Soil Horizons

Issue 16 September 2007

Landcare Research
Manaaki Whenua

Contents

A newsletter communicating our work in soil-related research to end users, customers and colleagues.

ISSN 1174-0922

S-map: a digital soil map for New Zealand

S-map is a national soil database programme that provides seamless digital soil map coverage of NZ. S-map has two main thrusts – to absorb and upgrade existing information in soil databases from reports and expert knowledge, and to upgrade soil maps where existing data are of low quality. The fundamental soil data incorporated in S-map support an inference system that is used to derive the soil information products needed by users. For example, S-map will generate available water capacity used in water quality and water quality modelling, and bulk density used to model carbon sequestration in soils.

Existing soil data are patchy in scale, age and quality, and the soil properties of soil types depicted on soil maps are currently very poorly described. S-map is addressing these problems by reclassifying soil types into clearly defined classes and attaching the new soil information needed to achieve crucial national environmental and sustainable development outcomes.

S-map is an initiative of the LRIS (Land Resource Information System) Nationally Significant Database. The work is driven by the demand for accessible, comprehensive, quantitative soil information to support sustainable management. This demand arises through the need for quality input soil data to support environmental and production models required for decision making by land-based industries and policy agencies.

System design has reached a point where the first information products are being produced. Areas entered into the S-map database include the Otago Region lowlands, Canterbury plains, dry South Island greywacke mountains, Motueka catchment, northern Wairarapa, Bay of Plenty lowlands, and Manukau City. Soil fact sheets have been produced for some of these areas to provide general information on soils as well as custom information needed for specific enterprise types. The fact sheets are derived dynamically on request over the web so that the sheets are automatically updated as the database is developed. See http://soils.landcareresearch.co.nz/smapfactsheet/default.aspx?gislayer=orc

S-map, designed to be applied at any scale from farm to region to nation, simplifies both soil description and the derivation of critical soil information.

Allan Hewitt
Phone 03 321 9698
HewittA@LandcareResearch.co.nz

Figure 1: Portion of the new soil map of the Ben More range, South Canterbury

Investing in our future

Throughout this issue we review knowledge generated and outcomes realized in three national soil science capabilities: soil functioning; soil mapping/spatial information management; and erosion process science and modelling. These impressive achievements have only been possible because of continued support and investment from industry, regional and central government, and the endorsement of our science and its value by the wider community.

In mid-July investments from the Foundation for Research, Science and Technology were announced. Highlights for Landcare Research included the soils team, who, together with collaborators, secured 6 years funding for continuation of the highly successful Soil Services Programme (as outlined in Issue 15, p. 4). This programme was recently rated as 'excellent' by an international panel on the basis of its outcomes and science quality (FRST Water Domain Review, May 2007). It is therefore well poised to continue generating critical science that facilitates gains in natural resource use efficiency and reduces the degradation of our environment, via improved practice and policy.

Our soil mapping/spatial information management programme of work, unfortunately, did not fare as well. A significant cut in funding, in combination with previous investment decisions, has effectively reduced the effort of soil field staff and pedologists to less than 0.8 full time equivalents (FTE) across New Zealand, per year, compared with approximately 49 FTE in the 1970s (Figure 1). This level of funding compares unfavourably with that provided for the maintenance and refinement of other nationally significant resources. Such a decline in investment also seriously jeopardizes aims to complete a national coverage (as outlined on p.1), or provide adequate farm-scale soils data for environmental planning, management, and eco-verification purposes.

