her career pathway. Megan gave many fascinating insights into twists and turns shaping her career.

NZSSS supports early career researchers, through a number of initiatives, including:

- representation on the committee
- establishment of an early career award, and several student awards
- at the conference this year NZSSS is providing financial support for students to attend both the conference and the soil judging competition
- supporting the soil judging competition (https://www.soilscience.org.nz/sjc), and
- on World Soil Day 2023 we partnered with the Lincoln University Soil Society to hold a 1-day forum, focussed on connecting early career and established researchers.

I came across this editorial paper in the European Journal of Soil Science, titled “Let's give a voice to young soil researchers” (Panagos et al. 2023). It discusses establishment of a Young Soil Researchers Forum, with a goal “to give a voice to young generations, as they often struggle to have their ideas heard in the policy arena.” (Panagos et al. 2023). A forum was held, and in a special thematic issue in the European Journal of Soil Science, nine journal papers were published. Further information and encouragement are available in the paper.

This issue of Soil News has a theme on careers. We also highlight some careers, awards and achievements of Professor Leo Condron of Lincoln University who has been awarded the title of Distinguished Professor; the 2024 Zonta Science Award (to further the status of women in scientific fields and recognises early career performance) to Dr Hadee Thompson-Morrison of Manaaki Whenua Landcare Research; and the Prime Minister’s Te Puiaki Kaipūtaiao Ānamata Future Scientist 2023 award to Sunny Perry, a Year 13 student at Kerikeri High School who investigated acid sulphate soils in Northland.

In addition, many thanks to Tanya O’Neill who has been the Soil News correspondent for the University of Waikato for the last few years. We welcome Dori Torres-Rojas as the new correspondent taking up the role.

References

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Panagos P, Orgiazzi A 2023. Let's give a voice to young soil researchers. European Journal of Soil Science 74(6): e13441. https://doi.org/10.1111/ejss.13441

John Drewry

Soil Judging Competition

The New Zealand Society of Soil Science, Manaaki Whenua – Landcare Research, and Lincoln University are organising an international Soil Judging Competition to bring together students, early career and experienced soil scientists and professionals for a celebrated professional development event.

We invite you (and your organisation) to enter individually or as a team in the 2024 Moana Oceania Soil Judging Competition from 28th November – 1st December in Rotorua, New Zealand. The event is being held in conjunction with SOILS ROTORUA 2024, the joint NZ-Australia Soil Science Conference, which takes place immediately afterwards, on the 2nd - 5th December 2024.

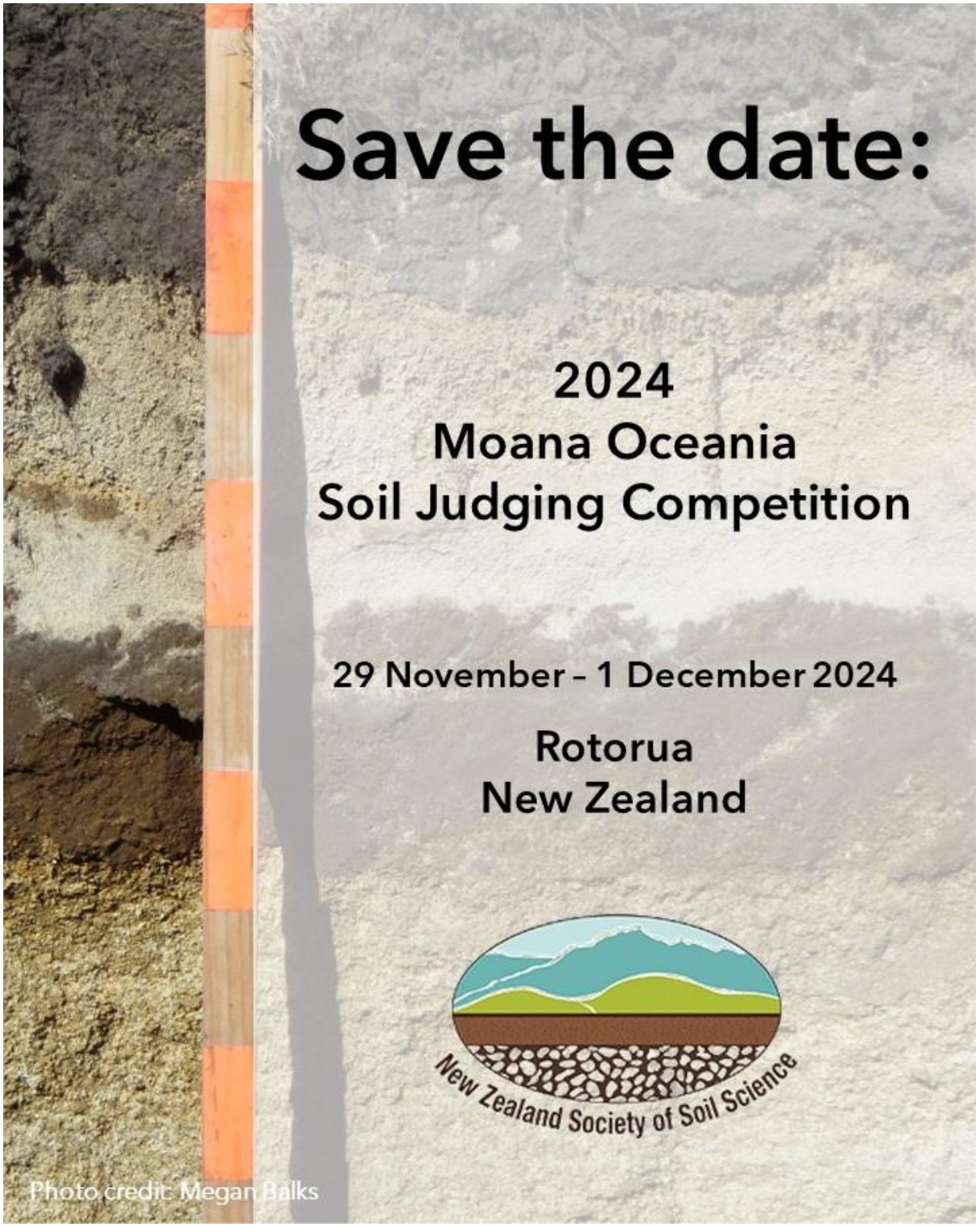
The competition requires teams and individual team members to correctly identify soil features, classify soil profiles, and interpret soil capability. The first two days are aimed at teaching and familiarising participants with soil judging and the third day is a competition day. This event is one of the best practical training and networking opportunities for aspiring soil professionals. You will learn alongside students, early career and experienced soil scientists, and soil enthusiasts, from New Zealand, Australia, and beyond!

No prior experience required.

ENTRIES OPEN IN APRIL 2024

Registration fee: $50 per person
Entry is open to any student or professional interested in soil science.

Click here to see save the date flyer for more information, or
visit https://www.soilscience.org.nz/sjc


Save the date:
2024
Moana Oceania
Soil Judging Competition
29 November – 1 December 2024
Rotorua
New Zealand
New Zealand Society of Soil Science
Photo credit: Megan Balks

New Zealand Society of Soil Science and Soil Science Australia Joint Conference

Save the date! The Joint New Zealand-Australian Soils Conference is coming to Rotorua, 2-5 December 2024.

The organisation committee is already busy to try and make sure this edition will be the most successful to date.

We need your help!

As part of this effort, your help is needed: the Science Program Committee is looking for help to review the abstracts and contribute to the high-quality standard of the scientific program of the conference.

Please contact Pierre Roudier (roudierp@landcareresearch.co.nz) or Sam Carrick (carricks@landcareresearch.co.nz) if you are interested to take part.

Help needed to review abstracts

NEW ZEALAND SOCIETY OF SOIL SCIENCE AND SOIL SCIENCE AUSTRALIA JOINT CONFERENCE

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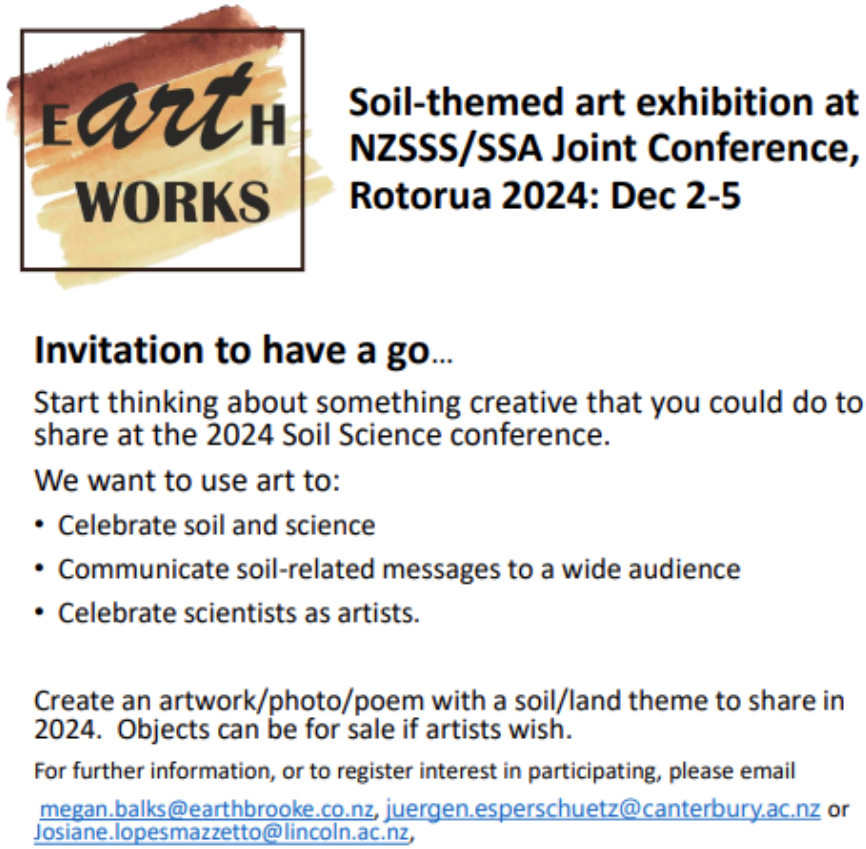
The organising committee

