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New Zealand Soil News

New Zealand Society of Soil Science Officers 2014–2016

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Editorial: by Paul Mudge

Can we pull off a soils version of "The Dunedin Study"?

The recent TV documentary on ***"The Dunedin Study"*** which tracked the health and development of a cohort of 1000 people from 3 to 43 years of age, made me think about the value and need for long-term soils research. I was struck by the massive impact the relatively simple "Dunedin Study" has had, with >1000 publications (or on average one every 13 days since the trial began!), making it the most influential study of its kind in the world. The Dunedin Study started with a good idea and a good design, but limited funding. Over time, the value of the data increased, additional questions arose, new technologies emerged, and more funding followed.

The value and need for longitudinal soils research in New Zealand (NZ) became apparent recently when I contributed to two reviews of soil carbon (C) stock changes in NZ's grazed grasslands for MPI [1, 2], and a similar review on changes in soil nitrogen (N) which I am currently working on. During this process I was surprised with how little published data we actually had on changes in C and N under NZ's long-term pastures – our dominant agricultural land use. This lack of data is despite C and N being key components of soil organic matter and critical for agricultural production and environmental sustainability. Maintaining or increasing soil C is clearly important from a green-house gas perspective, but C also contributes to maintenance of soil structure, water holding capacity, and is the base of the soil food web. Soil organic N is the main source of plant N uptake, and knowing whether N is being accumulated or lost from soil organic matter is critical for accurate nitrogen budgeting, at farm, catchment and national scales.

Data on changes in soil C and N under long-term pastures in NZ comes from repeated sampling of long-term field experiments [3-5], resampling National Soil Database [6] and Regional Council soil quality sites [7], and paired site 'space-for-time' substitution studies [8, 9]. Briefly, key findings from these studies were:

- Increasing rates of superphosphate fertiliser and associated increases in pasture production and stocking rate had no effect on changes in soil C stocks, but in some cases increased soil N stocks.
- Both soil C and N were significantly lower under irrigated than adjacent dryland pastures.
- Soil C and N had increased over time under hill country pastures, while on flat-rolling land, C and N decreased in Allophanic and Gley Soils, with no significant changes for other soil orders.
- There was no consistent effect of grazing regime (e.g. dairy vs. drystock) on changes in soil C and N stocks (on flat-rolling land).
- Using data from published studies, our best estimates of national C stock changes under NZ's grazed pastures were -0.23 ± 1.33 Mt C y^{-1} or 2.92 ± 2.15 Mt C y^{-1} depending on which studies were used [1]. The considerable uncertainty within and between these two estimates does not include uncertainty associated with known data gaps (e.g. ~70 % of hill country) and the 'representativeness' of sites where data was available.

While the existing data is not ideal, our ability to draw any conclusions about the trajectory of C and N changes in NZ's pastoral soils is largely due to the vision of the early researchers who established the long-term field trials or sampling sites – and archived soils. It wasn't until decades later when soil C and N were higher on the research agenda that the value of these trials and archived soils was fully realised. Further, new ideas and technology have allowed additional analyses on archived soils not dreamt of at the time of collection. For example, during my PhD I analysed archived soils from the long-term Winchmore trials which revealed that soil N isotopes were an indicator of the long-term N budget of the

different pasture systems [10]. Sadly, many of NZ's long-term agricultural field trials have now been decommissioned.

Looking forward

Can we pull off a soils version of "The Dunedin study"? My first response to this question was "Rothamsted", and indeed it would be difficult to top that globally significant series of long-term field experiments. However, aspirational goals (e.g. a predator free NZ) have a place in science, and now may be as good a time as ever in NZ to propose an ambitious long-term soils project because:

1) The National Science Challenges (NSC) have been set up to co-ordinate long-term multidisciplinary, multi-organisational collaborative research (the 'Our Land and Water' NSC is most relevant to soils research).
2) There now appears to be some stability in CRI core funding (now the "Strategic Science Investment Fund") which is aiming to "invest effectively for long-term impact", and finally,
3) MfE land domain reporting in 2018 will prompt a fresh look at what we know about how our soils resource is changing, and will no doubt identify limitations to what can be concluded from the currently available data.

The question then arises, "what would an ambitious and unique longitudinal soils study look like?" I don't have the answer for the 'unique' part of the question, but do think NZ desperately needs a specially designed, spatially representative, NATIONAL soil sampling and monitoring framework so that we can draw more quantitative conclusions about how our precious soils resource is changing – under different land uses, management regimes, soil types and climates.

I look forward to seeing many of you at the joint NZSSS/ASSSI conference in Queenstown in December – where we will be able to discuss the challenges and opportunities for future soils research.

Acknowledgement: Thanks to Bryan Stevenson for helpful comments on an earlier draft.

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Letter to the Editor – from Dr Peter Singleton

Letter to the editor in response to the Soil News May editorial 'Where have our soils gone?' by Hamish Lowe

National Policy Statement on Strategic Land Resources by Peter Singleton

I'm advocating for a **National Policy Statement on Strategic Land Resources**. It would include 'National Food Security Zones' of high class soil/land protected for exclusively soil based food production, along with national monitoring and reporting of the state of the soil resource.

Background

Concern for preserving high class soils has been smouldering for many years. Basically since the demise of the Town and Country Planning Act (1977) and its replacement by the RMA in 1991. This change resulted in the removal of the requirement to protect soils of Actual or Potential High Value for Food Production and other land protections regarded as matters of National Importance.

Section 3 (1) of the Town and Country Planning Act (1977)

(d) The avoidance of encroachment of urban development on, and the protection of, land having a high actual or potential value for the production of food:

(e) The prevention of sporadic subdivision and urban development in rural areas:

(f) The avoidance of unnecessary expansion of urban areas into rural areas in or adjoining cities:

The argument for change at that time was that a stony dry piece of land producing wine would not be classified as high actual or potential value for food production and yet was generating valuable income. Therefore, treat each piece of land on its merits.

This argument was battled against in commissioner planning hearings and environment court. But at that time there were no rules to support the arguments and invariably rural subdivision won and that sometimes rolled on into urbanisation.

These issues have been raised many times. The MFE publication Future Requirements for Soil Management in New Zealand (2014) is a recent example and summarises the issues of fragmentation of land and spillover from urban expansion. I also hear that vegetable growers have spent $600k trying to defend the Pukekohe growing area in the Auckland Unitary Plan.

The Problem

The problem is that the RMA does not readily protect productive land from subdivision. Monitoring results show steady and disproportionate subdivision and urbanisation of high class soils (class 1 in this example). These soils are highly versatile and productive making up only five percent of New Zealand's soils.

Section 5 of the RMA provides a clear mandate to safeguard soil but why isn't it happening as we would hope?

5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, **sustainable management** means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

The question to ask when it comes to loss of high class soils is 'so what?' There is still plenty of land and plenty of underutilised high class land. And that is the problem. People do not see the urgency, there is no crisis to raise the alert like water or conservation. The problem is that when there is a soil crisis it's too late. Unlike water, soil is not easily restored or regenerated. Unlike water it is not constantly being renewed. High class soils are a non-renewable resource. Once land is under houses or subdivided into small lots it is not likely to be reversed. Even contaminated land is not easily reversed. The smaller subdivision and urbanisation of New Zealand's best soils effectively removes them from production. In this respect it is similar to mining the land, but without the option of rehabilitation.

All the other life supporting resources in Section 5 (2)(b) of the RMA have special national policies focusing on their restoration and preservation. Water for example is a national obsession when it comes to quantity and quality. But where is soil, an essential life supporting resource?

Regional, District and Unitary plans are now recognising the importance of high class soils and restrict subdivision based on categories of LUC class, LUC subclass or even soil series name. But the problem of defending the land in court still comes up against the priority given to subdivision and the argument that a few houses have little impact and people have to live somewhere (as if there were no other locations to build!). I've seen this time and time again and even the valiant efforts of dedicated soil science advocates in councils are often not enough to turn the tide.

The Solution

There needs to be a national planning mechanism that gives high class land the same status and protection as conservation land. The land needs to be sufficiently barricaded by legislation so as to be impervious to breaches from omissions in definitions, minor variations in soil types, or implied economic and social decline if subdivision is not approved.

I propose a National Policy Statement on Strategic Land Resources. It would create 'National Food Security Zones'. These zones would have more status than currently exists in planning documents and be on par with conservation land. Hence the terms 'National' and 'Security' to give status.

These National Food Security Zones are to ensure unique or highly versatile land is reserved for generations for food production. This is consistent with section 5 of the RMA and gives land the same status as other RMA life supporting resources such as air, water and ecosystems.

The purpose of National Food Security Zones is preservation for current and potential use of special land for soil based food production. Areas of land to be designated on maps would include;

- areas of highly versatile soil
- areas of high class soil or land (specifically defined in each region)
- areas with special microclimates for food production
- areas of land for future specialist uses resulting from climate change
- soil reserves for scientific, historic or cultural purposes
- areas with unique soil services
- and any others you can think of

It is important that the National Food Security Zones are not just areas of a single class or soil type. Their boundaries need to be 'planning/regulated lines'. By that I mean they run along roads, follow straight boundaries or the base of hills etc. Everything contained within the strategic land reserve, even if not high class land, becomes protected. This is to ensure land management units are functional for

food production and the areas can continue to operate without cumulative increases in dwellings and impacts from reverse sensitivity.

There may be a temptation to broaden the purpose of National Food Security Zones to, for example, protect areas for sand and gravel for mining, or soil erosion by water or to ensure land use matches land capability. But these are not to do with high class soils or land and can dilute or complicate the objective.

I would also suggest no dwellings are permitted in National Food Security Zones. The only dwellings are in village style locations and people must travel to the fields. Any new roads are also not allowed (even motorways). Would you put a motorway through a national park! I would make no exceptions for urban areas either. National Food Security Zones in urban areas could be allotments, parks and green belts.

The National Policy Statement on strategic land resources would also require;

- national monitoring and reporting of soil quality
- characterisation of high class soil/land
- national archive of soil material
- national monitoring and reporting of land use and land use change based on soil and land type
- assessments of alternative crops and land use

Soil is largely taken for granted and like things taken for granted it is not properly cared for or managed, and then it's too late. The effects cannot be reversed. For soil the time to act needs to be before you need to i.e. now.

The Method

This is the hard part- actually getting it done. After some massaging and sanding of the idea to get full hearted support, the ideas can be spread far and wide to enlist the support of land users and councils, then political support. Once that has occurred a draft policy proposal could be taken to MPI or MFE for discussion. A full National Policy Statement could be embarked upon. For this to work it requires an agreed consistent message and sector support. Of course a team needs to be appointed and funded to work on the proposal. This could be through the Sustainable Farming Fund, or via Envirolink.