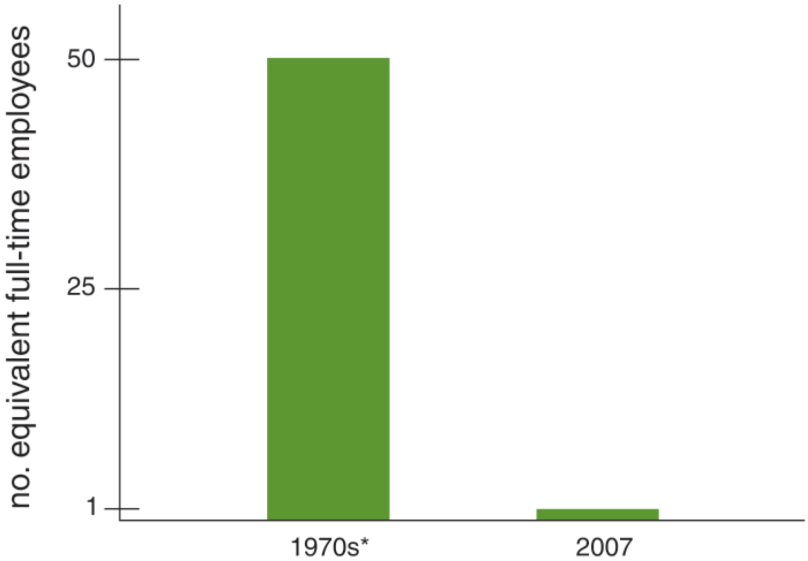


Figure 1: The number of active field staff building land resource databases.
*DSIR Soil Bureau: 24 people; Ministry of Works – Water & Soil Division: 25 people

Erosion capabilities were also hit by a withdrawal of funding, where the failure of a highly rated FRST bid resulted in a loss of $300K audit trail. This reduction in funding effectively disables our research on the causes and distribution of erosion and potential mitigation options, which is directly relevant to regional/district council and MAF sustainable land-use policy development (including the East Coast Forestry Project, as outlined on p. 4). Landcare Research is nationally unique in advancing fit-for-purpose capability to develop spatially distributed, dynamic models and visualization tools for erosion prediction (including modification of overseas models, e.g., SedNet as outlined on p.3). However, this result will severely limit the development of New Zealand relevant predictive modelling that deals with contemporary land-use concerns, such as flooding, erosion, and sedimentation and the likely impacts of climate change.

As well as impacting on our ability to deliver research and associated outcomes, these funding results also constrain our chances to attract, develop and maintain capability as outlined in Schipper (p.11), the value of which is well-illustrated by the successes of younger scientists such as Rosser (p. 5), Carrick (p. 8), or Scott (p. 10). Without continued and stable investment we are challenged to provide desirable career options for New Zealand scientists or sustain national capabilities that are available to solve society's next environmental trial or crisis.

In spite of these setbacks we have to move forward, working closely with our investors and developing strategic partnerships with our stakeholders and collaborators to look at alternative approaches to protect these nationally relevant capabilities. During this difficult time it is worth remembering, as SLURI did, that in every crisis there is an opportunity. And, above all else, continuing to find novel and stimulating ways to demonstrate and promote the value and utility of our science – research that provides for a healthy, economically and environmentally viable future.

Alison Collins
06 353 809
CollinsA@LandcareResearch.co.nz

Reducing erosion losses from hill country farms

Landcare Research estimate that the potential impact of introducing soil conservation policies to 500 key farms in the Manawatu catchment would almost halve erosion losses from the catchment. These conservation policies typically include tree planting on slopes, in gullies and along riverbanks to control bank erosion. Previous research has shown that such policies reduce long-term average erosion by 70% on average. In this case, the average amount of sediment discharged to the Manawatu River would be reduced from 3.8 to 2.0 million tonnes per year.

Much of New Zealand's hill country, originally covered with indigenous forest, has been converted to productive pastoral landscapes. This land-use change, however, led to increased mass movement erosion and sedimentation of waterways. Previous researchers have estimated erosion and sedimentation rates using rainfall and rock type. Now, John Dymond and colleagues have developed a new erosion model that for the first time includes land cover and management factors that clearly play a role in soil stability studies. The model can be used to investigate the effect of land-use change scenarios on erosion rates.

Mean sediment discharge is estimated from mean erosion rates using a sediment delivery ratio that depends on whether the erosion feature is connected with a waterway. This connectivity has been assessed using a 15-metre grid digital elevation model, providing detailed information for the whole country (Figure 1).

As well as predicting the potential effects of introducing soil conservation policies to 500 key Manawatu farms, the model has also been used to estimate that the total erosion associated with agriculture in 2002 was 80 million tonnes.

Thirdly, the model has been used in the Motueka catchment to predict the effect of three land-use change scenarios: complete indigenous forest cover; present land use; and intensive land use (conversion of all existing plantation forest to pastoral agriculture). The model predicts present land use is delivering double the sediment of the indigenous forest, and this will double again if all plantation forests are replaced by pastoral agriculture. Further conversion of forest to pastoral agriculture will therefore increase sediment discharge to Tasman Bay, with potential implications for productive aquaculture.

