World Soils Day 2025. Raising soil's profile – and (re)starting the conversation on research priorities for the future

The following questions were asked during our live webinar with Dr Paul Mudge and hosted by Dr Pierre Roudier.

1. I don't disagree that more soil research is required but we have a lot of science that is not being implemented as there is no effective way in Aotearoa to get that science out to the farmers - i.e., the land managers who have to implement the science. Should that be fixed first?

This question was answered live in the Q&A, but a summary is also provided here.

Good point. We agree that advancing knowledge and technology by itself doesn't lead to change. On one hand, people are pushing the bleeding edge of science, advancing knowledge and technology. On the other hand, there's the science-to-policy interface, which is equally important. Then there's bringing science to farmers, land managers, and Regional Councils. We shouldn't have to choose between these things. Science should do all three: create new knowledge, inform policy, and be implemented by people on the ground. This doesn't all have to happen in the same project. The Bioeconomy Science Institute currently has a project called Moving the Middle which is focussed on identifying the best approaches to empower land managers to make changes.

2. Can the complex systems science perspective be usefully applied in soil science?

Yes, I think this could be usefully applied to soil science. Soils are definitely complex! Some examples include previous work done in collaboration with Te Pūnaha Matatini and included complex systems and network science applied to soil survey data. Arguably, these emerging methods will be useful to put soil resources and their management within a very trans-disciplinary context.

3. **Given NZ's soil loss rate is 10x that of the global average - surely there are grave concerns that our export products will be rejected in the near future as our global markets recognise the true cost of our production systems. Also, as emerging contaminants - we need to include the risk from GM organisms and reject the current Governments Bill which will allow the release of GM. Again, aside from health risks etc from GM, our products stand to be rejected from the global market?**

   I didn't have time to cover this in the presentation, but New Zealand's high soil loss rates reflect a combination of natural factors such as underlying geology, steep terrain, and high rainfall, which predispose many landscapes to erosion. In some areas this has been exacerbated by land use change and introduced pests.

   There are recognised risks associated with erosion for both environmental outcomes and market perceptions, which is why there is ongoing research and significant on-the-ground effort focused on erosion mitigation, land use suitability, and reducing broader environmental impacts. Continuing to improve how we manage soils, alongside credible monitoring and transparent reporting, will be important for maintaining both environmental integrity and market access over time.

4. **Comment: Please don't confuse economic returns with financial returns. Economics if used correctly is a social science...**

   Thanks for the comment, I may have used the wrong terms. I agree that economics extends beyond financial returns alone, and includes social, environmental, and long-term system outcomes.

5. **Given this year's World Soil Day theme is Healthy Soils for Healthy Cities, any current or future research work on urban soils (e.g. mapping, classification, contamination, etc.)?**

   An overview of urban soils, including current and previous research projects, is provided on our soils portal here: Urban soils » New Zealand Soils Portal. This is probably the best starting point for your question.

6. **Comment: I agree with a more holistic view, but we also need to deepen our understanding of impacts/benefits for food production and safety.**

   Thanks for the comment. I definitely agree we need a good understanding of how changes in land use and management influence the quantity and quality of food we produce as well as broader environmental, social and cultural impacts.

7. **Will the soil, biological monitoring etc. data sets that will be 'harmonised,' be open access? I think it is important for getting more people interested.**

   This question was answered live, but a brief summary is provided below. The opportunity I was highlighting was for harmonisation of national-regional scale soil monitoring efforts, including linkages with above ground biodiversity and carbon measurements at the same sites to provide richer datasets.
   Our ability to make data open access (especially precise locations) is dependent on agreements with landowners and funders and can vary between projects.

8. **Perhaps additional National Environmental Monitoring Standards (NEMS) could provide a mechanism to greater national harmonisation of data.**

   Good suggestion. Anything that will aid consistency in study design, sampling, processing, and data storage/analysis would be incredibly useful and improve efficiency. Too often, you're left asking: was it done the same way? Is it the same metric? Is it comparable? There's also an opportunity to think beyond soils alone. What about biodiversity above and below ground? Across the Bioeconomy Science Institute, we've discussed expanding the type of measurements at the same sites (e.g. soils, vegetation, biodiversity) and weaving them together. That would provide a much richer story than measuring things in isolation. The challenge is to get sufficient funding to enable this.