Dr Peter Singleton has 20 years' experience as a soil scientist and 14 years as a Regional Council science and policy manager. He now has his own business Natural Knowledge Ltd. www.naturalknowledge.nz

Article – How do we best share soil data in 2016? – The Open Geospatial Consortium Interoperability Experiment (OGC IE)

The Open Geospatial Consortium (OGC) is an international consortium of public, commercial, and academic institutions cooperating in the development of globally accepted standards for the exchange of data.

The OGC IE is an initiative started by the International Union of Soil Sciences (IUSS) Working Group on Soil Information Standards (WG-SIS) to consolidate the various soil information models, and reconcile them into a single global standard for the exchange of soil data. The Landcare Research Informatics Team has been making great progress within the OGC IE toward establishing international

standards for sharing soil data. While Landcare Research took on the roles of project management and technical lead, the IE itself was a multi-agency effort. Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia) and ISRIC World Soil Information Institute (Netherlands) were the other two lead agencies. Other international participating agencies included the US Department of Agriculture National Resources Conservation Services, the US Geological Survey, and the Research Centre for Agrobiology and Pedology (Italy). NIWA and Horizons Regional Council were other NZ participants.

This Interoperability experiment evaluated existing models, proposed a common core model, and developed a standard for data exchange that was tested through the deployment of OGC web services and a number of demonstration clients. Landcare Research and CSIRO are now in discussions with the FAO and international soil agencies on how to progress the work.

If you are interested to read more about this project, an engineering report describing the results of the Soil Data Interoperability Experiment (IE) conducted under the auspices of the OGC Agriculture Domain Working Group and approved by the Open Geospatial Consortium (OGC) members for publication is available at: http://www.opengeospatial.org/docs/er.
Document URL: https://portal.opengeospatial.org/files/?artifact_id=69896

Proposed National Policy Statement on Urban Development Capacity

The NZSSS Exec has submitted on the Proposed National Policy Statement on Urban Development Capacity (NPS-UDC). *(See letter on next page)*

Over the years many members have been active in identifying and lobbying decisions makers to consider the impact of development on the loss of high class soils. The NZSSS exec has seen this NPS as an opportunity to further the discussion around the impact of losing high class soils. The consultation documents for the NPS-UDC are very high level and are really a political response to deal with housing demand. However, this issues has a far wider impact than just housing and includes development in general. The scope is potentially wide ranging but in our opinion misses several key aspects, particularly it doesn't mention the word 'soil'. This is a point also raised by several other submitters.

The NZSSS approach taken has been a positive one, in that development and increased urbanisation will occur, but it needs to be managed. It is a balancing act with other infrastructure and national resources. It comes with the opportunity cost of losing not only current production, but also the potential loss of land for new and developing production systems on the very soils that may be lost.

The current debate surrounding high class soils has unfortunately been relegated to a development by development level, and soils has lost. Let's hope that the proposed NPS creates the opportunity for debate at a national and regional level and some master planning for NZ Inc. With any luck soil related issues will become an integral part of future development decisions.

Hamish Lowe

14 July 2016

Chair
Local Government and Environment Select Committee
Parliament Buildings
WELLINGTON

Attention: To whom it may concern

Dear Sir/Madam

SUBMISSION – PROPOSED NATIONAL POLICY STATEMENT ON URBAN DEVELOPMENT CAPACITY

The Submitter

The New Zealand Society of Soil Science ("NZSSS") represents the professional and technical interests of professionals engaged in all aspects of the study, management and use of soils in New Zealand. NZSSS provides a forum for the exchange of ideas and information within the profession, and is thus normally engaged more internally in the science of the soil, rather than externally in the politics of its use.

However, an exception to its internal focus is a need to ensure that factual information in relation to our country's soil resources is given due recognition in the context of land use planning and decision making at district, regional and national level.

The Application

This submission is made by the NZSSS in respect of the proposed **National Policy Statement on Urban Development Capacity** (NPS-UDC).

This NPS-UDC proposal is supported, but with a request that the matters for consideration should be expanded and relevant detail incorporated to form a more comprehensive and coherent national guidance document.

We wish to be heard in respect of our submission, and we are willing to attend any convened meeting to orally present and talk to our submission.

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SpecificpParts of proposal on which submission is made

The aspects of the proposal which we wish to have noted and amended are as follows:

- The development of the NPS-UDC is timely and arguably long overdue;
- The NPS-UDC fails to mention soils - not only are soils not mentioned, but the impact of the loss of high class/value1 soils is not addressed, noting that class I-III soils represents 14 % of the NZ land area (Rutledge et al. 2010);
- Urbanisation and sprawling developments have the consequence of pushing a community's food resource further away from the community – an issue not addressed in the NPS-UDC, especially in light of the economic efficiencies of additional supporting infrastructure, transport and the need to generate soil fertility elsewhere. This is an issue that should be addressed at a national and regional level;
- An opportunity to consider the integration and trade-off of critical infrastructure resources, soil being one, in developing a master plan for urban development has been missed. In particular lateral urban spread will incur roading, water and sewer costs while consuming productive land; which in turn will result in further costs associated with having to transport food from further away and the need to spend considerable financial resources to generate the fertility of the land being lost at another location; and
- The NPS-UDC falls short, in that it does not provide for master planning whereby development is considered in light of its impact on the community as a whole, the region and the national economy.

Reasons for making this submission

Infrastructure	The proposed NPS-UDC provides the benefit of enabling a master planning exercise that has the scope to match urban development and expansion pressures against the availability of the resources required and their interconnectivity. These resources necessarily include the infrastructural requirements of water supply, sewer, transport connections and proximity to community services. When considered locally, regionally and nationally, **soils are also a vital infrastructure resource and need to be considered in parallel with other critical infrastructure.**
Previous Protection	The soils that occupy areas of land that have high productive versatility, and that may be considered to have comparatively high value for the production of food, are a finite and diminishing resource (Rutledge et al., 2010). This fact was recognised in the former Town and Country Planning Act, which made the protection of such soils a matter of national significance. The repeal of that Act, and its replacement with the Resource Management Act in 1991, removed the national significance of the protection of such soils; it did not, however, change the fact of the value of the resource, nor its finite and diminishing nature.

[1] High Class/Value Soils – those soils in Land Use Capability Classes I and II (excluding peat soils) and soils in Land Use Capability Class IIIe1 and IIIe5, classified as Allophanic Soils, using the New Zealand Soil Classification (Waikato Regional Council, May 2016). Soil Classes are defined in Lynn et al., (2009), with Class I to III soils typically associated with easy topography, high fertility and production of high value horticultural, vegetable and arable crops, along with historic high value dairy farms.

Recent Focus	In recent debates, the loss of high class soils has typically been considered in development by development discussions, with decisions made about individual land use proposals. Over the years, considerable effort has been made by many soil conservators and land use proponents to realise the value of soil and the social and economic consequence of losing soils in close to proximity urban environments. An opportunity with the NPS-UDC is the ability to develop a master planning approach whereby community, regional and national consequences can be considered, rather than the impacts of small areas where there are development opportunities, with gains solely measured by housing availability.
Loss of High Class Soils	The loss of high class soils has occurred nationally and internationally for many years as communities develop and grow. The rapid growth of communities has seen the rate of loss increase, with 29 % of the 25,000 ha of new urban areas in New Zealand developed between 1990 and 2008 occurring on high class land. Rutledge et al., (2010) indicated that "To date, LUC classes I and II (highest class land) have experienced the highest urbanisation rates as a percentage of original area (5.6% and 3.9% respectively) over the period 1985 to 2002. In addition, based on historical census data, housing density has increased across almost all areas of New Zealand, indicating that the extent of urbanisation may be broader than currently assessed." Between 1990-2008, 29% of new urban land occurred on high class land (Andrew and Dymond, 2013). In Auckland the rate of urban expansion onto high class land (LUC class I-III) has accelerated since 1996, with the majority of land allocated to urban expansion since 1996 has been high class land. Pukekohe has been identified as a potential satellite town with up to 50,000 new dwellings, but is the area where the majority of Aucklands LUC class I or elite land is located (Curran-Cournane et al. 2014). Lifestyle blocks occupy 10% of NZ high-class land, with 35% of the high class land in the Auckland region already occupied by lifestyle blocks. In Hawke's Bay and Marlborough a high proportion of urbanisation has occurred on high-class land (49 % and 50 % respectively).
Economic Future	By general consensus, New Zealand's long-term economic future will continue in large measure to rely on the production, and export, of high quality, high value food products for consumption by discerning purchasers. Such produce cannot be produced at will on just any old land; New Zealand has large areas of land that are suited only to pastoral or forestry uses at best, and only relatively limited areas of "high value soils". To illustrate this point, the Horticulture industry currently utilises approximately 130,000 ha of land and is aiming to be a $20 billion business by 2020. To double this return they need another 130,000 ha, but also they need the better landscape units, the very units which are nationally limited and could be consumed by urban development. Further, in the case of Auckland, but certainly other towns and cities as well, there is also the ongoing logistical issue of food supply for domestic consumption; local communities need to be fed as well.

Historic Investment	High value soils, incorporating unique combinations of geology, landform, climate, and comparatively short histories of productive use must be regarded as the foundation of any comparative market advantage enjoyed by our country. Further, the historic investment into the critical soil infrastructure should be recognised, which in many cases has seen millions of dollars used to create and maintain fertility that provides for financially viable production systems, which to a significant extent our national economy is already based on. The re-investment in developing fertility 'elsewhere' comes at a cost to the community and the nation, and should be considered as an opportunity cost (loss) when considering alternative land uses.
Site vs Community	Urban use can safely and sustainably be established on a wide variety of soils and sites. Provided flooding and landslide hazards are avoided as may be appropriate, a wide variety of topographies, soil types, and locations may be equally suitable for urban development. Therefore, while there is limited choice of whether to develop or not when considered in one area, a wider look at opportunities surrounding the larger community, and in some cases region, may identify scope that had not previously been considered.
Ecosystem & Biodiversity	Urban development has the scope to utilise landscapes that have maintained and developed unique ecosystems, some of which have inherent biodiversity characteristics not seen elsewhere. While not limited to high class soils, urban development can, and will likely, result in ecosystem changes through direct effects and loss of habitat; and also as a result of pressures on the ecosystem and habitat from cumulative effects beyond the development footprint.
Life Style Developments	Accompanying high density urban development is the peripheral development of 'life style' units, where large sections for land and buildings are preferred. These land development units consume large areas of land for limited residential occupancy. Landcare Research (Andrew and Dymond, 2012) estimated that in 2011 there were 175,000 lifestyle blocks, up from 100,000 just 13 years ago. This meant that 10 % of the country's high-class land is now occupied by these blocks of land. Rutledge et al., (2010) also noted "Several recent studies have also documented trends in land fragmentation. Northland Regional Council reported 10% of its LUC Class I–III land has been subdivided into lifestyle blocks between 2001 and 2007 (NRC 2010). If that rate was to continue (1.67 % per year), all of Northland's LUC 1-3 land will be subdivided in 60 years." Between 1990 and 2008, urban areas occupied an additional 0.5 % of high-class soils, with Canterbury (4,800ha) and Auckland (2,600ha) regions having the most high-class land (soils) converted to urban areas. The occupation of high class soils by lifestyle blocks greater. In Auckland region more than a third (35 %) of high class soils have been converted to residential lifestyle blocks.
Overhang	Outward development and not inward development generates an 'overhang factor', whereby further outward development provides for an even greater exposure to land, disproportionately increasing the "zone of influence" on land use beyond the urban boundary. This means there is scope for a rapid consumption of high class soils.