John Dymond
06 353 4955
DymondJ@LandcareResearch.co.nz

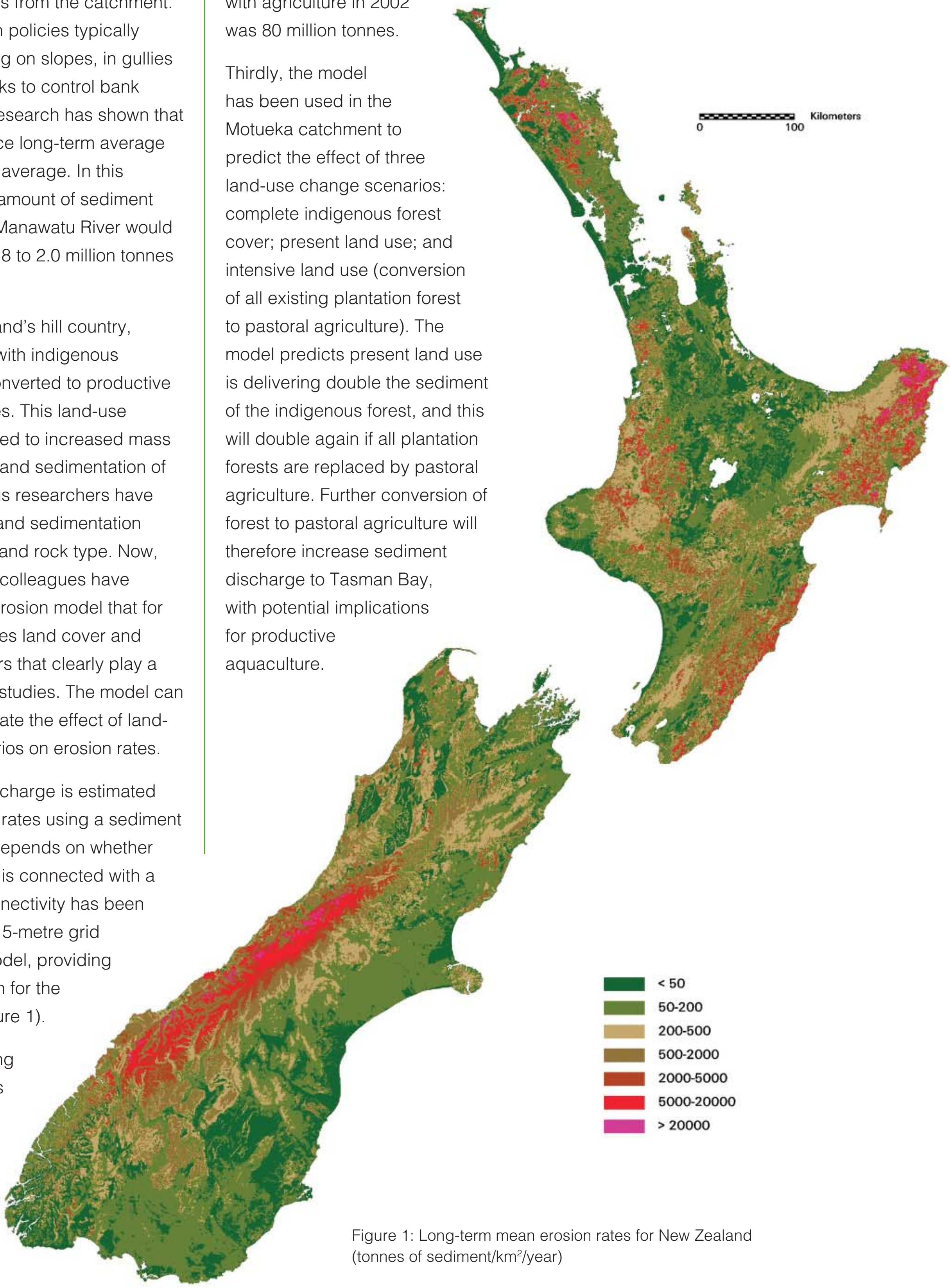


Figure 1: Long-term mean erosion rates for New Zealand (tonnes of sediment/km^2/year)

Core – it's another paleo-lake!