Soil-themed art exhibition

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



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

New Zealand Society of Soil Science Awards 2024

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

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

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

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

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

Email: Brendon.Malcolm@plantandfood.co.nz

Title of Distinguished Professor awarded to Leo Condron

Professor of Biogeochemistry, Professor Leo Condron, has been awarded Lincoln University's most prestigious title of Distinguished Professor.

Reserved for only four academics at any one time, the title of Distinguished Professor pays tribute to leadership of the highest order in research and education at an institutional, national and international level.

The honour has been conferred on Professor Condron in recognition of his world-class leadership and international eminence in his field of soil phosphorus dynamics and the interplay with organic phosphorus.

Joining Lincoln University in 1992, Professor Condron has continuously maintained a substantial teaching portfolio, and to date has supervised 110 postgraduate students from 21 countries (including 60 PhD students), as well as mentored and supervised 13 postdoctoral fellows. He has also acted as course examiner, served on a number of University committees and panels, and was the Academic Coordinator for the Bachelor of Agriculture and Agricultural Science degrees for 18 years.

His research has focused on investigating the biogeochemistry of organic carbon and major nutrients in natural and managed ecosystems, with an emphasis on the nature, dynamics and bioavailability of organic and mineral forms of phosphorus in the soil-plant system in relation to soil management and land use.
Professor Condron explains, "Together with nitrogen, phosphorus is the most important nutrient that determines the productivity of all natural and managed ecosystems on earth.

"Phosphorus is a finite resource, and New Zealand imports large quantities of phosphorus to sustain primary production. However only a small proportion of the phosphorus applied in fertiliser each year is taken up by plants, while most accumulates in soil as residual or legacy phosphorus, which means that repeated inputs are required to maintain plant growth.

"My research has mainly focused on investigating the fundamental processes that determine the fate of phosphorus in soil-plant system, with the aim of improving the efficiency with which phosphorus inputs are utilised in agriculture. This has principally involved assessing and quantifying the short- and long-term impacts of variations in nutrient inputs, land use/vegetation, land management practices, and environmental conditions on soil phosphorus transformations, plant acquisition and mobility.

"This research has highlighted the importance of biological processes in determining phosphorus availability and utilisation in soil, and how these can be employed to improve phosphorus use efficiency and thereby lower phosphorus inputs required to maintain productivity."

During his career, Professor Condron has developed and maintained an extensive network of research partnerships in Aotearoa and internationally, including collaborations with researchers in Australia, Brazil, Canada, Chile, Germany, Sweden, Switzerland, UK and USA. Since publishing his first paper in 1985, Professor Condron has published 314 articles, contributed more than 50 papers in leading science journals, authored or co-authored 15 book chapters and delivered to two major reports on the status of New Zealand soils for the United Nations.

He has been a Fellow of the New Zealand Society of Soil Science since 2008 and a Fellow of the British Society of Soil Science since 2015.

In the 2023 Research.com Best Scientist Rankings for Plan Science and Agronomy he was ranked first among New Zealand scientists and 183rd internationally. Based on SCOPUS citation data collated up to 2020, he was the number two ranked New Zealand soil scientist in the Agronomy and Agriculture category.

The above information was copied from: https://www.lincoln.ac.nz/news-and-events/most-prestigious-title-of-distinguished-professor-awarded-to-leo-condron/

Hadee Thompson-Morrison awarded 2024 Zonta Science Award

Hadee Thompson-Morrison of Manaaki Whenua Landcare Research was awarded the 2024 Zonta Science Award. The Zonta Science Award was established to further the status of women in scientific fields and recognises early career performance.

Hadee intends to use the award to attend the International Union of Soil Science (IUSS) conference in May to present on the recent work into the management of surplus soils done by Jo Cavanagh, Robyn Simcock, Garth Harmsworth and herself, and on a trace element model developed during her PhD. Following the conference, she'll visit Rothamsted Research in the UK for 2 weeks to work on this model with researchers from their agricultural modelling team and using data from their ~200 year-long field trials.

As women remain underrepresented in STEM fields, the Zonta Science Award provides a valuable opportunity for early-career females to progress their research and careers and Hadee is very thankful for the opportunities this award will provide.

Link to RNZ interview on 15 May 2024:
[Canterbury researcher awarded Zonta Science Award | RNZ]

Hadee Thompson-Morrison receiving the 2024 Zonta Science Award in Wellington.

The 2023 Prime Minister's science awards - future scientist

The Prizes were presented by Prime Minister of New Zealand, Rt Hon Christopher Luxon, and Minister of Science, Innovation and Technology and Minister for Space, Hon Judith Collins, at the prize ceremony at Parliament on 1 May 2024.

The Prime Minister's Te Puiaki Kaipūtaiao Ānamata Future Scientist 2023 is Sunny Perry, a Year 13 student at Kerikeri High School in Northland.

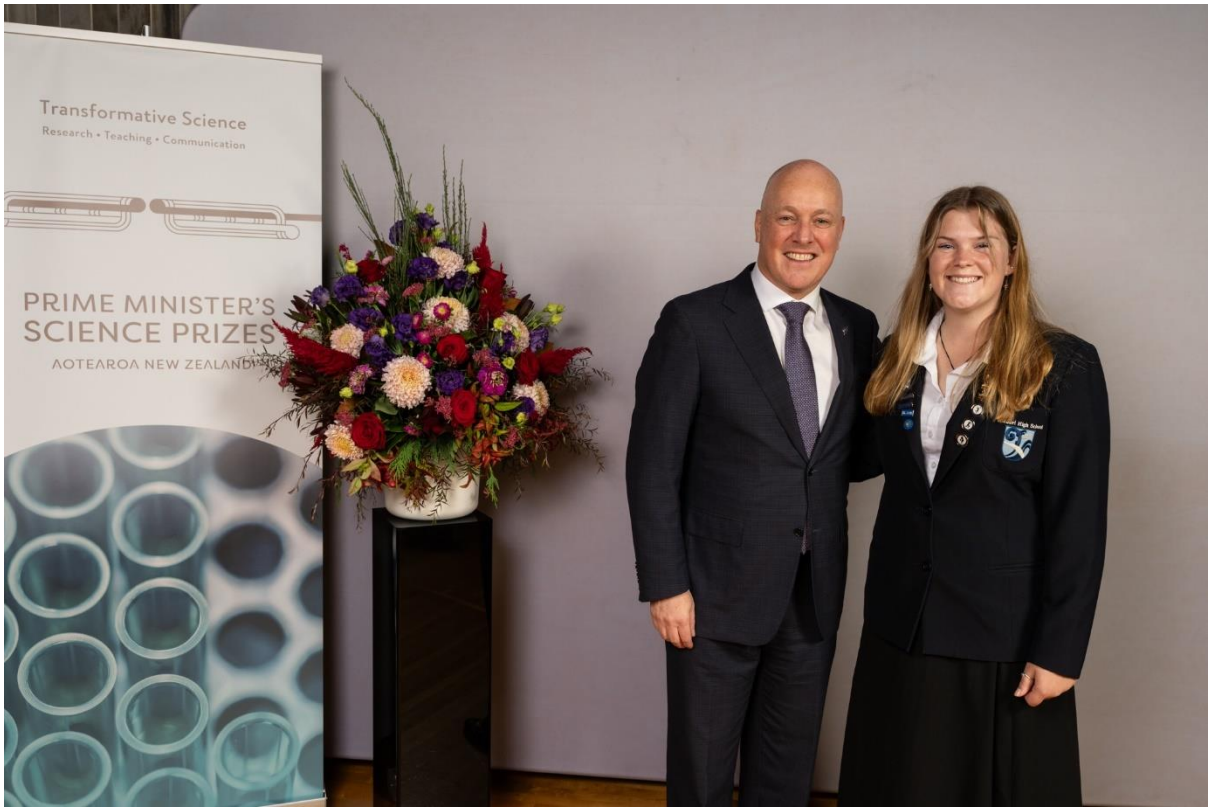
Sunny won the prize for her research project to test for and map the presence of highly corrosive soils in Northland. These soils are naturally rich in iron sulfides, and therefore can oxidise to produce sulphuric acid. This acid can harm human health and affect fish, animals, and plants. The acids can also affect concrete and metal structures, resulting in costs and risks of failure. This risk has not been well-studied in New Zealand, compared with Australia and other countries.