One Chance	Urban encroachment onto adjacent rural land has been seen to be an almost entirely one-way process. Once land has been used for the establishment of housing, commercial and industrial use, with the associated provision of communication and other public infrastructure, it is not cheap, not easy, and mostly not practical to reverse the process, remove the urban development, and return the land involved to its former actual or potential productive use.
The Value of Soil	A blanket ban on urban encroachment onto high value soils is not appropriate, and is not the position of the NZSSS. It is acknowledged by the NZSSS that a balancing of costs and values will be required to arrive at sound decisions on which land should, and should not, be made available for housing and associated developments. There will be circumstances in which it will be appropriate to decide to proceed with an urban development despite its consumption of valuable soils. However, in its present form the proposed NPS makes **no reference** to the need to include consideration of the value of the soils involved in reaching a decision on new urban development, and we consider that this omission needs to be corrected in the long term national interest.
Efficient Communities	The recent lateral spread of our communities shows a clear under-valuation of the natural resources they consume. In an attempt to provide for greater sustainability there is the need to think about where our local produce is grown and transported from. Greater transport adds greater cost to produce. Research by Richardson et al. (2016) has shown that 1-4 % of produce can be produced within an urban environment, with the remaining production coming from beyond the urban boundary. This cost of transport and sourcing produce from outside the urban boundaries needs to be added to the other costs of the spatial sprawl; with consideration given to avoiding cumulative costs by adopting land intensification within existing urban footprints. More roads to transport produce from further away to service a consuming wave of houses may not be as efficient as high value productive hubs that are centred close to the consumer in a more densely developed community.
Big Picture Resource	Looking after soils is important. Providing for growth is important. Dovetailing into existing hard infrastructure is important. Because many facets of development are important not all the objectives will necessarily be satisfied, and hence compromises will be needed. The most logical solution need not be the cheapest or the quickest; and there may be a time where a combination of factors, such as water reticulation limitations, roading limitations and loss of high value soils means that **less favourable and potentially more expensive building sites are best for the community**. These decisions cannot be made on a development by development basis; but require big picture national, regional and community perspectives to direct and influence what is right for New Zealand Inc, and not only for the benefit of expedient progress and the prosperity of developers.

Concluding comment

New Zealand needs an over-riding planning guidance document that provides direction for managing future urban growth, while balancing the needs of both new and existing infrastructural resources; **soils included**. The NPS-UDC could be that document.

The Ministry for the Environment should be commended for developing this national planning document; however, NZSSS believe it should be diligently developed to allow for the balancing of growth and resource use efficiency, and in a controlled and holistic manner that is not simply a kneejerk reaction to urbanisation, and in particular housing pressures.

The balance should consider economic, social, cultural and environmental factors. Not one factor should be the sole contributor to growth, with both positive and negative factors integrated and considered across the larger community, and not on an ad-hoc development by development basis at the whim of political and/or developer pressure. Soil, and particularly the loss and consequence of loss, of high class soils should be an integral part of the decision making matrix.

Decision requested

NZSSS requests that the need to protect and sustain the availability and versatility of New Zealand's high value soil resources is included in the matrix of matters for consideration when evaluating land use changes. Ideally this consideration should occur at a master planning stage and not when evaluating a local development proposal.

Yours faithfully

New Zealand Society of Soil Science

Reece Hill
NZSSS President

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Article – A Call to Action to save one of America's most important natural resources

https://www.whitehouse.gov/blog/2016/08/01/call-action-save-one-americas-most-important-natural-resources
August 1, 2016 at 9:55 AM ET by Jo Handelsman and Parker Liautaud

Summary:
The White House Office of Science and Technology Policy is issuing a national Call to Action and forming an interagency group to protect America's soil.

Soil plays critical roles in food security, climate mitigation, ecosystem function, and buffering against extreme weather events. Although it is essential for the stability of the planet, soil is disappearing at an alarming rate.

In the United States, estimates are that soil on cultivated cropland is eroding at an average rate of 5.2 tons per acre per year, while the average rate of soil formation falls between 0.008 and 0.51 tons per acre per year. Some parts of the Midwest are losing soil at a much faster rate, especially during extreme weather events—in some regions of the United States, erosion has been measured at over 100 tons per acre in a single storm. That means that a layer of soil that took over 350 years to form was destroyed in a single day.

Climate change is expected to increase pressure on soil as the frequency of extreme weather events increases, bringing forceful rain and flooding, which can strip away soil. Without coordinated action, the United States is on track to run out of topsoil—the medium upon which crop production depends—before the end of the 21st century.

Erosion is not the only threat to America's soil. Many urban soils have been contaminated with lead or toxic substances, posing a threat to human health. In some cases, intensive forestry and rangeland practices have also resulted in release of substantial soil carbon into the atmosphere, slowing progress toward tackling climate change. Another threat has been the deposition of atmospheric

pollutants in forests, which has leached essential nutrients from forest soils in many parts of the Nation.

In issuing a call to action for soil, OSTP seeks innovative actions from Federal agencies, academic scientists and engineers, farmers, entrepreneurs, businesses, advocates, and members of the public in a nationwide effort to impede soil loss, enhance soil genesis, and restore degraded soils.

Federal Agency Input on Soil: A New National Science and Technology Council Working Group
Under the National Science and Technology Council, OSTP has established the Soil Science Interagency Working Group (SSIWG), which will receive technical input from 15 Federal departments and agencies. This input will include identifying knowledge and technology gaps, identifying research and conservation priorities, fostering public-private collaborations, and working toward Federal actions to protect soil resources.

A National Call to Action
OSTP is issuing a nationwide call to action for farmers, scientists, entrepreneurs, engineers, advocates, and the broader public to work together to develop innovative solutions to promote soil health and protect soil from degradation. In order to meet a challenge of this scale, innovation and collaboration are needed at three key stages:

- **Monitoring Soil and Obtaining High-Quality Data**
  Implementing precise solutions to protect soil requires vast quantities of information. Data are needed about soil moisture, horizon depths, nutrient availability and cycling, soil architecture, type and extent of vegetation cover, microbial presence, soil carbon content, climate (especially precipitation and temperature), and other topics. This information needs to be continuously collected at high resolution across the Nation and made available to inform precise solutions.

  This daunting task can be achieved through a combination of innovative technology and traditional expertise in soil science. In particular, OSTP is interested in actions focusing on: (1) low-cost sensors for soil moisture and chemistry that are ready for large-scale deployment; (2) remote-sensing tools for mapping soil moisture, water use, vegetation type, and other soil-related metrics; and (3) expanded availability of high-quality data on soil for communities and farmers, including by obtaining open access to private agricultural and climate datasets for the purpose of soil conservation.

- **Informing Targeted Decision-Making and Engaging the Public**
  OSTP is specifically interested in actions and efforts that seek to: (1) advance interdisciplinary research on the role of soil in resilience of the food system, energy production, and water quality (especially in computational, chemical, and biological sciences), through, for example research grants or fellowships; (2) develop web portals and other mechanisms that improve the relevance and usability of data relevant to soil conservation; and (3) educate and engage the American public in the importance of soil and ways of participating in its protection, including through the creative arts as well as reliable citizen science

- **Applying Scalable Solutions on the Ground**
  Scientists, farmers, policymakers, and the public need scalable solutions that can be deployed widely at low cost. To that end, OSTP welcomes efforts to develop or deploy solutions or incentives achieve the following: (1) rapidly generating healthy soil or restoring degraded or contaminated soil; (2) increasing soil carbon content and sequestration; and (3) reducing pressure on agricultural soil that is particularly vulnerable to erosion.

ASA-CSSA-SSSA extracts from the Science Policy Report

Americans think national parks are worth U.S. $92 billion, but we don't fund them accordingly
The National Park Service celebrates its 100th birthday this summer. In a new study released this month, researchers developed the first-ever comprehensive assessment of what national parks are worth to the public and show that we're not funding the park system at a level that reflects its value. Researchers calculated that Americans put a total value of US$92 billion per year on our national parks, monuments, seashores and recreation areas. However, what we also concluded is that we are not funding the park system at a level that reflects its value. Read the full article

Did herbicide resistance exist before GMO crops?
Society may think weeds resistant to herbicides are a new phenomenon linked to the overuse of glyphosate in genetically engineered crops, but nothing could be further from the truth. Next year will mark the 60th anniversary of the first reports of herbicide-resistant weeds, while this year marks only the 20th anniversary of glyphosate-resistant crops. The first known report of herbicide-resistance came in 1957 when a spreading dayflower (Commelina diffusa) growing in a Hawaiian sugarcane field was found to be resistant to a synthetic auxin herbicide. Since then, 250 species of weeds have evolved resistance to 160 different herbicides that span 23 of the 26 known herbicide mechanisms of action. They are found in 86 crops in 66 countries, making herbicide resistance a truly global problem. Read the full article.

The 7 biggest problems facing science, according to 270 scientists
Science is in big trouble. Or so we're told. In the past several years, many scientists have become afflicted with a serious case of doubt — doubt in the very institution of science. As reporters covering medicine, psychology, climate change, and other areas of research, we wanted to understand this epidemic of doubt. So we sent scientists a survey asking this simple question: If you could change one thing about how science works today, what would it be and why? Read what they had to say in the full article.

Food security's ability to unite, power to protect
In today's chaotic world with numerous conflicts and unprecedented numbers of displaced persons, food security has emerged as an issue of critical global importance. Food is both a strategic weapon of war and a smart investment to foster peace. It is also a powerful political commodity. Political instability and conflict are often fueled by food-insecure populations; price volatility can spark unrest among urban communities unable to afford basic staples. When the United States takes steps to reduce global hunger and poverty in the developing world, we are protecting our own security and national interests. In fact, it is one of the most effective ways we can combat radical extremism. Read the full article.

At 101, Loyd Ratts of St. John embraces technology changes
Loyd Ratts first began irrigating his farm fields in 1973 and said he's better much seen every type of irrigation evolve. Two years ago, Ratts lost his center pivot irrigation system to a severe storm, he decided to replace it with the latest, best technology he could find. He replaced his pivot with a new Zimmatic center pivot and equipped it with Lindsey Corp.'s FieldNET system. The fully automated system allows him to monitor and control his center pivot from his smart phone or his Apple laptop computer, both of which the 101-year-old farmer handles with ease. Read the full article.