During a routine sediment-coring expedition in the East Coast's Waipaoa catchment, Landcare Research scientists discovered the site of a former lake. There are no surface clues as to the presence of this lake so it was a chance discovery and an important one as the core contains volcanic ash and organic material (wood and pollen) used to date the commencement, duration and cessation of the lake record. In addition, pollen extracted from the sediment can be used to deduce the composition of the vegetation cover and this in turn is used as a surrogate for climate. The sediment accumulation record thus provides valuable clues to the relationships between climate, vegetation and sediment generation for the period the lake existed.

The steep, hilly landscape surrounding this lake is dominated by large, deep-seated landslides, the size and extent of which suggest the lake was likely dammed by a landslide, temporarily blocking a stream. Dateable material from the lake core indicates sediment began collecting behind the landslide-dam about 14 000 years ago and ceased about 3000 years ago. The significance of this find is in the timing of the landslide-damming, which may well have been triggered by a high-energy event such as an earthquake, the effect of which appears to have been widespread throughout the Waipaoa catchment and in all probability resulted in a large influx of sediment to the Waipaoa River. This sediment flux would ultimately have been delivered to the Poverty Bay shelf. If so, then this event may also be recognisable in cores of marine sediment collected off the coast of Gisborne, currently a priority research site of the National Science Foundation of America-funded MARGINS, Source-to-Sink (S2S) Programme (www.ldeo.columbia.edu/margins).

This is not the only paleo-lake to be discovered by Landcare Research scientists in the Waipaoa catchment. A previously undiscovered sequence of lake sediments was found in 1993 and subsequently investigated by Verne Pere of Canterbury University. He established that this lake was formed as a result of a deep-seated landslide temporarily blocking part of Ngatapa valley about 28 000 years ago and that this lake persisted until 15 000 years ago, at which time the landslide-dam was breached. Given the unstable nature of the Waipaoa landscape and its susceptibility to earthquake-generated landslides, it is highly probable that many more landslide-dammed lakes have existed at different times in the past. Their effectiveness in trapping sediment and their influence on sediment yields from the Waipaoa catchment to the shelf has still to be evaluated.

Figure 1: Mike Marden and the paleo-lake core

The combined sediment record stored within these two landslide-dam lake deposits contains a wealth of information on the influence of past tectonic, climatic and volcanic events and of vegetation change on the landscape for the period between 28 000 and 3000 years ago. Interpreting the past from these two paleo-lake sequences is the key both to understanding the magnitude of landscape change and resilience following such events and to predicting how the current landscape might respond to similar events in the future; in particular to climate scenarios predicted for New Zealand as a consequence of climate change. Increased understanding of landscape response and resilience is required to anticipate and manage risk and to sustain ecosystems, both within NZ and globally.

Mike Marden
06 863 1345
MardenM@LandcareResearch.co.nz

Pasture productivity slipping away…..

Regional Councils and land managers require real data to assess the sustainability of our hill country land use. Therefore Landcare Research scientists are investigating pasture productivity in some of our marginal hill country, where keeping the soil in place can be a challenge.

Soil slip erosion can result in immediate and often dramatic reductions in pasture production on steep hill country. The first New Zealand trial, by Greg Lambert, Noel Trustrum and Des Costell, in the 1980s, examined some of the effects of this erosion on pasture dynamics and was conducted on seasonally dry Wairarapa hill country. The findings from this study were that pasture dry matter yields on young slip scars were about 20% of the yields produced on uneroded ground. However, while such scars revegetated rapidly over the first 20 years and could attain 70–80% of original productivity, further recovery was slow and complete recovery may never occur. By extending pasture dry matter yields from slips of differing age to the scale of a whole hillside, these researchers concluded that the cumulative effect of slipping, in response to previous storms, reduced the potential pasture productivity by 18% of that on uneroded ground.

To determine whether soil recovery and pasture dry matter productivity had further improved over the last 25 years, the original study site was relocated by Landcare Research scientists Brenda Rosser, Mike Marden and Craig Ross. Research modelled on the earlier trial began in June 2007. This site had also previously been used to investigate how quickly the soil biological properties recover following a landslip (Soil Horizons Issue 6, p. 9).

Figure 2: Stock exclusion cages measure pasture growth rate on uneroded ground

The trial site has terrain that is underlain by unconsolidated Tertiary sediments, typical of North Island soft rock hill country. Extensive areas of soil slipping are a feature of this landscape (see Figure 1).