Sunny adopted a method from Australia and tested 480 samples from 20 sites across the Far North region. She developed a Geographic Information System (GIS) map to help her predict sites which might have these soils – often former wetlands—and she has now updated the map to include the soil-testing results. Source: https://www.royalsociety.org.nz/news/prime-ministers-science-prizes-recognise-work-in-cancer-genetics-psychology-of-music-communication-of-volcanic-risk-student-engagement-and-soil-science/

Sunny says that the idea for her research came when her father, an engineer, told her about potential acid sulphate soils (PASS). These types of soils, when exposed to oxygen, generate sulfuric acid, which can have a detrimental impact on biodiversity, infrastructure, and human health. Sunny's results showed that her predications were very accurate – she detected PASS at 90% of the sites, including inland sites where PASS had never been recorded before. Sunny explains that when these types of soils are exposed to air, iron sulfides can react rapidly with oxygen to produce sulfuric acid. Sulfuric acid in soils can have a range of negative effects, including for plants, animals, humans, and can even "attack" materials such as concrete.

The experts on the selection panel were very impressed with the scale of Sunny's research and its potential applications for management of land use. Sunny plans to use this prize to finance her university education, but with a broad interest in the world of science, she's still deciding what she plans to specialise in. Source: https://pmscienceprizes.org.nz/groundbreaking-soil-research-wins-high-school-student-the-prime-ministers-future-scientist-prize/

Further information and stories:
https://www.rnz.co.nz/national/programmes/ourchangingworld/audio/2018936314/the-2023-prime-minister-s-science-prizes-communicating-volcano-science-and-sampling-soils
https://www.farmersweekly.co.nz/people/sunny-shines-light-on-northland-soils/



Prime Minister of New Zealand, Rt Hon Christopher Luxon, with The Prime Minister's Te Puiaki Kaipūtaiao Ānamata Future Scientist 2023 Sunny Perry, at the prize ceremony at Parliament on 1 May 2024.

Letter to the editor

Kia ora Soil News readers!

Sunny Perry here, I am the recent recipient of the Prime Minister's Future Scientist Prize 2023. I'm honoured to be writing to you today, not just as an award winner, but as a passionate advocate for the world of soil science.

My research focused on a specific type of soil in Northland – one with the potential to become highly acidic if disturbed. I know "acidic soil" might sound scary, but here's the good news: with awareness and proper management, these soils pose no threat. In fact, my project aimed to achieve just that – to bring these "potential acid sulfate soils" (PASS) to light.

Why? Because knowledge is power, especially when it comes to land use and development. By mapping these soils across Northland, I hope to empower landowners, councils, and developers to make informed decisions. This means we can utilise this land while safeguarding the environment and infrastructure.

Think of it this way: before building a house, you wouldn't ignore the foundation, right? PASS is similar. By identifying these areas beforehand, we can take proactive steps, like adding lime to neutralize the acidity, ensuring a healthy future for the land and everything that thrives on it.

My journey into soil science wasn't planned, but it's been an incredible adventure. It all started with a conversation with my dad, an engineer, about the potential dangers of PASS. That sparked a curiosity that led to countless hours of research, testing, and ultimately, a map that hopefully helps to inform people about these special soils.

This experience has solidified my appreciation for the often-overlooked world of soil. Soil is the foundation of life, and understanding its complexities is critical for a sustainable future. While I may not be pursuing soil science specifically in university (the options are still wide open!), I'll forever be grateful to the incredible soil science community for their guidance and the wealth of knowledge I gained.

For all the young readers out there, remember: curiosity is a powerful tool. Don't be afraid to ask questions, delve into the unknown, and explore the fascinating world around you. You never know where it might lead!

And to all the soil scientists out there, thank you for your dedication to this vital field. Your work is the foundation upon which a healthy future is built.

Ngā mihi,
Sunny Perry

In the following pages of Soil News, we'll be diving deeper into the specifics of my research and its potential applications. I hope you'll enjoy learning more about this fascinating area of soil science!

Understanding and managing potential acid sulfate soils (PASS) in Northland

Ben Perry

Introduction

Acid sulfate soils (PASS) present a unique challenge in agricultural and land development settings. These soils harbour iron sulfide minerals, primarily pyrite (FeS_2), that undergo oxidation upon exposure to air, generating sulfuric acid (H_2SO_4). This oxidation process is triggered when previously waterlogged PASS, typically benign in their saturated state, are drained or excavated. The release of sulfuric acid from the soil can have a number of negative consequences:

- It can kill or harm plants and animals by making the environment too acidic.
- It can release metals and metalloids, such as aluminium and arsenic, into the soil and water. This can contaminate drinking water and harm aquatic life.
- It can damage infrastructure, such as buildings, roads, and bridges.

A Pioneering Map for Northland Management

A research project led by Sunny Perry, a remarkable 17-year-old, aimed at providing a map showing where these special soils might be found. Perry's work has yielded the first-ever regional map of potential PASS distribution across Northland, New Zealand. This map serves as a valuable tool for land managers and planners to help make informed decisions regarding PASS risks.

Key Findings and Significance

The study employed a multi-phased approach, integrating existing geological data with targeted field sampling and advanced spatial analysis techniques. The resulting map confirms the expected higher likelihood of PASS occurrence in low-lying coastal areas (0-5 meters above sea level) due to their proximity to historical sea level fluctuations and associated depositional environments favoring pyrite formation. Interestingly, the research also identified an unexpected inland site with strong PASS indicators. This finding underscores the need for a broader understanding of PASS formation processes beyond strictly coastal settings, potentially involving paleo-environmental drivers like ancient freshwater wetlands or episodic marine incursions. This discovery warrants further investigation into the specific conditions that facilitated inland PASS formation.

The PASS distribution map has some remarkable benefits:

- **Informed Land-Use:** By identifying areas with potential PASS occurrence, both coastal and inland, the map allows for informed decision-making regarding agricultural and land development practices. This can guide the selection of suitable acid-tolerant crops or the implementation of drainage management strategies that minimize the risk of PASS oxidation and subsequent generation of sulfuric acid.

- **Soil Management:** Understanding PASS distribution allows land managers to tailor soil amendments. Where historic landuse may result in sulfuric acidification of soils the application of lime ($CaCO_3$) could be considered to neutralize soil acidity and mitigate the negative impacts on essential soil

nutrients and microbial communities. The map could also be used to design targeted field studies to assess the effectiveness of various mitigation strategies in different PASS severities and soil types.

- **Infrastructure Protection:** While there are agricultural implications, PASS events can also impact buried infrastructure like house foundations and concrete drainage pipes due to increased sulfuric acid corrosion. This highlights the potential for collaboration between soil scientists and infrastructure engineers to understand the acid generation potential of the soils and develop mitigation strategies to ensure infrastructure lasts the test of time.

A Starting Point for Future Research

The map serves as a foundation for further research efforts in agriculture, engineering, and soil science:

- **Expanding the Sample Size:** A more comprehensive regional picture can be achieved by collecting additional soil samples across Northland. This will allow for a more robust understanding of PASS distribution patterns.

- **Detailed Laboratory Analysis:** Quantifying sulfate content (SO_4^{2-}) in both coastal and inland sites through detailed laboratory analysis will provide a clearer understanding of the spatial variability of PASS risk. Additionally, analyzing other relevant soil parameters like pH, electrical conductivity (EC), and extractable metals can provide valuable insights into the overall soil health and potential environmental impacts associated with PASS.

- **Mitigation Strategy Development:** Exploring and evaluating additional mitigation strategies beyond liming, such as the use of specific cover crops or biochar amendments, could be beneficial. Collaborative research between agricultural and soil scientists can be instrumental in developing and testing these strategies in field settings.

- **Inland PASS Formation Mechanisms:** Investigating the mechanisms behind inland PASS formation is relatively unknown within the New Zealand context. Research into this source of PASS could inform the paleo-environmental conditions that facilitate PASS development.

Opportunities to Collaborate

This research on Northland PASS distribution complements similar initiatives underway by Auckland Council and Environment Waikato. Collaborative efforts across the upper North Island will contribute significantly to a more holistic understanding of PASS and ultimately lead to improved environmental protection and sustainable land management practices for the benefit of agriculture, infrastructure, and the wider environment.

Report on urban soils from Parliamentary Commissioner for the Environment

Read the latest PCE report on ‘Urban ground truths’ recently released by the Parliamentary Commissioner for the Environment, ‘Urban ground truths - Valuing soil and subsoil in urban development’.

Healthy soil is the unseen engine room of our urban green spaces. The biophysical services that green spaces provide, such as stormwater filtering and absorption, shade, cooling and air filtration are reliant on an adequate volume and depth of topsoil and subsoil. Yet many of our new residential developments may not have enough deep, permeable soil to support these services.

In his latest report, ‘Urban ground truths’, the Commissioner investigates what happens to soil during the urban residential land development process. The report identifies practices undermining the health and extent of soil and subsoil in new subdivisions and infill developments, as well as market and regulatory drivers behind these practices.