Food waste on the farm
Food waste doesn't just come from your plate or the back corners of your refrigerator. Food waste starts at the farm- whether that farm covers hundreds of acres or some space on your terrace. Growing and

harvesting food is not a 100% efficient process. The fate of excess lettuce is one classic example. Lettuce is one of the first things you plant in the spring. It comes in lovely shapes and colors and you plant it at a time when the whole notion of gardening is fresh and full of promise. That often means that you plant too much. Round about July that excess lettuce starts thinking that perhaps the reason you haven't harvested it is that it was destined for greater things than simple salads. Read the full article.

European Soil Data Centre News

Soil hydraulic properties for Europe

Soil water information is an essential input for environmental, hydrological or land surface models. A reliable soil water map can serve multiple purposes, including scientific research and application of models on different geographical scales. It is also essential for the development of a comprehensive soil quality (SQ) indicator. New soil hydraulic pedotransfer functions (PTFs) were recently developed and could support the computational basis of the new series of maps of soil hydraulic properties. The purpose of the study that JRC undertook is to assist with the implementation of the research programme on soil quality indicators, namely to facilitate the completion of a new soil quality indicator by supplying reliable spatial data on soil hydraulic properties. For this, the following map layers were developed: **Water retention of topsoil** (saturated water content, water content at field capacity, water content at wilting point; **Hydraulic conductivity of topsoil** (saturated hydraulic conductivity)
http://esdac.jrc.ec.europa.eu/content/maps-indicators-soil-hydraulic-properties-europe

LANDMARK project

LANDMARK is a European Research Project on the sustainable management of land and soil in Europe. The questions that LANDMARK aim to address are: "How can we make the most of our land ? How can we ensure that our soils deliver on the many expectations we have of our land ?" In the second newsletter, you can find information about the project, interesting project papers, Workshop details and the LANDMARK Glossary
http://landmark2020.eu/wp-content/uploads/LANDMARK-newsletter-n2_english.pdf

Glinka World Soil Prize

The Glinka World Soil Prize honors individuals and organizations whose leadership and activities have contributed, or are still contributing to the promotion of sustainable soil management and the protection of soil resource. The award will contribute in a timely manner to raise awareness of policy makers and the general public about possible solutions to tackle acute national and local problems of soil degradation, and to encourage all stakeholders and soil practitioners to engage in field-oriented work, with direct contributions to the preservation of the environment, food security and poverty alleviation as specified in the Revised World Soil Charter.
Deadline for nominations: 30 August 2016
http://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/421963/

The Dirt

Ever feel like you're missing out on something? Do you find it hard to keep up with all the research going on? Are you frustrated that the Soil News only comes out 4 times year? Here's a tip: use Twitter to get tons of soil-news from around the globe! Here's a taste of what you might be missing:

Norman Taylor Memorial Lecture 2016

I have great pleasure in announcing that the 2016 recipient of the Norman Taylor Memorial Award is Professor Louis Schipper. Professor Louis Schipper has more than 25 years experience as an environmental biogeochemist. After receiving his PhD degree in biology from the University of Waikato he accepted a postdoctoral position at the University of Florida before returning to New Zealand to work as a scientist for Landcare Research. Louis then joined the University of Waikato in 2005, becoming a Professor in 2012. His research interests include long-term changes in soil organic matter, nitrogen cycling (with a focus on denitrification and nitrogen immobilisation), impacts of land use change, carbon fluxes and nutrient cycling in agricultural and indigenous ecosystems, including wetlands and soil microbial ecology. Louis is a Fellow of the New Zealand Society of Soil Science as well as a Fellow of the Soil Science Society of America, is an author on two patents and has more than 100 peer reviewed publications. Professor Louis Schipper will be presenting the 2016 Norman Taylor Memorial Lecture on the 16th December, 11.00am, at the NZ Society of Soil Science & Soil Science Australia Joint Conference 2016: 'Soil, a Balancing Act Down-under', Millennium Hotel, Queenstown.

News from the Regions

Waikato/Bay of Plenty

Waikato University

David Lowe is currently on study leave, having swapped with ***Louis Schipper*** who has just returned from a few months of leave spent mainly locally at Landcare Research. ***Megan Balks*** attended the International Permafrost conference in Potsdam in June. She convened a cryosol session and presented two papers related to Antarctic soil research. ***Tanya O'Neill*** has just returned from the SCAR conference in Kuala Lumpur where she presented papers on her recent work related to microbial temperature response and related to the history of environmental management in Antarctic terrestrial environments.

The first students are now on board for our new MEnvSci degree. Three of them, Jonno Rau, Ricki Singh, and Kelli Patterson are planning thesis projects related to soils. We are looking forward to the Queenstown conference with nine students planning to attend with seven presenting papers and four participating in the soil judging competition. So we are looking forward to meeting everyone in December!

Lincoln Agritech

Compiled by Roland Stenger

Transfer Pathways research – come rain or shine!

Brian Moorhead and ***Tasman McKelvey*** from our Hamilton office have witnessed first-hand over winter how much rainstorms affect drainage flows at our two new research sites in the Hauraki Plains. Sharing infrastructure with colleagues from NIWA (Chris Tanner, Lucy McKergow) means that we can combine forces to unravel the surface and subsurface water and nutrient dynamics at these sites.

Fig. 1: Rain coming in just after Tasman had checked the rain gauge.

Fig. 2: High winter rainfall necessitating frequent trips to replace sample bottles in the auto-samplers.

Lincoln Agritech showcases nitrate sensor technology at Fieldays

In June, several staff members attended the Fieldays in Hamilton to present in the Innovation Centre a prototype of the low-cost "Optical Nitrate Sensor" developed by Lincoln Agritech. This sensor has been developed to enable nitrates to be measured more frequently and in a wider range of locations than has previously been affordable. It ultimately aims to assist farmers and regional councils in making better decisions about land use changes.

Blair Miller, Group Manager Environmental Research, explained to the interested audience that several environmental processes that take place below the root zone may affect the fate of leached nitrates. It is Lincoln Agritech's goal to tackle this problem by measuring nitrates in groundwater, rather than just modelling root zone losses, and to make the technology affordable.

This prototype is currently being field-trialled at the Hinds, mid-Canterbury district. Groundwater in the Ashburton and Tinwald area has some of the highest concentrations of nitrates in New Zealand due to agricultural intensification, droughts and over-extraction of water. The Hinds/Hekeao Managed Aquifer Recharge (MAR) Pilot project aims to replenish and improve the health of the aquifer and water quality. Lincoln Agritech's optical nitrate sensor in-field deployment is being used to real-time monitor the displacement of high nitrate, in situ groundwater by alpine, low nitrate river water. This will build an accurate picture of the effectiveness of nitrate hotspot dilution by recharge schemes.

Sino-NZ Technical Cooperation on Water-Saving Agriculture

In May, Lincoln Agritech's CEO, ***Peter Barrowclough***, travelled to China to sign a Memorandum of Understanding (MOU) with the Chinese Ministry of Agriculture. In the upcoming months, Lincoln Agritech will be working closely with NATESC to provide advice on irrigation, soil moisture monitoring and fertigation, including Lincoln Agritech's irrigation design software package, IRRICAD.

Fig. 3: . Lincoln Agritech CEO, Peter Barrowclough, and Deputy General of NATESC, Mr Chen Sheng Dou, sign the "Sino-NZ Technical Cooperation on Water-Saving Agriculture" agreement.

Staff news

Juliet Clague had a baby boy in late June and will be on maternity leave until early 2017. The boys in the Hamilton office are eagerly awaiting her return!

AgResearch Ruakura

The Pastoral 21 (or P21; MBIE partnership programme) is well into its extension year. P21 has a number of different objectives including one related to off paddock solutions for lowering agriculture's N footprint. There is a multi-organisational group of projects that have been developing low-cost solutions for farmers that meet the environmental reductions. Some of these solutions have already been demonstrated. The team includes ***Dave Houlbrooke***, ***Ross Monaghan***, ***Diana Selbie***, ***Moira Dexter***, ***Jane Chrystal*** (AgResearch), **Keith Cameron** (Lincoln University) and **Dave Horne**, **James Hanly** (Massey University). By February 2017 this team aims to have identified good management practice principals and likely approaches required to achieve these aims.

Jeerasak Chobtang completed and submitted his PhD on "Appraisal of Environmental Sustainability of Milk Production Systems in New Zealand" which involved application of life cycle management and was supervised by ***Stewart Ledgard*** (Ruakura), **Sarah McLaren** and **Danny Donaghy** (Massey University). Jeerasak had spent the last 2 years at Ruakura and has had 3 papers published or in press in scientific journals. He will return to Thailand after his oral examination in late August.

Stewart Ledgard attended an inaugural meeting in Rome of the Livestock Environmental Assessment and Performance (LEAP) Partnership. He is Co-Chair of a LEAP Technical Advisory Group (with 30 other international researchers) on nutrients accounting and impact assessment of livestock supply chains. A necessary part of this was checking out the end results of the supply chain so he also did an Italian cooking course! (*Pictured left)*

The newly named "Environmental Research" team has welcomed *Nannan Zhang* (Pictured below). Nannan is a LEARN (Livestock Emissions & Abatement Research Network) co-funded PhD candidate from the Centre for Agricultural Resources Research, Institute of Genetics and Developmental Biology (IGDB), Chinese Academy of Sciences (CAS; Shijiazhuang, Hebei, China). Nannan Zhang is supervised by Drs **Lin Ma** and **Zhaohai Bai** in China and Drs ***Stewart Ledgard*** and ***Jiafa Luo*** in New Zealand. Nannan's PhD topic relates to gaseous emissions and mitigation options from a typical dairy production system in China. Her study is aiming to (1) quantify the GHG emissions from the whole manure management chain of dairy production, including manure production during housing, manure storage, manure treatment and manure application; (2) quantify the ammonia volatilization from the cow confinement, including outdoor animal rest areas, and (3) explore mitigation options for GHG and ammonia emissions from dairy production. The main research methods involved in her study include in-situ trials, an indoor simulation experiment and modelling.

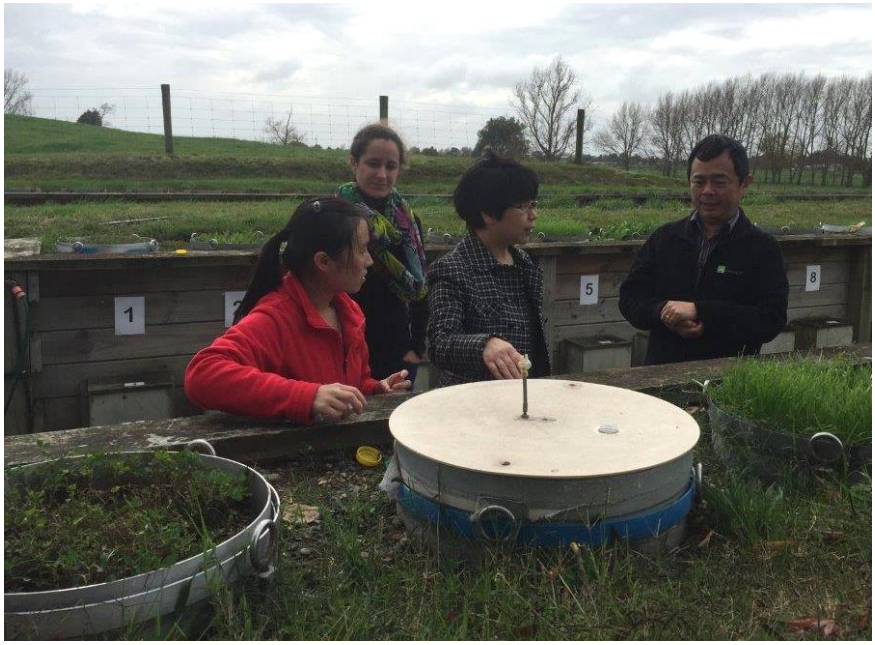


Photo: Out at the Ruakura lysimeter facility, from left to right: Nannan Zhang, Sandra Payen, Xiying Zhang (CAS), and Jiafa Luo.