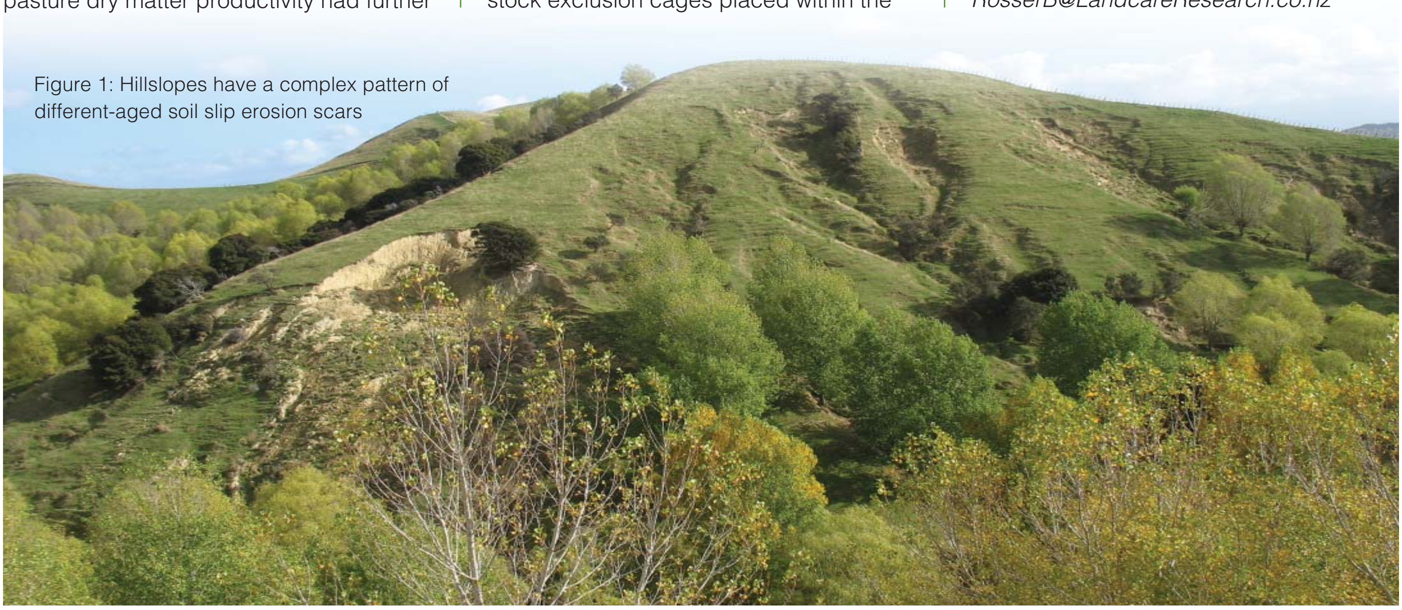
The group relocated landslide scars, initiated during storms in 1977, 1961, and pre-1943, and previously dated and sampled by Lambert. In addition to these scars the group also located landslides initiated during storms in 1981.

Pasture productivity is being measured by stock exclusion cages placed within the scar itself. Additional cages were placed on adjacent uneroded ground as a control site with similar slope and aspect.

Soil cores were collected for soil analyses from each of the eight landslide scars and also from adjacent uneroded sites. These cores will be compared with analyses of the same scars from the previous trial. The trial, which is expected to continue through to 2010, will measure pasture productivity regularly, thus providing valuable data for future land-use planning.

Brenda Rosser
Ph: 06 353 4979
RosserB@LandcareResearch.co.nz

Figure 1: Hillslopes have a complex pattern of different-aged soil slip erosion scars



Larger soil macropores under organic orchards

The average soil macropore size in an organic orchard was found to be four times larger than in an adjacent integrated orchard. Soil macropores are the pores that provide preferential flow paths through the soil. They may be cracks or fissures and are formed in many ways, for example by plant roots and soil fauna, wet-dry and freeze-thaw cycles and chemical weathering. These macropores therefore play a very important role in the filtering and buffering capacity of the soil.

This research is being conducted by a collaborative project that includes SLURI researchers, Markus Deurer and Brent Clothier, AGMARDT post-doctoral fellow Tehseen Aslam, and internship German masters student, Stephanie Ralle, who have been working with new ways of measuring and observing macropores in situ.