9. **Comment: Paul, I'm glad that you mentioned the initiative on addressing concerns over the Contaminants of Emerging Concern including micro/nano plastics. The virtual workshops will be held in early March and will help define the relevance of this issue to a soil health and function perspectives. Thank you.**

   Thanks. It will be interesting to learn of the outcomes of the workshop in due course.

10. **What is the NZ Capability levels in soils? Are you proactively building relationships with universities so students can research highly relevant subjects needed by the country?**

    These two questions were answered live. Some details are also provided below.

    There are good relationships with universities, including a lot of co-supervision between universities and Bioeconomy Science Institute staff. We actively try to support that, and while there's always room for improvement, those relationships are reasonably strong.

    Capability in soils is something that the New Zealand Society of Soil Science is passionate about, and it's a real battle. One initiative worth highlighting is soil judging competitions. We've observed less practical soil science being taught at universities, and this is one way to re-energise those practical skills. Led by Carol Smith and Kirstin Deuss,

these competitions bring students and professionals together around a soil pit, helping refresh field skills. The competition in Rotorua last year was very successful. We need to be creative in how we engage with universities and ensure land managers have the skills they need.

11. Based on your slide about resource management national direction, and with reform of the Resource Management Act likely to be announced next week, what in your mind needs to be strengthened in the regulatory system to better protect the health and values of soil?

This question was answered live, details below.

I think one key issue is protecting highly productive land for future generations. New Zealand doesn't have all that much of this land as lot of it is hill country and not particularly versatile for a range production systems (especially cropping). It's critical we look after our highly productive land because this land enables production of food and fibre with the least external inputs (and impacts). Once these versatile soils are put under houses they are gone for good and intensive food and fibre production will move less suitable soils. More broadly, New Zealand depends heavily on exports and high-quality products, and their production depends on the health of our soils. We therefore need to keep our finger on the pulse of this resource because it underpins a large part of our economy.

12. Is the focus on economic metrics to gain traction and attention to sway implementation and uptake? I ask because I note that directives and mandates globally are not being reached (carbon/emissions, SDGs, keeping within planetary boundaries, etc) because there is such an economic growth drive. We know that the environment suffers with growth.

I think the focus on shorter-term economic metrics related to soils to date has been swayed by the fact that these metrics are perhaps easier to calculate and communicate than other metrics. However, we do need a much more holistic view and holistic metrics, and have been working with Ani Kainamu, a Kaihautū Māori Research Impact Leader who has been encouraging us to incorporate a broader view of soils, including their connections to other ecosystems, such as aquatic environments.

Additional ideas/comments shared by the audience

- Research gaps - opportunities for Master's and PhD students to kick off perhaps
- Our educators include Botanic Gardens (not all have soil maps or much soil intrepretation) and places like Zealandia (linking soils to ecology), and schemes that are planting trees with kids (Trees for Survival) where we could provide material.

- We need reliable nature-centric reporting. IFRS took over IIRC, obscuring the value of natural capital. Biodiversity metrics create incentives for financial institutions to claim credit for stewardship w/o accountability for the outcomes of that stewardship. We need a nature-centric, science-based framework to measure soil health, productivity, resilience, etc.
- I think that communicating the value of soil and land resources need to start in our primary and secondary schools. Let's work more with our educators.
- We need to keep a record of changing land use and how the environment is being affected.
- NFP sector also interested in soil education. Edible Canterbury and Food Resilience Network in early stages of developing public education platform, to improve soil health in Waitaha/Canterbury. Nationwide also.
- I'm attempting to link work at Massey, Lincoln, and VUW on creating a soil-centric agenda aimed at definitively improving soil by 2040 and putting us on a track to improve beyond that. The initiative is to integrate soil science with NZ startups who can help create or leverage soil-based improvements.