Manawatu/Hawke's Bay

Landcare Research

***Gerard Grealish**,* pedologist, recently joined the Soils and Landscapes team, at Landcare Research in Palmerston North. He will be working with the other pedologists on soil survey, farm-scale soil mapping, soil assessment and soil standards. Gerard, who hails from Wellington, and is a Massey University graduate, has spent the last 30 years working overseas, mainly as a self-employed consultant on many varied projects for government agencies and consulting companies. He has worked in a wide range of environments from arid and semi-arid deserts in the Middle East and Australia, through to the tropics of Philippines, Brunei, and Myanmar.

Figure 1 A novel method to get around when soil surveying in the Lower Lakes, South Australia in the recent drought of the 2000s. Gerard also used this mode of transport for Middle East surveys (Photo: Gerard Grealish).

Figure 2 Gerard Grealish soil surveying in the Philippines.

Gerard's previous roles have seen him conduct soil and land resource assessment with applications for agriculture, monitoring, land suitability assessment, soil contamination, war damage assessment, mining, oil and gas, and infrastructure development.

Gerard joins ***Andrew Manderson*** as a Palmy Pedologist. Andrew reports that he is flat out writing technical reports, the most immediate of which includes an evaluation of N-loss change according to the many options for parameterising Overseer with soil data. He is also looking forward to starting the development of farm-scale soil mapping standards and protocols (for regional councils), and another project looking to predict the extent of surface and sub-surface drainage across NZ.

Carolyn Hedley recently attended the 7th Global Digital Soil Mapping (DSM) workshop in Denmark, presenting some results from soil carbon mapping research projects. Although soil carbon was a major focus, other presentation topics addressed ways to map a range of soil properties, including drainage class, heavy metals, pH, texture, erosion and soil depth. A presentation from Hungary reported methods for mapping natural constraints, such as pH and rooting depth, for which they receive EU subsidies.

There was a discussion on how digital soil maps are being used internationally – and on the global importance of quality soil data. For example, a recent study published in Nature Communications showed that soil data used in a global crop model can often outweigh the effects of weather variability. This study observed that estimated climate change effects on yield can be negative or positive, depending on the chosen soil type. The finding highlighted the importance of digital soil maps to provide better soil data for crop modelling, for example, in global food security studies.

Ahmed El-Naggar has recently arrived in Palmerston North to undertake PhD studies in precision irrigation, with supervisors Dave Horne, Carolyn Hedley, Pierre Roudier, and Brent Clothier. Ahmed travelled from 40°C heat in Egypt to freezing, stormy NZ, but is adapting remarkably well, and last week was busy collecting soil samples from the Massey VRI Pivot to initiate his soil data collection.

Surinder Saggar is at present in Kathmandu, Nepal, helping South-East Asian researchers develop sustainable nutrient and water use technologies for future food security and sustainable agriculture production.

Invited by the IAEA/FAO Professor Surinder Saggar gave lectures and hand-on training to the selected researchers from 13 South-East Asian countries (Bangladesh, Cambodia, Indonesia, South Korea, Lao, Myanmar, Mongolia, Nepal, Philippines, Pakistan, Sri Lanka, Thailand, and Vietnam). The lectures and training contribute to i) an understanding of management of marginal lands; ii) an assessment of nutrient losses from productive and marginal landscapes and their mitigation, using both conventional and nuclear techniques; iii) knowledge of best management practices of nutrients to increase crop productivity in a sustainable way; iv) calculations of nutrients from different N inputs (chemical fertilizer, animal manure) and fertiliser application; and v) the development of management strategies and solutions for these marginal lands to be implemented in the Southeast Asian countries for future food security and sustainable agriculture production (Fig. 3).

A training course on nutrient and water management was conducted, providing methods to overcome constraints affecting agricultural production. A thorough understanding of stable isotope 15N and its application in determination of N dynamics and loss mechanisms was also provided. The researchers worked together to develop a research project by identifying the key issue, outlining the hypothesis, and describing the methodology to test the hypothesis. The need for a collaborative and participatory

approach for sharing knowledge with the government policy makers and end-users (farmers and business community) was stressed.

Figure 3 Regional Training Course on Water and Nutrient Management for Marginal Land in Kathmandu, Nepal.

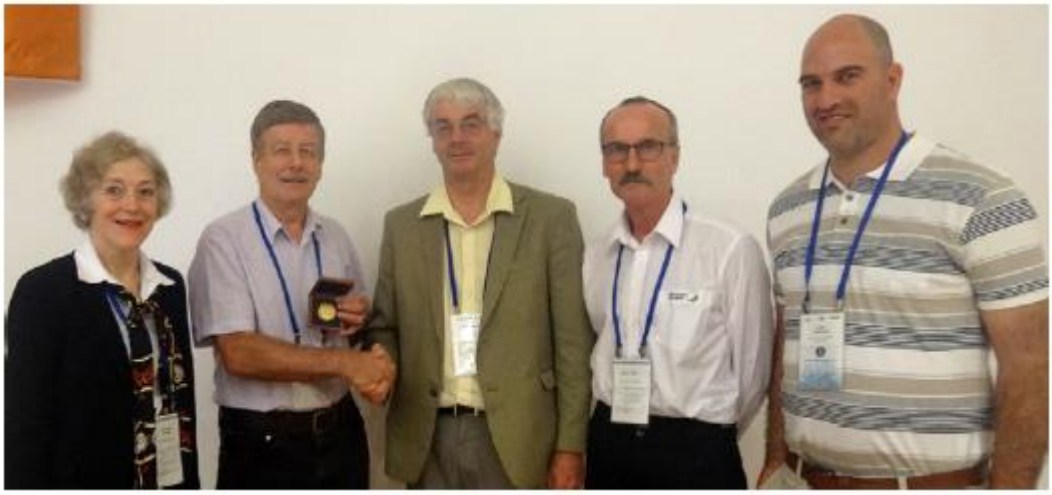
Surinder reports that to implement these solutions these countries need to establish mechanisms and national programmes for:

- providing sufficient resources to the regional research institutes to assess and understand the region-specific soil, water, and nutrient constraints that limit agricultural production in marginal and productive lands, and to develop solutions for efficient management of water and nutrients and for reducing the intensity of GHG emissions
- employing agricultural specialists to develop technologies, provide information and training on irrigation & water management, integrated use of fertilisers
- involving industry to co-fund research in developing technologies to reduce nutrient and water losses from productive and marginal lands
- developing climate smart technologies to maintain and enhance agricultural production.

Plant & Food Research – Palmerston North

Kirkham Soil Physics Conference

The 5th Kirkham Soil Physics Conference was held in April at the Ben Gurion University of the Negev Desert in Sede Boqer, Israel. The Conference theme was "The Root Zone: Soil Physics and Beyond". About 75 scientists attended the meeting. ***Brent Clothier*** is the Chair of the Soil Science Society of America's Kirkham Conferences Committee, and he attended the meeting. Kirkham Conferences are held every four years, and funding is provided through the Agronomic Science Foundation of the SSSA. Some 16 graduate students and early career scientists were supported to enable them to attend the meeting



Rien van Genuchten (second from left) receiving the Kirkham Medal. Also shown are Mary Beth Kirkham (left) recipient of a Distinguished Scientist Award, along with Kirkham Committee members Jan Hopmans, Brent Clothier and Naftali Lazarovitch.

Every 8 years, the SSSA Awards the Kirkham Medal to someone who has made landmark contributions to soil physics. Don Nielsen was the first recipient, and at Sede Boqer the second Kirkham Medal was awarded to Rien van Genuchten. The Kirkham Conference Committee also made a Distinguished Scientist Award to Mary Beth Kirkham.

Massey University, Palmerston North

In July ***Ranvir Singh*** travelled to USA and Europe to attend and present at an international conference "Toward Sustainable Groundwater in Agriculture –Linking Science and Policy 2016" in San Francisco, and to participate as an expert member of a Water Footprinting Technical Advisory Group (TAG) of the Livestock Environmental Assessment and Performance (LEAP) Partnership of the FAO (http://www.fao.org/partnerships/leap/en/). Ranvir also took this opportunity to visit and meet growers in the Central Valley, California, and Professor Matthew J. Helmers and his team at Iowa State University in Ames, Iowa.

At the conference, Ranvir presented on-going research work to better understand and effectively manage nitrogen flow pathways and attenuation in sensitive NZ agricultural catchments. Ranvir gained the impression that NZ appears to be well advanced in their water quality management efforts and found the conference very interesting and informative, with many speakers presenting on potential

challenges and solutions for sustainable groundwater and its quality management in the Central Valley California.

In some parts of the Central Valley, groundwater levels are falling and groundwater quality declining. Recently (in 2014), the California State Govt. enacted a Sustainable Groundwater Management Act (SGMA) to achieve sustainable, reliable and resilient groundwater systems in the State. Many talks and discussions were focused around the SGMA and how effectively this could be implemented.

Following the conference Ranvir visited the Central Valley in California and met the managers of a local Almond Growers Association and learned about how the local growers are grappling with shortage of irrigation water supply and its effects on orchard's survival and growth.

Ranvir Singh visiting and discussing irrigation in Almond Orchards in Central Valley, California

Ranvir also visited Iowa State University and met with Professor Helmers, discussing his experimental work and research on agricultural drainage water management. The research group are running long-term field trials studying agriculture drainage and investigating edge-of-field technologies such as integrated drainage/wetland systems and bioreactors to help reduce nitrate loads from Iowa's agriculture landscape.

Professor Helmers explaining their denitrification bioreactors at the research site at Iowa State University, Ames

Ranvir's last stop was a meeting of the FAO LEAP Water Technical Advisory Group at FAO Headquarters in Rome. This group of international experts is now well underway to work together and develop clear guidelines on water footprinting that can support water management solutions through the identification of hotspots of water use in livestock supply chains. The group will work via e-mails and video calls over next three months to prepare the draft guidelines and case studies, and then meet again in November 2016 to review to finalise the guidelines.