The team have been working in two adjacent apple orchards in Hawke's Bay that are on the same soil type. The carbon content in the organic orchard is now 3.8 kg C per square metre, whereas it is just 2.6 kg C per square metre in the integrated orchard. The team carried out an intensive field campaign with disc permeameters (Figure 1) to measure the near-saturated hydraulic characteristics of the soil profiles in the two different orchards. They found that the average soil pore size in the organic orchard is over a millimetre in diameter, whereas for the integrated orchard it is one quarter of this, about 250 μm.

Figure 2: X-ray tomographs of the surface soil from the organic orchard (left) and the integrated orchard (right)

The extra soil carbon in the organic orchard appears to have had a significant effect on the hydraulic properties of this soil, increasing the average pore size. X-ray tomographic observations (Figure 2) of the two soils revealed very different internal structures, providing evidence for the inferred functional differences.

The larger macropores under the organic orchard help maintain key soil services such as buffering and filtering capacities of the surface soil. An increased macroporosity will, for example, allow air, water and nutrients to move more easily through the soil.

Figure 1: Stefanie Ralle tending a flock of disc permeameters

Brent Clothier
bclothier@hortresearch.co.nz

The global economic value of soil macropores

SLURI soil researchers Brent Clothier, Markus Deurer and Steve Green have estimated that the economic value of the soil's large pores – its macropores – to global ecosystem services is US $304 billion (NZ $419 billion). Compare this with the market value of the world's biggest company, ExxonMobil, which is US $411 billion!

The importance of this calculation is underlined by the fact that soil comprises a substantial part of the earth's natural capital stocks – and because of macropores it leaks preferentially. The soil's ecosystem services are the flows of energy and materials from the soil's natural-capital stocks. These are valuable. The soil's ecosystem services often operate preferentially because of macropores, and this common aspect of the soil's functioning might add value to these functions or degrade them. For example, irrigation water may flow rapidly past the rootzone where it is required. It is therefore important to put an economic value on macropores.

Soil macropores are the pores that provide preferential flow paths through the soil.

These researchers used the landmark Nature paper by Costanza et al. (1997)[1] as a starting point for their calculations. This paper estimated the value of the whole world's ecosystem services and natural capital. It considered 17 ecosystem services across 16 biomes, and concluded that the annual value of the world's ecosystem services is US$33 trillion. In addition, the annual value of terrestrial forest systems (US$4.7 trillion), grass and rangelands (US$906 billion), and croplands (US$128 billion) provides just some US$5.74 trillion worth of services. Brent Clothier and colleagues have used these results to make a crude estimate of the value played by macropores, including preferential flow and transport processes across those 17 services.

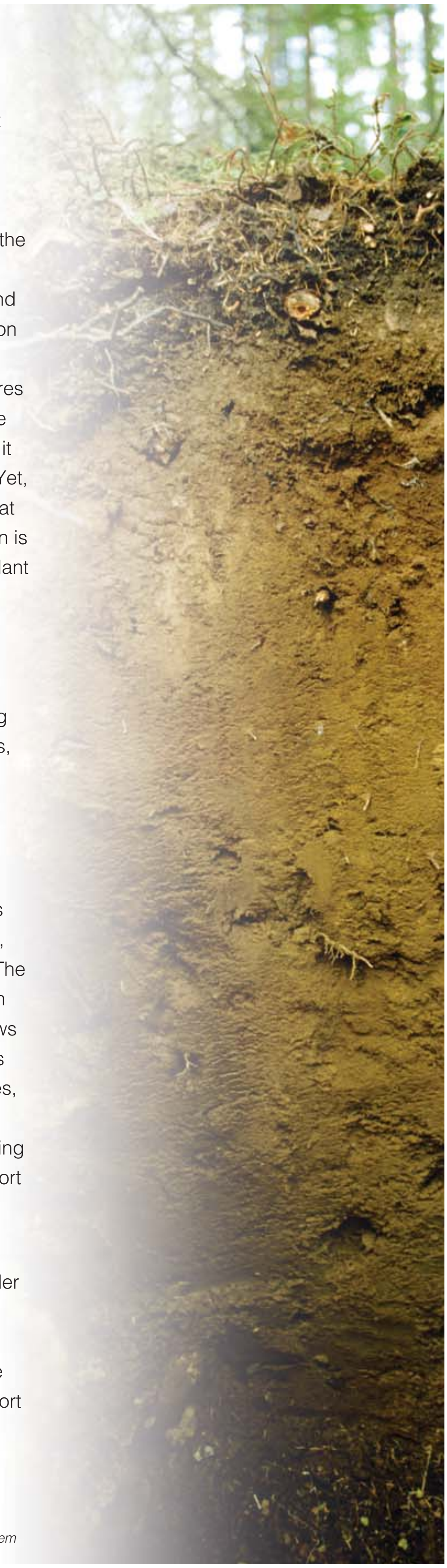
All these 17 ecosystem services involve soil. Brent Clothier's group deemed that only two are not affected by preferential flow processes. Twelve, they consider, benefit positively from preferential flow processes. For example, they consider the service of nutrient cycling benefits from macroporosity and preferential flows, and suggest that when nitrogen mineralization proceeds within the soil's matrix, it is isolated from by-pass flows in macropores that might otherwise preferentially leach it from the rootzone. Yet, within the matrix, that mineralised nitrogen is still accessible to plant roots. Conversely, for the service of waste treatment, preferential flows can, by far-reaching and rapid transport through macropores, carry contaminants to receiving waters. Therefore, for this service, they assign a negative value to preferential flow processes.