The Commissioner made several recommendations that aim to provide greater protection for soil and ensure that new residential developments have enough soil to provide essential environmental services.

A separate report is also available on a review of soil replacement and retention requirements of unitary and territorial authorities, by Hadee Thompson-Morrison, Robyn Simcock, and Jo Cavanagh.

https://pce.parliament.nz/publications/urban-ground-truths/
StoryMap:
https://storymaps.arcgis.com/stories/ee9f99df2567410ab62d73158bfe7ace

Review: Soil replacement or retention requirements of unitary and territorial authorities and their adequacy from an ecosystem services perspective:
https://pce.parliament.nz/media/2ugaetew/soil-replacement-or-retention-requirements-and-their-adequacy-mwlr.pdf

News from the Regions

Waikato/Bay of Plenty

AgResearch

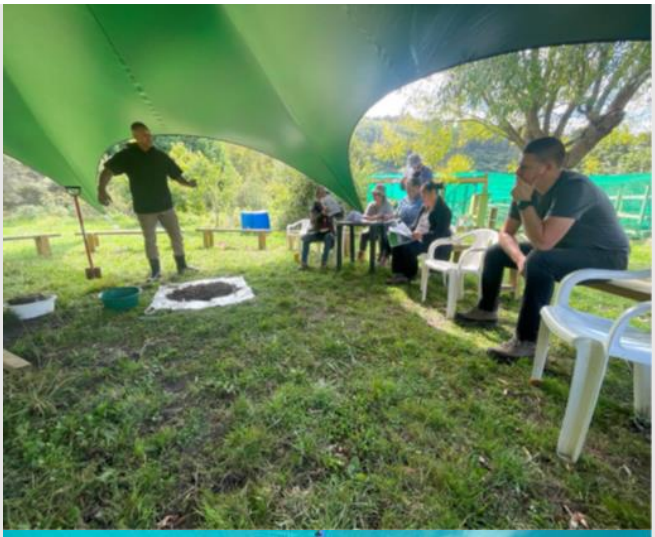
Piwakawaka Farm / Nursery hosted a wānanga which was held in March. This wānanga organised by Te Pū Oranga Whenua (and Mouri Turoa) created opportunity for learning and engagement, as part of the Muhupopo project.

Muhupopo is a collaboration between AgResearch and Te Pū Oranga Whenua, a collective of Māori agri-businesses, providing a platform for AgResearch to engage with maori, upholding tikanga maori practices alongside western science. Vice versa it provides Te Pū Oranga Whenua access to western science research, testing and practises.

At the Wananga Agresearch staff member, Irirangi Warbrick, who is also hoa haere for TPOW and a member of the Muhupopo team, was invited to share ideas practices and matauranga; the host nursery shared their mahi with the group providing a tour of the site, and pūrākau (story). Irirangi Warbrick conducted a visual soil assessment with the group and spoke briefly about soil health and fertility. This was an engaging session with all attendees participating and showing great interest.

A note from Irirangi: “On a personal note, this was my first solo VSA lead session and the feedback I received was positive giving me grounding and confidence in my delivery, for next time. I can attribute this good learning outcome for the VSA attendees at Piwakawaka Nursery to my team within Land Use Functions and Evaluation, their support (“you’ve got this Iri”) and the learnings I have had and works I have been exposed to and contributed to over the past 6 months. A big thanks to my lab partner Rachel always making sure I’ve got what I need.

This and many other experiences I have had here at AgResearch support and increase my interest in soil health. I want to be able to provide healthy nutritious chemical free kai for my whānau; have conversations with whanau about the benefits of soil health; and encourage others to better understand to live healthier lives. The other aspect that continues to interest me is the regeneration of land (soil) that has been damaged (devastated) by pine – this interest started during my time as a Hoa Haere with Te Pū Oranga Whenua.”



University of Waikato

Waikato University
Louis Schipper, Charlotte Alster (Lincoln University), and **Andrew Barnes** met with Everlyn Forrest and others from Ngati Tahu-Ngati Whaoa (NTNW) to build on an earlier kawenata. The team have a joint Marsden funded project (led by Andrew and Charlotte) that will utilise geothermal soils to explore the impacts of increased soil temperatures on soil food webs. Ngati Tahu-Ngati Whaoa are kaitiaki of these taonga geothermal sites that may lead to critical insight into how soil ecology will change with global warming. Louis also presented their earlier research on geothermal soils at Ngapouri farm (Auckland University research farm) as part of a field day by the Liggens Institute.

Research meeting at the beautiful Waimangu Valley café with Ngati Tahu-Ngati Whaoa, University of Waikato and Lincoln University initiating planning on a Marsden funded project.

David Lowe, despite being part time, has been busy. He is retiring in mid-June this year after teaching, researching, and supervising in Earth Sciences at Waikato University for more than 40 years. He has just completed (30 April 2024) his final report for Marsden-funded research on using liquefied tephra layers (termed tephra seismites) in lake sediments in the Hamilton lowlands as a paleoseismic tool (see https://tephra-seismites.com/). With colleagues mainly from GNS Science, David also took part in trenching across the Te Puninga Fault near Morrinsville as part of the same Marsden project (co-funded by EQC), in late February (see report on earlier trenching in 2022 in Villamor et al. 2024). Joshua Hughes helped at the trench sites by conducting a number of soil tests including the NaF test for allophane. Josh showed that the soil horizons formed in the cover bed of thin, incrementally deposited tephra fall beds overlying Okareka tephra are halloysitic, not allophanic (Figs. 1 and 2).

Fig. 1. Newlands trench across Te Puninga Fault, Quine Rd, with details of soil profile including buried soil evident at right. Note fault and occurrence of (probable) Okareka tephra (age 23,500 cal yr BP) as white ash layer top right. Photos: David Lowe.

Fig. 2. Soil profile (Newlands trench) including buried soil beneath Okareka tephra (Ok). Note that the darkish grey colour of the soil beneath Okareka tephra reflects a coating of mangans (MnO_2), not organic matter. The post-Okareka tephra mantle is non allophanic, indicating that drainage has been sufficiently slow to keep desilication in check, thereby favouring the formation of halloysite rather than allophane, as occurs for the (halloysite-dominated) Silverdale soil in a somewhat similar setting (see Singleton 1991; Lowe et al. 1994; Lowe 2023). Photo: David Lowe.

David ran his last undergraduate field trips in March this year for 1st year students based at the Tauranga campus of University of Waikato. His first trip (4 March) was to show students their first ever soil profile, and they were lucky to see one of the most beautiful soils in all of Aotearoa: the Katikati sandy loam on Upper Ohauiti Road, Tauranga, formed by upbuilding pedogenesis (Fig. 3) (Rijkse 1991; Rijkse and Cotching 1995).