Ranvir Singh with Professor Arjen Hoekstra and Dr Camillo DeCamillis at the first face-to-face meeting of 'Livestock Environmental Assessment and Performance' Technical Advisory Group at FAO HQ, Rome

Late in August 23 rumen nutritionist visited the Massey No. 4 dairy farm to see how duration controlled grazing can be used to reduce N loss to water. Isabel Tait, Courtney Mitchell and Nouman Kyamanywa (staff from the Fertilizer & Lime Research Centre) presented the results of cow feeding trials that demonstrated the low urinary load that can be achieved with silages introduced into late summer cow diets.

NZ Association of Rumen Nutritionists listening to Dave Horne discussing the results of P21 research programme at Massey No. 4 farm.

Massey Soil Scientist ***Chris Anderson*** leads the MFAT-funded East Indonesia Innovative Farm Systems and Capability for Agribusiness Activity (IFSCA as it is now known) which has been operational now for over six months. This project involves several Massey staff and a key Massey Soil Science alumnus, Dr Bambang Kusumo, from the University of Mataram in Indonesia. The project is working to establish better connections between fruit and vegetable farmers and high-value hotels on the island of Lombok, and to increase the performance outcomes for cattle and corn farmers on the island of Sumbawa.

Massey was represented on the Prime Ministers' recent trade and education delegation to Indonesia (16-18th July) by Pro Vice Chancellor of the College of Sciences Prof Ray Geor and Chris Anderson was in attendance to help promote the IFSCA project. Bambang Kusumo was, however, the star of the show, and took on responsibility for describing the project to John Key. He immediately captured the PM's attention by announcing that he was a proud Massey Soil Science graduate. This visit further highlighted the current strength of the bilateral partnership between Massey and the University of Mataram which today spans, agriculture, animal science, food technology and education.

Bambang Kusumo describing the IFSCA project to John Key and the Minister of Trade Todd McClay (just out of camera shot).

To Bambang's left is the Head of the International Office of the University of Mataram, and to his right, a concerned looking Chris Anderson, and the PVC of the College of Sciences, Prof Ray Geor.

Chris Anderson and the University of Mataram engaging with farmers in Dompu District on Sumbawa Island

Canterbury

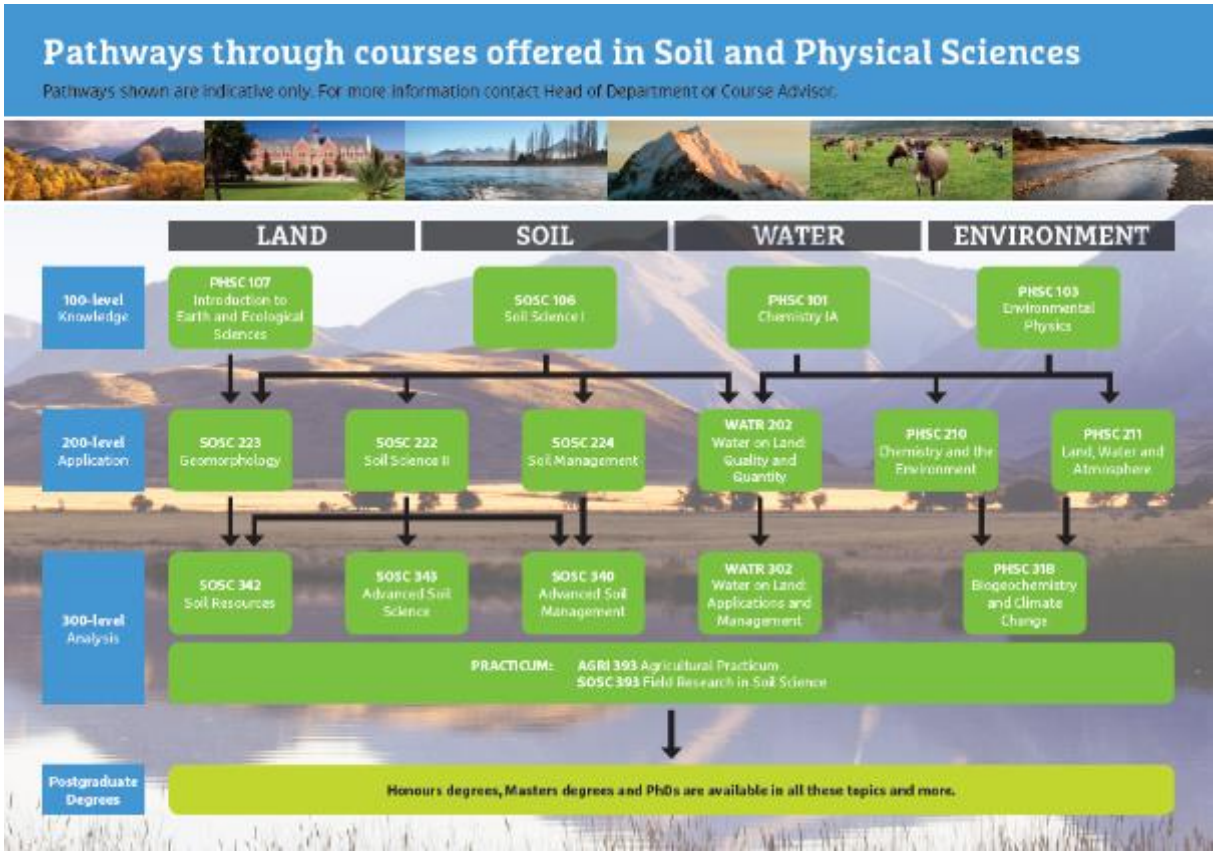
Lincoln University

Congratulations to ***Prof Tim Clough*** on being selected as a Soil Science Society of America Fellow award recipient. Tim will be formally presented with the award at the SSSA Awards Ceremony on 7th Nov 2016 during the scientific Society's International annual Meeting in Phoenix, Arizona. The annual awards are presented for outstanding contributions to Soil Science through education, national and international service, and research. Fellow is the highest recognition bestowed by the Soil Science Society of America.

DSc recognises contribution to soil-plant systems research

Prof Leo Condron has been awarded a Doctor of Science from the University of Canterbury. The award recognises his extensive contribution to research on the biogeochemistry of phosphorus in soil-plant systems. Prof Condron, a Professor of Biogeochemistry at Lincoln University and Senior Research Scientist in the Bio-Protection Research Centre, has spent 34 years researching phosphorus, a non-renewable resource that is key to determining ecosystem productivity. His work has improved understanding of the role and function of phosphorus in both natural and managed ecosystems. The award recognises his outstanding contribution to this field of research with more than 90 peer reviewed publications and an international network of collaborators. During his career, Prof Condron has developed methods for measuring phosphorus levels and bioavailability in soils. He has also studied the impact of land management and land use change on soil phosphorus in New Zealand, and the effects of long-term forest development on soil phosphorus. More recently, his work on recovering and recycling existing phosphorus addresses a worldwide concern that finite reserves of non-renewable phosphate rock are being steadily exhausted as demand continues to increase. The Doctor of Science Degree is of a higher standing than either a Master's degree or the degree of Doctor of Philosophy (PhD), and is awarded for work that makes an original, substantial and distinguished contribution to knowledge in a field with which the candidate is concerned. The Degree is awarded for published work of an exceptional standard, containing innovative contributions to the advancement of knowledge and learning which has given the candidate international distinction in their chosen research field.

The Department of Soil Science at Lincoln University has not a graphical representation of the pathways that students can take through their soil degree!



University of Otago

New Zealand has an enviable reputation for the efficient production of comparatively large amounts of food given our favourable climate and good soils. Producing this food sustainably and with resilient systems has emerged as a growing influence on the world's food production systems. Energy and climate is a growing focus of political and consumer attention, and the majority of our energy supply comes from price-volatile fossil fuels that are tightly linked to GHG emissions. Recognising and acknowledging the essential role of energy inputs into our food supply systems is therefore a key part of understanding and adapting to these changing market demands.

The role of energy in New Zealand food production is an extremely complicated nexus and is currently poorly understood at a systems level. Any changes in fertiliser use, irrigation, land intensification, agri-chemicals, effluent disposal, etc. will affect both the energy flows in the wider system, as well as the soils ability to grow the desired produce. In order to improve the efficiency and resilience of New Zealand's food supply chain, we must also understand the implications of energy flows in the soil science realm.

The University of Otago Centre for Sustainability is currently undertaking a pilot project to investigate how energy is woven into New Zealand's food supply chain, and to investigate where the areas of interest are for further research. If you are interested in this line of research and either have questions or feel you could add to the direction or scope of the project, ether academically or from an industry perspective, please contact Warren Fitzgerald on warren.fitzgerald@otago.ac.nz

Warren Fitzgerald, Assistant Research Fellow, Centre for Sustainability

AgResearch Invermay

Jane Chrystal, ***Tom Orchiston***, ***Seth Laurenson*** and ***Ross Monaghan*** have been busy this winter evaluating the suitability of sawdust and lignite materials for capturing N and P deposited to standoff pads by cows that have been on-off (6:18) grazing fodder beet crops. This study is conducted as part of the Pastoral21 programme of research and is seeking to identify more affordable approaches for minimising cow grazing durations over winter, whilst still keeping forage crops as an affordable winter feed source.

Alison Rutherford and ***Tony van der Weerden*** completed a field study quantifying nitrous oxide and ammonia emissions from barn-derived manure application to pasture. The study was conducted as part of a NZAGRC-funded programme to provide suitable data for estimating the greenhouse gas footprint associated with the Pastoral21 Telford dairy farmlets. The footprint analysis will continue this year.

Wayne Worth and ***Cecile de Klein*** have been conducting an AgResearch core-funded field trial to assess the effect of urine-N loading rate on N2O emissions, soil pH and soil mineral N dynamics. Combined with results from earlier work, the data will help improve our understanding of the effects of low-N diets on N2O emissions.

"Clean" and "Used" versions of an in-field standoff pad that has been evaluated in Southland this winter.

Abstracts

The available water holding capacity of soils under pasture

D.J. Horne, D.R. Scotter
Institute of Agriculture and Environment, Massey University, Palmerston North, New Zealand

The concept of available water holding capacity (AWHC) is important to many aspects of soil water management, particularly those involving a soil water balance calculation. In New Zealand AWHC estimates are commonly based directly or indirectly on laboratory measured pressure plate data. Such retentivity based values for AWHC are relatively similar across a range of soil types. Less often, AWHC values have been measured under rye grass/white clover pasture in the field. We critically discuss an important earlier New Zealand study. It noted that field-measured values are commonly about twice the laboratory-based estimates. We conclude that variable rooting depth, due to the presence or absence of compacted soil at depth and/or variable pasture vigour or species composition, usually has a greater effect on the AWHC than does the soil properties in the top 760 mm depth. Finally, it is claimed that this uncertainty around the exact size of AWHC need not undermine its utility. The one exemption to this assurance is where reliable predictions of drainage (and leaching) below the root zone are required: in this case there is the likelihood that use of the often quoted values for AWHC in the water balance will result in a significant overestimation of drainage (and leaching).
Agricultural Water Management 177 (2016), 165-171.

Denitrification in the shallow groundwater system of a lowland catchment: A laboratory study

Clague, J. C., Stenger, R., Clough, T. J. (2015)

Evidence for the occurrence of denitrification in shallow groundwater systems in New Zealand (NZ) is poorly documented; however, an observational study of the Toenepi dairying catchment in the Waikato region of NZ revealed a prevalence of reduced groundwater with very low nitrate (NO_3^-) concentrations (predominantly <0.5mg L^{-1} N). Denitrification in the shallow groundwater system could play an important role in catchments with high NO_3^- leaching losses, by reducing the impact of land use and management practices on freshwater bodies. International studies have shown that denitrification below the root zone is often limited by the low availability of carbon (C) or other electron donors. In this laboratory incubation study we investigated three different profiles (to a maximum depth of 4.7 m below ground surface) in the Toenepi catchment (15 km^2).

Denitrification capacity was measured following the addition of ^{15}N-enriched NO_3^-, while glucose was used as a readily available C source when ascertaining the denitrification potentials. The largest total ^{15}N fluxes (without C amendment) were observed in samples from the Kereone (1.3–2.1 nmol N g^{-1} h^{-1}) and Topehaehae sites (2.8 nmol N g^{-1} h^{-1}); however, all sites had samples with fluxes of a similar magnitude (3.3–4.7 nmol N g^{-1} h^{-1}) with no significant difference between sites ($p > 0.05$) when glucose was added. The profiles were generally C-limited, as indicated by more than 80% of samples showing an increase ($p < 0.01$) in total ^{15}N gas ($^{15}N_2$ + $^{15}N_2O$) production after C addition. The composition of the total ^{15}N gas flux varied with depth but $^{15}N_2$ was ≥69% of the total ^{15}N flux and typically >92%. Extrapolation of denitrification capacity rates to field temperatures (14 °C) indicates that much of the material found at depth, particularly at the Kereone and Topehaehae sites could contribute substantially towards attenuating the estimated NO_3^- leaching losses (29–42 kg N ha^{-1} $year^{-1}$) from the root zone and is likely the cause of the very low NO_3^- concentrations prevalent throughout the catchment.
Catena 131:109-118. (DOI: 10.1016/j.catena.2015.03.012)

Diurnal and spatial variations of soil NOx fluxes in the northern steppe of China

Bing Wang[1], Xinqing Lee[1], Benny K.G. Theng[2], Jianzhong Cheng[1] and Fang Yang[1,3]

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[2] Landcare Research, Private bag 11052, Palmerston North 4442, New Zealand
[3] Graduate University of the Chinese Academy of Sciences, Beijing 100049, China

Abstract
NOx emissions from biogenic sources in soils play a significant role in the gaseous loss of soil nitrogen and consequent changes in tropospheric chemistry. In order to investigate the characteristics of NOx fluxes and factors influencing these fluxes in degraded sandy grasslands in northern China, diurnal and spatial variations of NOx fluxes were measured in situ. A dynamic flux chamber method was used at eight sites with various vegetation coverages and soil types in the northern steppe of China in the summer season of 2010. Fluxes of NOx from soils with plant covers were generally higher than those in the corresponding bare vegetation-free soils, indicating that the canopy plays an important role in the exchange of NOx between soil and air. The fluxes of NOx increased in the day time, and decreased during the night time, with peak emissions occurring between 12:00 and14:00. The results of multiple linear regression analysis indicated that the diurnal variation of NOx fluxes was positively correlated with soil temperature ($P < 0.05$) and negatively with soil moisture content ($P < 0.05$). Based on measurement over a season, the overall variation in NOx flux was lower than that of soil nitrogen contents, suggesting that the gaseous loss of N from the grasslands of northern China was not a significant contributor to the high C/N in the northern steppe of China. The concentration of NOx emitted from soils in the region did not exceed the 1-hr National Ambient Air Quality Standard (0.25 mg/m^2).

Journal of Environmental Sciences **32**: 54−61 (2015)

Effect of biochar addition on short-term N_2O and CO_2 emissions during repeated drying and wetting of an anthropogenic alluvial soil

Fang Yang[1,3], Xinqing Lee[1], Benny K.G. Theng[2], Bing Wang[1], Jianzhong Cheng[1] and Qian Wang[1,4]

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Abstract
Agricultural soils are an important source of greenhouse gases (GHG). Biochar application to such soils has the potential of mitigating global anthropogenic GHG emissions. Under irrigation, the topsoils in arid regions experience repeated drying and wetting during the crop growing season. Biochar incorporation into these soils would change the soil microbial environment, and hence affect GHG emissions. Little information, however, is available regarding the effect of biochar addition on carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions from agricultural soils undergoing repeated drying and wetting. Here we report the results of a 49-day aerobic incubation experiment, incorporating biochar into an anthropogenic alluvial soil in an arid region of Xinjiang province, China, and measuring CO_2 and N_2O emissions. Under both drying-wetting and constantly moist conditions, biochar amendment significantly increased cumulative CO_2 emission. At the same time, there was a significant reduction (up to ~ 20%) in cumulative N_2O emission, indicating that the addition of biochar to irrigated agricultural soils may effectively slow down global warming in arid regions of China.

Environmental Geochemistry and Health DOI 10.1007/s10653-016-9838-9 (2016).

Synthesis of organoclays: A critical review and some unresolved issues

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[5] *University of Chinese Academy of Sciences, Beijing 100049, PR China*

Abstract
The synthesis of organoclays (OC) by intercalation of quaternary ammonium cations (QAC) into expanding clay minerals, notably montmorillonite (Mt), has attracted a great deal of attention during the past two decades. The OC have also found applications in the manufacture of clay-polymer nanocomposites (CPN) and environmental remediation. Despite the wealth of information that exists on the formation and properties of OC, some problems remain to be resolved. The present contribution is an attempt at clarifying two outstanding issues, based on the literature and experimental data obtained by the authors over the past years. The first issue concerns the relationship between the cation exchange capacity (CEC) of the Mt and the basal spacing of the OC which, in turn, is dependent on the concentration and the nature of the added QAC. At a concentration less than 1 CEC, organo-Mt (OMt) formed using the QAC with a short alkyl chain length with $n_c < 16$ (e.g., dodecyltrimethylammonium) give basal spacings of 1.4-1.6 nm that are essentially independent of the CEC. However, for long-chain QAC with $n_c \geq 16$ (e.g., hexadecyltrimethylammonium), the basal spacing varies with the QAC concentration. For Mt with a CEC of 80−90 meq/100 g, the basal spacing of the OC increases gradually with the CEC, and shows a sudden (stepwise) increase to 3.2-3.8 nm at a QAC concentration of 1.5 CEC, and to 3.5−4.0 nm at a concentration of 2.0 CEC. The second issue pertains to the "locking" effect in QAC and silane-modified pillared interlayered clays (PILC) and Mt. For silylated Mt, the "locking" effect results from the covalent bonding of silane to two adjacent layers within a single clay mineral particle. The same mechanism can operate in silane-grafted PILCs but in this case, the "locking" effect may primarily be ascribed to the pillaring of adjacent basal surfaces by metal hydr(oxides).

Applied Clay Science **100**: 22−28 (2014).

Irrigating grazed pasture decreases soil carbon and nitrogen stocks

Paul L. Mudge[1], Francis M. Kelliher[2], Trevor L. Knight[2], Denis O'Connell[2], Scott Fraser[1] and Louis A. Schipper[3]

Global Change Biology, in press: DOI: 10.1111/gcb.13448

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Abstract
The sustainability of using irrigation to produce food depends not only on the availability of sufficient water, but also on the soils 'response' to irrigation. Stocks of carbon (C) and nitrogen (N) are key components of soil organic matter (SOM), which is important for sustainable agricultural production.

While there is some information about the effects of irrigation on soil C stocks in cropping systems, there is a paucity of such studies in pastoral food production systems. For this study, we sampled soils from 34 paired, irrigated and unirrigated pasture sites across New Zealand (NZ) and analysed these for total

C and N. On average, irrigated pastures had significantly (P<0.05) less soil carbon (C) and nitrogen (N) than adjacent unirrigated pastures, with differences of 6.99 t C ha^{-1} and 0.58 t N ha^{-1} in the uppermost 0.3 m. Differences in C and N tended to occur throughout the soil profile, so the cumulative differences increased with depth, and the proportion of the soil C lost from deeper horizons was large. There were no relationships between differences in soil C and N stocks and the length of time under irrigation.

This study suggests SOM will decrease when pastures under a temperate climate are irrigated. On this basis, increasing the area of temperate pasture land under irrigation would result in more CO_2 in the atmosphere, and may directly and indirectly increase N leaching to groundwater. Given the large and increasing area of land being irrigated both in NZ and on a global scale, there is an urgent need to determine whether the results found in this study are also applicable in other regions and under different land management systems (e.g. arable).

Early view: http://onlinelibrary.wiley.com/doi/10.1111/gcb.13448/full

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A review of the policies and implementation of practices to decrease water quality impairment by phosphorus in New Zealand, the UK, and the US

R. W. McDowell . R. M. Dils . A. L. Collins . K. A. Flahive , A. N. Sharpley · J. Quinn

Abstract
The improper use of phosphorus (P) on agricultural land in developed countries is related to P losses that impair surface water quality. We outline policy in New Zealand, the UK, and the US who have imposed limits for P measured as ecological status, but in some cases, also as chemical concentrations or loads. We contrast the strategies used in each country and discuss their likelihood of being able to decrease P losses and improve surface water quality. All three countries have focused on understanding pathways and catchment processes so that cause and effect can be traced across spatial and temporal scales. A poor understanding of catchment processes and critical source areas of P loss has resulted in some areas where regulation has had minimal effect on P discharges

Furthermore, while biophysical science can inform policy, we give several examples where social and economic challenges are of equal if not greater relevance to P discharges (e.g. subsidies). Some evidence shows that these challenges can be overcome at the farm to small catchment scale with a mix of mandatory and voluntary rules in targeted areas. Other policy instruments (e.g. trading schemes) may be needed at larger scales, but should be flexible and encourage innovation over a culture of dependence. There is increasing recognition among all three countries that while targeting good management practices can substantially decrease P losses from existing land use, to achieve 'good' water quality in catchment, policy may have to consider land use change.

Nutr Cycl Agroecosyst (2016) 104:289–305

Conferences:

NZASSS

NZ SOCIETY OF SOIL SCIENCE & SOIL SCIENCE AUSTRALIA

It gives us great pleasure to invite you to the joint conference of the New Zealand Society of Soil Science and Soil Science Australia. The conference will be held in one of the most iconic places of New Zealand, Queenstown, and will run from 12-16 December 2016. The overarching theme of the conference is '**Soil, a Balancing Act Down-under**' and reflects the challenges we are facing in managing our soils to reach a careful balance between many, often competing, land-use, productivity and environmental aspirations. We also anticipate that the conference will include a debate between leading science, industry and policy representatives to challenge the question whether soil science can provide the solutions that will allow us to continue to use our soils sustainability amidst growing societal pressures and demands.
We look forward to welcome you to Queenstown in December.