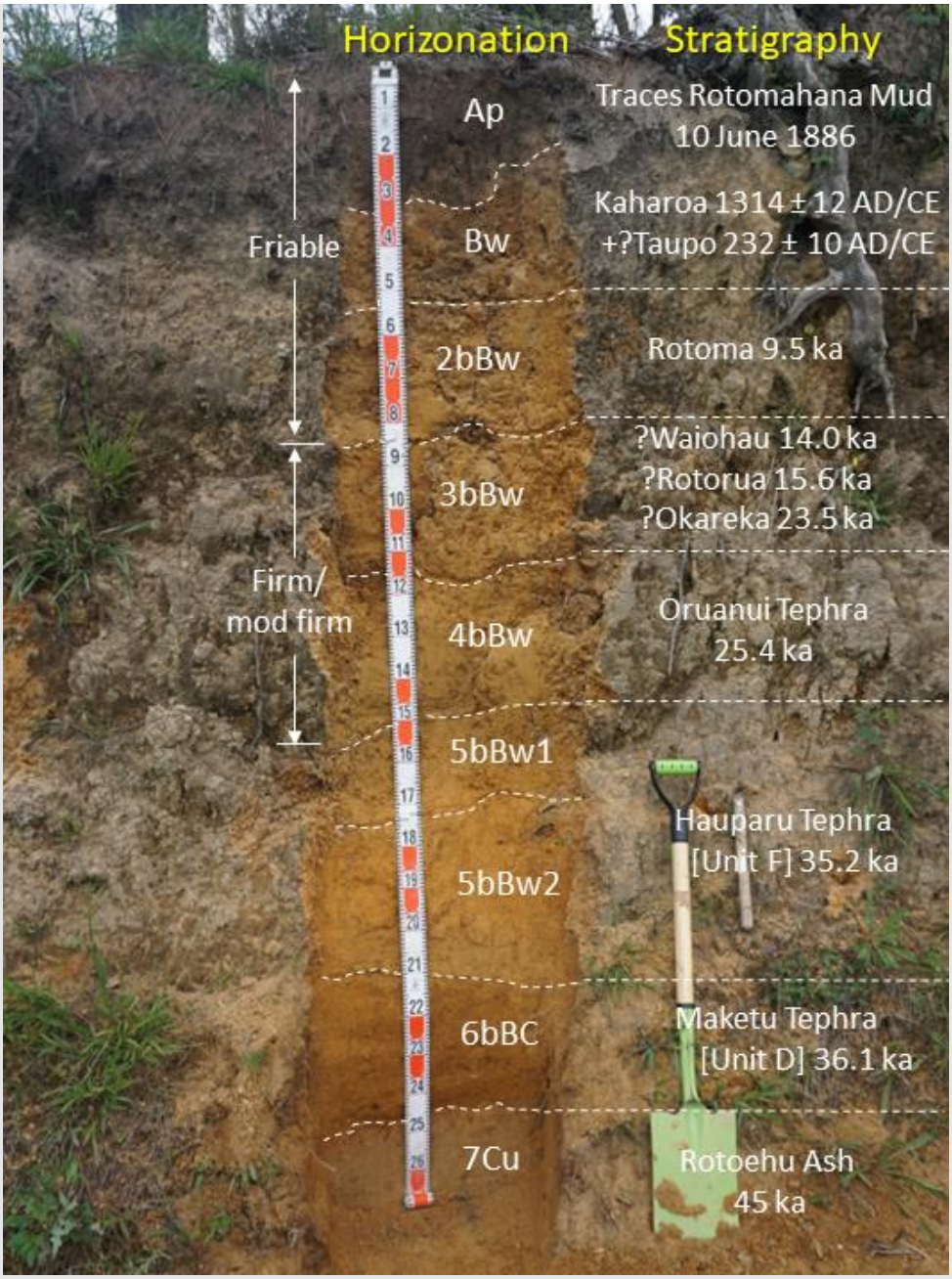


Fig. 3. Katikati sandy loam, Ohauiti Rd, Tauranga. Typic Orthic Allophanic Soil (Hewitt 2010). Photo: David Lowe.

David's second trip (24 March) was run along the Matata coast (Fig. 4), onto the Rangitaiki Plains, and also on young (700 years old) Kaharoa tephra deposits near Pongakawa. As well as a Gley Soil exposed in a drain on Rangitaiki Plains (Figs. 5 and 6), David wanted to show the students a Pumice Soil given the importance of these in the history of soil science (and agricultural economy) in New Zealand. Armed with information from Scott Fraser and Emily McKay (Landcare Research, Hamiton), and Bill Cotching's Te Puke soils bulletin and map (Cotching 1998), David located an excellent new section with the Paengaroa loamy sand exposed by road widening on Old School Road, near Pongakawa school (Fig. 7).

In mid-March, David gave a talk (possibly for the last time) to the Auckland branch of the Geoscience Society of New Zealand (doubling also as Auckland Geoclub) hosted by Bruce Hayward. His talk, entitled "Waikato lakes and paleolakes – distribution,

origins, and history", arose from research on the region's lakes, and the paleoenvironmental records they contain, prepared for two chapters (Green and Lowe 2024; Lowe and Green 2024) in a forthcoming book being published by Waikato Regional Council entitled "The hidden gems of the Waikato – the history, ecology and management of the Waikato lakes – Ō Tātou Roto - He Taonga Tuku Iho."

Fig. 4. David explaining the pyroclastic deposits and paleosols exposed in cliffs along Matata coast (behind David). Photo: Hazel Needham.

Fig. 5. Students happily getting down to it on the margins of a dry drain on Omeheu Road, viewing the Paroa silt loam on peat (exposed behind the photographer) on Rangitaiki Plains (Fig. 6). Photo: David Lowe.

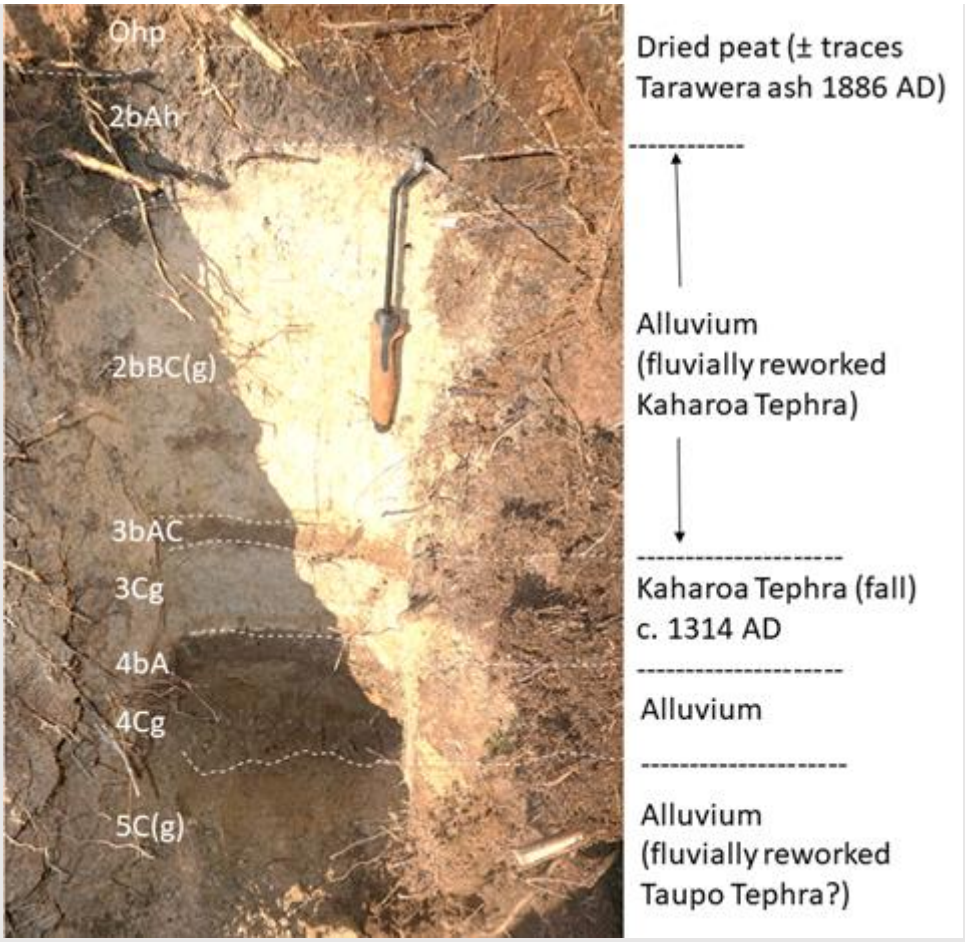


Fig. 6. Paroa silt loam on peat on Omeheu Rd on Rangitaiiki Plains near Edgecumbe (see Pullar 1985). Peaty Recent Gley Soil. Photo: David Lowe.

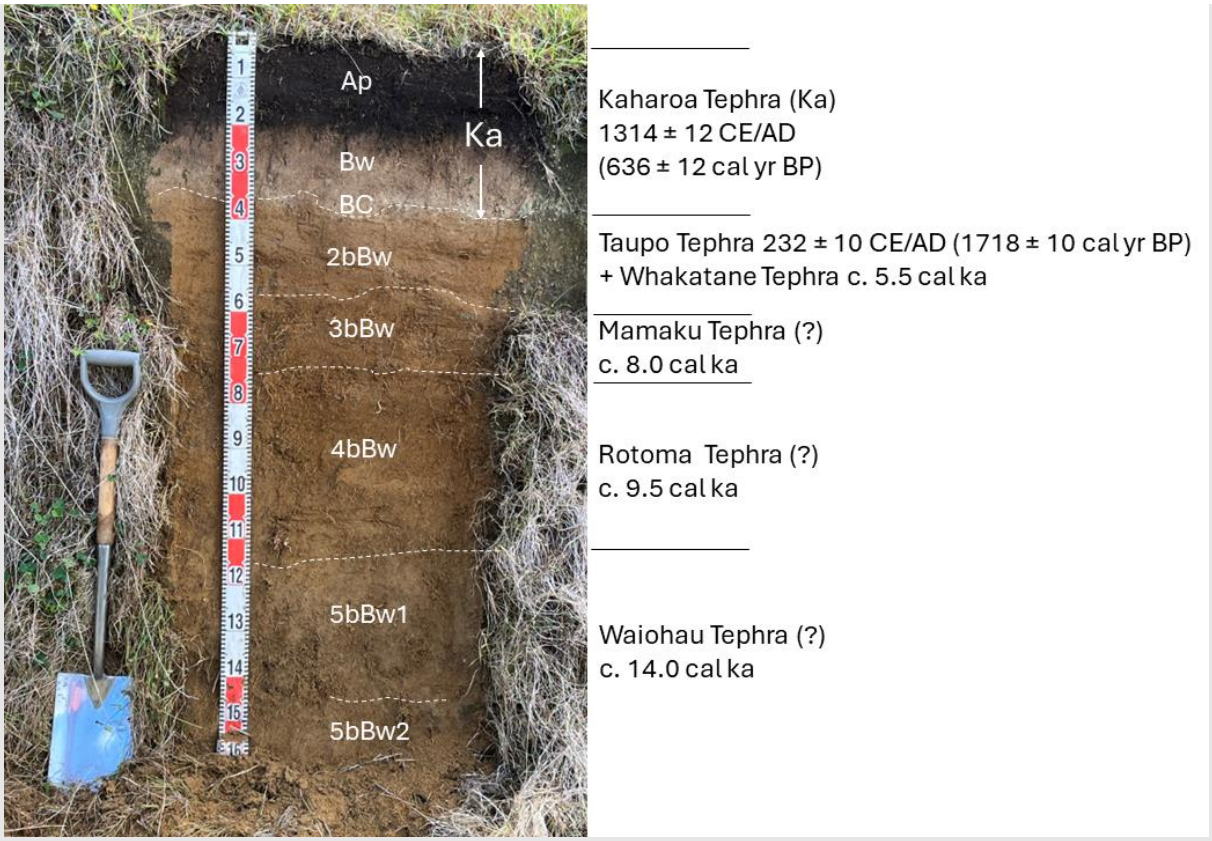


Fig. 7. Paengaroa loamy sand, Old Coach Road, Pongakawa. Buried-allophanic Orthic Pumice Soil. Photo: David Lowe.