KEYNOTE SPEAKERS

We have an exciting line-up of plenary speakers covering a wide range of topics, from soil fertility, to soil biology, greenhouse gases, land use intensification and future farming challenges and opportunities.

Steven Carden
Talk Time: 13 December 2016, 9.00am
Topic: Future Farming: Challenges and Opportunities

Julian Cribb
Talk Time: 15 December 2016, 8.30am
Topic: The Age of Food

Steve Wakelin
Talk Time: 13 December 2016, 9.45am
Topic: Soil Biology

Jeff Baldock
Talk Time: 14 December 2016, 9.15am
Topic: Minimising Greenhouse Gases

Mike McLaughlin
Talk Time: 14 December 2016, 8.30am
Topic: Nutrient Management

The Norman Taylor Memorial Lecture Presented by Professor Louis Schipper
Talk Time: 16 December 2016, 11.00am

PANEL DISCUSSION: THURSDAY 15 DEC, 3:30PM- 5:00PM

FACILITATED BY KIM HILL, RADIO NEW ZEALAND. The panelists will address future challenges and pressures placed on our soils by competing production, social, political and environmental demands. Panel discussion members include:

Jacqueline Rowarth
Professor Agribusiness, University of Waikato

Susie McKeague
Consultant, McKeague Consultancy Ltd

Andy Macfarlane
Consultant, Macfarlane Rural Business and AgResearch director

Bob Gilkes
Emeritus Professor, University of Western Australia

FIELD TRIPS: MONDAY 12 DEC, 8:00AM - 6:00PM

TRIP 1 - Northern Southland farm systems, Kindly Sponsored by AB Lime
Join us as we journey into beautiful Southland as we follow the Oreti River from its source high in the pristine tussock clad Southern Alps and more...

TRIP 2 - Central Otago Landuse balancing act, Kindly Sponsored by Ballance Agri-Nutrients
The central Otago field trip will focus on the balancing of multiple landuse demands in one of New Zealand's iconic landscapes and more...

PROGRAMME AT A GLANCE

Please note: This is a provisional programme and is subject to change at the discretion of the conference committee.

SUNDAY, DECEMBER 11, 2016

12:30 PM - 4:00 PM	Soil Science Australia - Federal Council Meeting
From 8:00 AM	Soil Judging Competition - Practice Day Kindly Sponsored by Ballance Agri-Nutrients

MONDAY, DECEMBER 12, 2016

8:00 AM - 6:00 PM	Field Trips Kindly Sponsored by Ballance Agri-Nutrients & AB Lime
8:00 AM - 6:00 PM	Soil Judging Competition - Competition Day
5:00 PM – 6:00 PM	Pre Conference Registrations
6:30 PM – 9:00 PM	BBQ Social Function Kindly Sponsored by Ravensdown

TUESDAY, DECEMBER 13, 2016

7:00 AM - 8:20 AM	Registration Desk Open
8:30 AM - 9:00 AM	Conference Opening
9:00 AM - 9:45 AM	Keynote: Steve Carden (CEO, Landcorp)
9:45 AM - 10:30 AM	Keynote: Steve Wakelin (Scientist, AgResearch)
10:30 AM - 11:00 AM	Morning Tea
11:00 AM - 12:30 PM	Concurrent Sessions
12:30 PM - 1:30 PM	Lunch, Kind Sponsored by Irrigation NZ
1:30 PM - 2:50 PM	Concurrent Sessions
2:50 PM - 3:30 PM	Afternoon Tea
3:30 PM - 4:50 PM	Concurrent Sessions
5:00 PM - 6:00 PM	Pre Soil Science Australia AGM / NZSSS AGM Drinks & Nibbles
6:00 PM - 7:00 PM	Soil Science Australia AGM / NZSSS AGM
6:30 PM - 9:00 PM	Student Function Kindly Sponsored by Plant & Food Research

WEDNESDAY, DECEMBER 14, 2016

8:30 AM - 9:15 AM	Keynote: Mike McLaughlin (Scientist, CSIRO & Uni of Adelaide
9:15 AM - 10:00 AM	Keynote: Jeff Baldock (Scientist, CSIRO)
10:00 AM - 10:30 AM	Morning Tea
10:30 AM - 12:00 PM	Concurrent Sessions
12:00 - 1:00 PM	Lunch
1:00 PM - 3:00 PM	Poster Session
3:00 PM - 3:30 PM	Afternoon Tea
3:30 PM - 5:00 PM	Concurrent Sessions
6:00 PM - 8:00 PM	Social Touch Rugby Tournament

THURSDAY, DECEMBER 15, 2016

8:30 AM - 9:15 AM	Keynote Speaker: Julian Cribb (Consultant, Australia)
9:15 AM - 10:00 AM	Plenary sessions
10:00 AM - 10:30 AM	Morning Tea
10:30 AM - 12:30 PM	Concurrent Sessions
12:30 PM - 1:30 PM	Lunch
1:30 PM - 2:50 PM	Concurrent Sessions
2:50 PM - 3:30 PM	Afternoon Tea
3:30 PM - 5:00 PM	Panel Discussion: "Confronting the balancing act" Facilitated by Kim Hill
6:30 PM - Midnight	Conference Dinner at the Skyline Restaurant Kindly Sponsored by Landcare Research Manaaki Whenua

FRIDAY, DECEMBER 16, 2016

9:00 AM - 10:30 AM	Concurrent Sessions
10:30 AM - 11:00 AM	Morning Tea
11:00 AM - 12:00 PM	The Norman Taylor Memorial Lecture
12:00 PM - 12:20 PM	Official Conference Closing
12:20 PM - 1:00 PM	Lunch

ACCOMMODATION

Queenstown offers a wide range of accommodation options to suit all budgets. Get in quick to book your accommodation before it's too late. Accommodation options can be found on the conference website. http://www.nzsssconference.co.nz

OTHER HIGHLIGHTS

Soil Judging Competition
Sunday 11 Dec / Monday 12 Dec
Kindly Sponsored by Ballance Agri-Nutrients

- Sunday 11 December: practice day. Several soil profiles will be available for practising soil judging skills.
- Monday 12 December: competition day.

Price: $100 per team
To register a team email lealdon-cue.co.nz

Pre & Post Conference Field Trips
Allow an extra day or two to attend one of our pre and post field trips.
The preconference trip provides the opportunity to travel overland from Christchurch, through the inland Mackenzie basin to Queenstown. The post conference trip loops back to Christchurch, through the rain forest region of the West Coast of the South Island. The trip will go via Haast and Arthur's Pass focussing on soil biogeochemistry, forest ecology and geomorphology of Pleistocene and Holocene landforms.
See the conference website for further details.

Social Touch Rugby Tournament
Wednesday 14 Dec, 6:00pm - 8:00pm
This will be a fun way to stretch the legs and have a bit of fun with our friends from across the island or across the ditch. Make sure to bring your sports gear and be in with a chance to take the inaugural conference trophy in its first year. Please organise your team of 5-7 people, or simply turn up on the day and we can allocate teams. For further information, please contact seth.laurenson@agresearch.co.nz

GOLD SPONSOR: Hill Laboratories

MAJOR SPONSOR: AGMARDT

SILVER SPONSORS: ARL, eurofins, agresearch

BRONZE SPONSOR: Fertiliser & Lime Research Centre, Massey University

CONFERENCE DINNER SPONSOR: Landcare Research Manaaki Whenua

BBQ FUNCTION SPONSOR: ravensdown

STUDENT FUNCTION SPONSOR: Plant & Food Research

LUNCH BREAK SPONSOR: Irrigation New Zealand

FIELD TRIP SPONSOR: AB Lime, Ballance

SOIL JUDGING COMPETITION PRIZE SPONSOR

www.nzasssconf.co.nz

A conference on the cutting edge of science, management and policy to minimise effects of agriculture and land use changes on the quality of groundwater and surface waters.

LuWQ2017
3rd International Interdisciplinary Conference on LAND USE AND WATER QUALITY:
Effect of Agriculture on the Environment
The Hague, the Netherlands, 29 May – 1 June 2017

More information is on http://www.luwq2017.nl/

Objectives

This conference aims to discuss the entire policy cycle for water quality improvement. This cycle includes problem recognition, formulation of technical options, the process of policy development, interaction with policy makers, stakeholders and pressure groups, policy implementation, monitoring and research. This conference also aims to intensify contacts, on the one hand, between scientists with a background in natural sciences and scientists with a background in social and economic sciences and, on the other hand, between scientists, water managers and policy makers. In short, the objectives are:

- to provide forum for exchange of scientific knowledge, research on system knowledge, modelling and uncertainty;
- to discuss the entire policy cycle for water quality improvement;
- to intensify contacts (a) between soil/water related scientists, agro related scientists, social scientists, ecological scientists and economists, and (b) between scientists, water managers and policy makers.

LuWQ2017 is the follow-up to the successful LuWQ conferences, LuWQ2015 held in Vienna, Austria, in September 2015 and the LuWQ2013 conference held in The Hague, the Netherlands, in June 2013.

Target groups and keywords

Target groups (professionals, fields of expertise, audience) are scientists, managers and policy makers involved in the policy cycle for water quality improvement. The conference deals with themes and topics characterised by the following keywords:

- **Keywords for fields of expertise and scientific disciplines:** agronomy, agro-economics, agro-sociology, water management, water policy, action plan, river basin management plan, hydrology, soil science, drinking water supply
- **Keywords for system description:** aquatic ecosystems, terrestrial ecosystems, unsaturated zone, groundwater, surface waters, monitoring, modelling, chemical water quality, biological water quality, nitrate vulnerable zones, river basins, catchments
- **Keywords for best management practices:** buffer zones, sedimentation ponds, constructed wetlands, incorporation of fertilisers, catch crops, erosion control, cost effectiveness, voluntary measures, laws and regulations
- **Keywords for substances:** nutrients, nitrate, phosphorus, pesticides and other organic agrochemicals, heavy metals.

25 - 27 January 2017

The International Plant Nutrition Institute is pleased to invite you to participate in the upcoming international conference designed to exchange information on how to improve potassium plant nutrition and soil management to better the health of soils, plants, animals, and humans. The 4R Nutrient Stewardship framework is integrated into the conference structure to keep the discussions anchored to the information needs of farmers and those who provide nutrient management guidance.

Website: http://kfrontiers.org
Location: Rome, Italy

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20 – 23 June 2017

The Second Global Workshop on Digital Soil Morphometrics at The James Hutton Institute in Aberdeen, Scotland UK. For more information see http://www.digitalsoilmorphometrics.org