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Villamor, P., Clark, K., Coffey, G., Hughes, J.W., Lowe, D.J., Hogg, A.G., Moon, V.G., Moratalla, J., Thingbaijam, K. 2024. The Te Puninga Fault, Hauraki Plains: a new seismic source in the low seismicity northern region of New Zealand. *New Zealand Journal of Geology and Geophysics* (open access)
https://doi.org/10.1080/00288306.2023.2296875

Manawatu

Manaaki Whenua – Landcare Research

A new Leco C and N analyser was installed in the Environmental Chemistry (EC) laboratory, Palmerston North. The new Leco has greater capacity for analysing more samples than our old one, and the whole lab team will be trained on its use. The EC lab has also installed other new equipment including a new furnace, fume cupboard and several soil drying ovens – the new equipment, will help to meet the needs of our clients.

The new LECO CN 928 Carbon and Nitrogen Analyzer has been installed in the Environmental Chemistry (EC) laboratory. Compared to the previous TruMac LECO, key improvements include increased throughput with a 100-sample position autoloader and a lower cost-per-analysis, achieved by replacing the very expensive helium gas with cheaper argon. In addition, Cornerstone Mobile remote software allows users to stay updated on their smartphone about the instrument's analysis batch progress, performance, and status while away, providing a significant benefit for the technician, which flows through to improving client turnaround times and quality.

Sujatha Senanayake operating the new LECO Carbon and Nitrogen Analyzer in the Environmental Chemistry (EC) laboratory

The Soils and Landscapes team attended a team retreat at Kaikoura for several days. The team enjoyed getting to know each other more, listening to several guests' perspectives, workshopping some new ideas, and going on a 'treasure hunt'. We were fortunate to have Megan Balks as a guest speaker, talking about her career, people, 'forks in the road', and decisions that influenced her career pathway. Megan gave many fascinating insights into her career, including 19 expeditions to Antarctica. Many thanks to Andrew Manderson and Jeanette King and the team for organising it.

The project 'Linking soil quality indicators to land use pressure and water quality' finished. John Drewry, Rich McDowell, Stephen McNeill, Richard Law and Bryan Stevenson worked on an Our Land and Water National Science Challenge funded-project which explored ways to link soil quality, water quality, land pressure and land valuation data to better understand the impacts of land management on water quality.

Check out their storymap and the interactive map for water quality trends in a catchment near you! The storymap gives an overview of high-level research, plus an interactive map of 192 NZ catchments with catchment land use statistics and water quality trends, from 15 years data, of 9 water quality indicators. Graphs of long-term and short-term trends from extensive statistical modelling can be viewed. A 'heat map' of soil quality sampling nationally is available.
https://storymaps.arcgis.com/stories/30d6312e64c94c0b9567f439a0cac45b

There are a range of soil and land-based articles on MWLR recent research in Putaiao that may be of interest. Keep an eye out for future journal papers on this project.
https://www.landcareresearch.co.nz/publications/putaiao/

Benny Theng's textbook revised after 50 years!

Congratulations to **Benny Theng** on the publication of the newly revised edition of his 1974 textbook '*The Chemistry of Clay-Organic Reactions*'.

The second edition of *The Chemistry of Clay-Organic Reactions* book provides a comprehensive and fully updated summary of the literature on the interactions of clay minerals with organic molecules, including reaction mechanisms and bonding modes together with their practical and industrial applications. The reader will gain an insight into the formation and properties of complexes between clay minerals and a variety of organic compounds and the use of such complexes as sorbents and carriers of organic pollutants, pesticides, dyes, and pharmaceuticals.

Book link here:
The Chemistry of Clay-Organic Reactions | Benny K.G Theng | Taylor & F (taylorfrancis.com)

Massey University

Soils are more than just dirt – School students get hands-on with soil

Massey's School of Agriculture and Environment had the pleasure of hosting classes from Tauranga Boys College and Rathkeale College this month. These visits provide a brilliant opportunity to get back to basics and present a well and poorly drained soil profile to the students and have them assess colour and structure. We kicked the sessions off with a quick introduction to soil and why it's important, including:

- Soil acts like a big sponge and can soak up water and reduce flood risk.
- Soils are alive and can break down waste before it gets into the river. We can take advantage of this by applying farm or human waste to land.
- Soil stores carbon. It's important to understand and protect soil's ability to act as a carbon sink to help mitigate climate change.
- We build homes on soil. It's important to build these in smart places where they will not be impacted by natural hazards like flooding or liquefaction.
- We grow our food in soil. A lot of the food you find at the shop relies on the ability of a farmer to grow plants in soil. It all starts with the soil, it's the single most important resource on any farm and we need to look after it.

Students were then told not all soils are made equal, some have distinct advantages and disadvantages over others. We presented two soils that are located within 35km of Massey, occurring on similar quartzofeldspathic loess parent materials and within

similar rainfall zones of around 1000mm/yr. However, the soils have very different properties and productive potential.

Students started by describing what colours they could see and what differences they noticed between the two soil types. This led to an activity involving a Visual Soil Assessment drop shatter test and structure layout to ensure everyone was getting hands-on. Some students required more persuasion than others, with passionate high school teachers helping by offering handfuls of soil to anyone feeling particularly reluctant. Before long all students were adequately dirty, showing clear evidence of some hands-on learning. My favourite comment from a high school student when presented with Ohakea silt loam was “this soil looks heavy, it's going to take much more energy to work this one up”. Students were all very quick to pick their favourite soil, no surprises there.

Following on from this we had a general discussion about what this all means for farming. In particular, thinking about the current intensive dairy land use on the Ohakea silt loam and some of the winter management considerations to minimise pugging and compaction as well as difficulties around effluent application. This all has important financial implications as many of the management strategies to minimise environmental risk involve large capital investment. On the other hand, vegetable production on the Levin silt loam comes with another set of considerations around organic matter loss, the need to rest soil under pasture for 3-4 years following 3-4 years of cropping and the potential for leaching if nutrients are in excess of plant demand.

Students from Tauranga Boys College had a quick go at a Visual Soil Assessment structure layout on Levin silt loam (well drained, Allophanic Brown soil) and Ohakea

silt loam (poorly drained, Perch-gley Pallic soil), before having a discussion about what this means for the way roots, water and air can move through these soils and implications for landuse and management.

Tauranga Boys College students checking out the coarse blocky structure of the poorly drained Ohakea silt loam and learning about the significance of colour and what we mean by mottling.

Giving a group of Rathkeale College students an introduction into why soils are important before setting them loose on a couple of soil profiles to get a first hand look at what well and poorly drained soil looks like and the significance of that from a landuse and management perspective.

Refining estimates of nitrogen attenuation in New Zealand to inform modelling of catchment water quality management scenarios

Subsurface nitrogen attenuation is a measure of how much nitrogen is removed below the root zone. This varies from place to place, meaning some land units are more resilient in dealing with nitrogen loss than others. The variability of nitrogen attenuation across the landscape creates uncertainty in models attempting to estimate nitrogen loss to waterways.

Massey's Farmed Landscape Research Centre and Horizons Regional Council are collaboratively investigating how to refine, measure and account for subsurface nitrogen attenuation in New Zealand landscapes to inform modelling of catchment-scale water quality scenarios.

As part of this work, PhD student Stephen Collins has been undertaking fieldwork on Massey's Tuapaka Farm to understand soil redox conditions and the potential of different soil types to attenuate nitrogen.

Stephen is being supervised by Associate Professor Ranvir Singh, Professor David Horne and Dr Jon Roygard (Group Manager Catchment Operations at Horizons Regional Council).

Left-Right: Feilding Intermediate teacher Jiselle Rider, Associate Professor Ranvir Singh, PhD student Stephen Collins and Associate Professor Lucy Burkitt digging and describing a soil profile through Shannon fine sandy loam (Imperfectly drained, Mottled Immature Pallic soil) on Massey's Tuapaka sheep and beef research farm.

News from the European Soil Data Centre

Soil bulk density in Europe
In the LUCAS 2018 soil survey, bulk density has been analysed at different depths, i.e. at 0–10 cm and 10–20 cm. By applying a Cubist model, we spatialised the circa 6,000 LUCAS samples and developed a high-resolution map (100 m) of bulk density for the 0–20 cm depth and also maps at 0–10cm and 10–20 cm. The modelling results as described in the peer-reviewed publication show a very good prediction (R^2:0.66) of bulk density for the 0–20cm map, which outperforms previous assessments. The bulk density maps were then used to estimate packing density which is a proxy to estimate soil compaction; to this end, clay content was also used. Data available: https://esdac.jrc.ec.europa.eu/content/soil-bulk-density-europe
Paper: https://doi.org/10.1016/j.agee.2024.108907

Pesticides residues in European agricultural soils
This dataset contains the results of a study targeting residues of active ingredients of pesticides used as crop protection products in soil samples collected from the 2018 LUCAS survey. This dataset is an output of a study providing a comprehensive characterization of the extent of residues of active ingredients from pesticides in the soils of the EU (118 substances for 3473 sites). The data are available from: https://esdac.jrc.ec.europa.eu/content/pesticides-residues-european-agricultural-soils
Report:
https://esdac.jrc.ec.europa.eu/public_path/shared_folder/doc_pub/JRC133940_01.pdf

Land suitability in temperate Europe
Land suitability assessment is used in conjunction with geographic information systems to spatially model diverse aspects of soil functions, having the potential to facilitate a sustainable increase in agricultural production, reduce land degradation, or aid humans in adapting to climate change. Compared to the existing datasets, this study provides a new higher resolution geospatial assessment of the agricultural land suitability for several crops and land uses in the temperate continental climate across Europe. This dataset includes land suitability maps for several crops and land uses (14 crops , 7 fruit trees, 3 land-use types) in the temperate continental climate of Europe. To model the land suitability we used geospatial data depicting seventeen eco-pedological indicators (e.g. soil texture, pH, porosity, temperature, precipitation, slope). Data available:
https://esdac.jrc.ec.europa.eu/content/land-suitability-temperate-europe

Database on Soil health related citizen-science projects
Soil-related citizen science projects have gained significant interest driven by the prominence of soil within public policy agendas. EUSO in collaboration with the ECHO Soil Mission project makes a review on previous citizen science projects, initiatives and activities that have engaged citizens to monitor soil. In this work, over 60 citizen science projects that considered soil health were reviewed. Citizen science projects were collected based on literature search, expert interviews, project partner contributions and through the mailing lists of the European Network for Soil Awareness (ENSA) and the European Soil Data Center (ESDAC). Download the database:

https://esdac.jrc.ec.europa.eu/content/soil-health-related-citizen-science-projects
Link: https://echosoil.eu/

Arsenic in topsoils
EUSO has developed a new method to model Arsenic (As) contamination in European soils using LUCAS 2009 soil samples. We introduced the GAMLSS-RF model, a novel approach that couples Random Forests with Generalized Additive Models for Location, Scale, and Shape. The methodological approach is published in this paper (https://doi.org/10.1016/j.envint.2024.108544). The model also consists of a valuable probabilistic tool for assessing As contamination risks in soils, contributing to informed policy-making for environmental and health protection. Data available: https://esdac.jrc.ec.europa.eu/content/arsenic-european-topsoils

Soil Mission calls
The call for proposal on the Soil Mission work programme 2024 has been published. These calls include 9 topics for 13 projects and a total budget of 134.5 Million Euros. Topics included: soil health in Living Labs (LL), LL in urban areas, dynamic monitoring of soil erosion, systems to quantify nitrogen fluxes , pollinators and key ecosystem functions, soil biodiversity for healthy cropping systems, high spatial-resolution monitoring approaches for carbon farming, forest peatsoils, soil health in Africa. Calls will be open on 8.5.2024 with deadline: 8.10.24. Calls can be found in the linked document (pages 268-299): https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-12-missions_horizon-2023-2024_en.pdf

Sediments removal costs from the reservoirs of the European Union
As part of the EUSO working group on soil erosion, we provide a comprehensive assessment of the existing costs of sediment removal from European Union (EU) catchments due to water erosion. The cost of removing an estimated 135 million cubic meter (m3) of accumulated sediments due to water erosion only is likely exceeding 2.3 billion euro (€) annually in the EU and UK, with large regional differences between countries. Details about both methods can be found in the published paper (https://doi.org/10.1016/j.jclepro.2023.140183). Download the data: https://esdac.jrc.ec.europa.eu/content/sediments-removal-costs

IUSS bulletin

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Abstracts

Nutrients and Contaminants in Soils of Current and Former Oil Palm Production Systems from Indonesia

Palm oil production in Southeast Asia often occurs on nutrient-poor, acidic soils converted from primary forest. Both the agricultural conversion and the production of oil palm are subsidised in Indonesia. As well as depleting soil organic C and plant nutrients, agricultural production on these soils can result in the accumulation of trace elements (TEs)—including micronutrients and non-essential trace elements—from the use of TE-containing agrichemicals including phosphate fertilisers and Cu fungicides. We tested the hypothesis that palm soils will have lower C concentrations than forest soils, as well as accumulation of TEs including Cu, Zn and Cd. Soil samples from active and abandoned oil palm plantations in Sumatra, Indonesia, were analysed for general soil properties as well as TE concentrations. Soils were acidic and low in key nutrients, with production likely to be limited by deficiencies of N, P, K, Mg and Mo, present at some sites in mean concentrations as low as 0.021%, 118 mg kg^{-1}, 778 mg kg^{-1}, 1023 mg kg^{-1} and 0.095 mg kg^{-1}, respectively. Mean organic C was lower (2.0–3.3%) than reported values in nearby forest soils (7.7%). Soils under palm production contained elevated levels of Cu, Zn, As and Pb up to 38, 91, 9.0 and 28 mg kg^{-1}, respectively, likely due to agrichemical use. The correction of nutrient deficiencies in palm production would require significant fertiliser inputs, which would exacerbate TE accumulation and reduce the net economic revenue from oil production. Our data have shown that in the plantations we have sampled, soils have become degraded. These tropical, weathered, and naturally nutrient-poor soils are ill suited to intensive production that requires high ongoing nutrient inputs. These findings have implications for the sustainability of a regionally significant production system across Southeast Asia.

Thompson-Morrison H, Ariantiningsih F, Arief SM, Gaw S, Robinson B 2023. Land 12(12): 2144. https://www.nature.com/articles/s41598-023-50492-8

chemical elements in *Elaeis guineensis* materials and derived oil.

The production of oil palm (Elaeis guineensis) in Southeast Asia is vital to the economies of Indonesia and Malaysia. Both fertilisers and pesticides used in palm production can contain elevated concentrations of Trace Elements (TEs) which may accumulate in soils and leaf tissues of plants. We hypothesised that leaves from oil palms may be deficient in essential elements, while containing elevated concentrations of non-essential TEs commonly found in agrichemicals. Samples of plant materials (leaves and fruitlets) were collected from active and former plantations in Sumatra, Indonesia, and analysed for essential and non-essential elements. Indonesian palm oil samples were sourced in New Zealand and their elemental concentrations determined. Leaf materials from both active and abandoned production sites were deficient in N, K, S and Mo, while leaf materials from abandoned sites were deficient in P. These deficiencies may have been a contributing factor to the abandonment of production at these sites. Concentrations of non-essential elements were below or comparable to average plant concentrations and no evidence of contamination was found in plant tissues. Palm oil contained low concentrations of TEs, which did not pose any toxicity risks. However, Na and Al were present in concentrations of 1198 and 159 mg kg^{-1} respectively, which were higher than have been previously reported. Tropical oil palm production could benefit from the determination of bioaccumulation factors for fertiliser contaminants in E. guineensis, to limit the transfer of contaminants to plants and products if increased fertiliser applications were used to correct nutrient deficiencies.

Thompson-Morrison H, Ariantiningsih F, Arief SM, Gaw S, Robinson B 2024. Chemical elements in *Elaeis guineensis* materials and derived oil. Scientific Reports 14(1): 1836. https://www.mdpi.com/2073-445X/12/12/2144

Special issue: New Zealand and Antarctica in a changing climate

The Journal of the Royal Society of New Zealand has released a special issue on the impact of climate change on New Zealand and Antarctica. The eight papers in this issue cover aspects of change in the physical climate and its consequences, how we think about climate change and the nature and pace of our response.

The actions taken nationally and globally through the rest of this decade, the 2020s, and into the coming 2030s will determine the future of humanity for centuries to come. This special issue of the JRSNZ helps illuminate both the challenges and the opportunities before us.
https://www.tandfonline.com/toc/tnzr20/54/4

The special issue consists of these articles:

- Climate change profiles of New Zealanders over time: a one-year latent transition analysis of climate change beliefs and concern
- Managing Aotearoa New Zealand's greenhouse gas emissions from aviation
- Climate change, risk perceptions and barriers to adaptation among forest growers in New Zealand
- Melting ice and rising seas – connecting projected change in Antarctica's ice sheets to communities in Aotearoa New Zealand
- The need to reconfigure consistency and variability to best manage changing flood risks in Aotearoa-New Zealand
- Climate change adaptation through an integrative lens in Aotearoa New Zealand
- Climate change impacts on Aotearoa New Zealand: a horizon scan approach
- Defining our legacy to all future generations

Grazing strategies for reducing contaminant losses in surface runoff from winter forage crop fields located in hill country and grazed by sheep

A paired catchment study approach was used to quantify fluxes of Nitrogen (N), Phosphorus (P), sediment and *Escherichia coli* (*E. coli*) in surface runoff from fields where sheep were wintered on swede (*Brassica napus*) and kale (*Brassica oleracea*) crops. The effectiveness of a strategic grazing approach that protected critical source areas (CSAs) was examined to determine if these fluxes could be reduced. Averaged over two years, estimated fluxes of N, P and sediment in surface runoff recorded in winter and early spring (June-September) were up to 0.64, 0.22 and 51 kg ha^{-1}, respectively, and up to 2×10^{11} MPN ha^{-1} for *E. coli*. With the exception of *E. coli*, these fluxes were low compared to those reported in other studies and largely attributed to the low amounts of surface runoff recorded. This, in turn, can be explained by relatively benign weather conditions recorded during the study period and the relatively light grazing pressures imposed by sheep. Compared to standard grazing practice, protection of CSAs reduced N, P, sediment, and *E. coli* fluxes by 38%, 48%, 55% and 63%, respectively. These reductions can largely be attributed to lower concentrations of contaminants in surface runoff when the CSA was protected.

Ghimire CP, Monaghan R, Rutherford A, Muirhead R, Lasseur R 2024. Grazing strategies for reducing contaminant losses in surface runoff from winter forage crop fields located in hill country and grazed by sheep. New Zealand Journal of Agricultural Research Online early: 1-17. https://doi.org/10.1080/00288233.2024.2336043

Tree root research in New Zealand: a retrospective 'review' with emphasis on soil reinforcement for soil conservation and wind firmness

Background: Trees and forests have been used in New Zealand to reduce erosion, particularly from rainfall-triggered landslides, gullying, and earthflows. Most New Zealand tree root research has been conducted during the life of the New Zealand Journal of Forestry Science, with much published in it. Methods: We undertook a retrospective 'review' of New Zealand tree root research focusing on soil reinforcement and its application for erosion control, slope stability assessment, and understanding tree stability in forests. The published and grey literature was searched using common search terms and relevant papers assessed. The international literature was not reviewed but helped provide context for the New Zealand studies. Results: Results were aggregated into broad topic areas and key findings summarised. Where multiple studies existed for a particular species, results are presented by species. Selected data are presented to enable inter-species comparisons, and the reader is directed to additional data or the original study. Conclusions: New Zealand tree root research has focused mostly on root description or simple measurements to support applied studies of root structure and function. Nonetheless, such research has made a valuable global contribution in addition to improving the understanding and management of New Zealand's forests. Studies show that generally, exotic species outperform indigenous species for most empirical root metrics other than root tensile strength. A combination of both lateral and vertical roots provides the best soil reinforcement and contribution to slope stability. Future research should focus on acquiring more field data and improvements in dealing with spatial and temporal variability in model development. Practical tools for land managers to target the right places with the right vegetation (species, amount, density) are a pressing need as changing climate is changing the way we manage natural hazards like landslides, floods and wildfires.

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Inhibitors application time and pasture canopy capture regulate gaseous losses of urine-N

Technologies have been developed for the in-situ treatment of urine patches deposited by grazing livestock to mitigate nitrogen (N) losses using N transformation inhibitors. For this mitigation to be effective, close contact between the applied inhibitors and the N in the urine patch is required (similar to N-fertilisers coated with inhibitors). This research aimed to determine the proportions of urine-N that mixed with inhibitor at or exceeding the threshold concentration (inhibitor concentration at which the nitrification rate is reduced by at least 40%) when inhibitors were applied to simulated urine patches at 4, 24 and 48 h after synthetic urine application. Three commonly used nitrification inhibitors (NIs) [dicyandiamide (DCD), 3,4-dimethylpyrazole phosphate (DMPP), and 2-chloro-6-(trichloromethyl) pyridine (nitrapyrin)] were applied at 40 mL of inhibitor per urine-patch at two different concentrations. The field studies were undertaken in two dairy-grazed pasture

soils with contrasting drainage. Large proportions of applied NIs (38%–59% DCD, 27%–58% DMPP, and 31%–58% nitrapyrin) were retained in the pasture canopy. In most cases, the inhibitor threshold concentration was present only within the top 0–20 mm of the soil, with only 16%–40% of the urine-N present. In some cases, the proportions of urine-N intercepted was 12%–15% higher when inhibitors were applied 4 h after urine application compared to delayed application of 24 and 48 h after urine application. Our results revealed that a substantial proportion of N in the urine-patch remained out of the reach of the inhibitor solution. This is possibly due to the small volume (40 mL per 2 L urine patch, 1:50) of the inhibitors applied, with up to 59% of inhibitor solution retained in the pasture canopy. The time delays (4 to 48 h) between the urine deposition and the inhibitor application could have also contributed to this poor physical mixing between inhibitor and urine. Increasing the volume of water applied with the inhibitor and assessing the effect of rainfall/irrigation on increasing urine-N and inhibitor mixing warrants further consideration.

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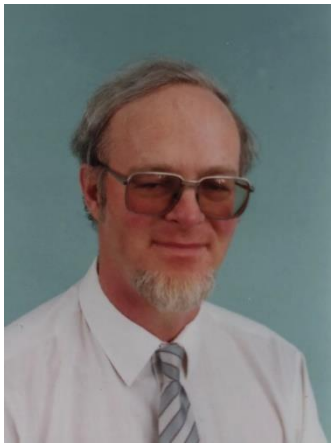
Obituary: Harry Percival

Dr Henry Joseph (Harry) Percival (1943–2024)

Harry Percival, a former colleague and staff member at Manaaki Whenua-Landcare Research and NZ Soil Bureau, DSIR, died of a heart attack at his home in Palmerston North, on 23 March 2024.

Harry was born in Wellington on 31 August 1943. He attended primary school at Te Aro Valley and Silverstream (Upper Hutt), and secondary school at New Mana College where he was head prefect. He then enrolled at Victoria University of Wellington (VUW), gaining a BSc degree in 1965, an MSc (Hons) in 1966, and a PhD degree in Chemistry in 1970 under Professor J.F. Duncan.



Harry's PhD study, like that of his long-time scientific colleague, G. Jock Churchman, was funded by a government grant, in the form of four PhD scholarships, to the NZ Pottery and Ceramic Research Association (PACRA). The first of these scholarships was awarded to Harry at VUW to investigate the chemical and structural changes that occur when the clay mineral, halloysite, was fired. The second award went to Jock to study the low-temperature dehydration of halloysite at Otago University.

After completing his PhD degree, Harry spent an obligatory year (1971) at PACRA headquarters in Gracefield, Lower Hutt. Because of a hefty cut in operational funding, Harry (and Jock) had to find alternative employment. In Harry's case it was a postdoctoral fellowship from the Institut de Chimie Industrièlle, Université Libre de Bruxelles in Belgium under Professor W.L. Keyser, while Jock took up a fellowship in Wisconsin, USA.

In late 1973 Harry returned to New Zealand to work for the New Zealand Fertilizer Manufacturer's Research Association (NZFMRA) in Otara, Auckland as a research chemist. The following year Harry was appointed director of PACRA allowing him to do a business trip to several European countries in 1978. This appointment, however, proved to be a poisoned chalice. When funds were cut, Harry had to dismiss some staff members, a task that must have taken a toll on his generous and friendly nature if not his constitution. PACRA itself went to the wall in 1981 when Harry, together with Carin Burke, joined the NZ Soil Bureau, DSIR at Taita, Lower Hutt.

There Harry worked on the equilibrium and kinetic relationships between soil minerals and solutions. He also did research into the behaviour and fate of heavy metals in soil that had been amended with sewage sludge. In 1988 he was appointed science manager (marketing) of NZ Soil Bureau as well as being responsible for the purchase and installation of a modern X-ray diffractometer.

The DSIR Taita campus closed in December 1993. In 1994 Harry and wife, Keitha Giddens (see attached photo), moved to Palmerston North to join Manaaki Whenua-Landcare Research where he was team leader in the Environmental Processes group, while Keitha was a senior technician in the environmental chemistry laboratory. When Keitha retired in 2003, Harry decided to take early retirement allowing him to do some tramping in New Zealand, read books, attend cinema but most of all to play golf. Indeed, Harry kept playing his favourite sport until two days before his passing.

Harry had been a member of the New Zealand Institute of Chemistry (NZIC) since 1970, becoming a Fellow in 1981. He also held membership in the Wellington and Manawatu branches of the Royal Society of New Zealand, the NZ Society of Soil Science, and the NZ Association of Scientists. Harry was national president of NZIC in 1990/91.

Bibliography

Harry was the principal author or co-author of several laboratory and scientific reports for PACRA, NZFMRA, NZ Soil Bureau, DSIR Land Resources, and Landcare Research. He was also the author/co-author and presenter of oral and poster papers at NZIC annual meetings and at international conferences in Canada, Austria, and Sweden.

Below is a selection of Harry's scientific publications listed in chronological order:

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