They believe twelve ecosystem services benefit from preferential flow processes, whereas three are affected negatively. The researchers presumed that 10% of each service derives from the preferential flows and heterogeneous transport processes that are created by the soil's macropores, and derived the figure of US$304 billion per year using simple multipliers providing a value for preferential flows and transport through macropores in these terrestrial ecosystems of our world.

No wonder then that pedologists consider there is a direct relationship between the quality status of a soil and those macroporous characteristics that initiate and sustain preferential flow and transport through structured soils.

Brent Clothier
bclothier@hortresearch.co.nz

[1] Costanza et al. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253–260



Preferential flow through soils

Recent research has shown that the patterns of infiltration and water movement within soils are strongly influenced by the behaviour of a network of preferential flowpaths. These preferential flowpaths rapidly transport water down the profile and, interestingly, bypass a fraction of the soil matrix.

Knowledge of the hydraulic attributes of most New Zealand soils is scarce; however, it is needed for decision making by land managers, research agencies, and regulatory authorities for sustainable land use. For example, if the hydraulic properties of a soil are understood then appropriate application rates of irrigation and effluent disposal can be used to minimise runoff and activation of subsurface preferential flow that can rapidly leach contaminants.

Preferential flowpaths rapidly transport water down a soil profile and bypass a fraction of the soil matrix.

Landcare Research, AGMARDT and Lincoln University are funding a PhD project by Sam Carrick on methods to measure soil hydraulic attributes that will accurately characterise preferential flow behaviour. At the completion of this project, guidelines will be provided to research, consultancy, and regulatory agencies on the reliability of different measurement methods. Flow pathways have been identified in the soil profiles using a dye stain technique, where dye is poured onto the soil surface and its flow patterns can be seen by subsequent destructive sampling of the soil core (see Figure 1a–f). The research is characterising the hydraulic attributes of a Typic Firm Brown soil, which is an extensive pastoral soil of the Southland Plains.

As well as indicating that patterns of infiltration and water movement in the soil are strongly influenced by the behaviour of preferential flowpaths, these preliminary results also indicate that measurement methods vary in their reliablity to characterise preferential flow behaviour. For example, spatially averaging sensors, such as Time Domain Reflectometry rods (TDR), are less sensitive to the behaviour of preferential flowpaths than are quasi-point sensors such as tensiometers. The reliability of these sensors to identify the activation of subsurface preferential flowpaths is important for achieving efficient application rates of irrigation.

Sam Carrick
CarrickS@lincoln.ac.nz

a b c d e f

Figure 1a–f: Soil flow paths shown by a dye stain
- a) A pastoral Southland soil profile used for the dye stain test
- b) Vertical section through the soil profile
- c) Horizontal section through the soil profile at 2 cm depth
- d) Horizontal section through the soil profile at 20 cm depth
- e) Horizontal section through the soil profile at 40 cm depth
- f) Horizontal section through the soil profile at 60 cm depth

Figure 2: The research characterises the hydraulic attributes of a Typic Firm Brown soil, an extensive pastoral soil of the Southland Plains

Scientists unite to protect our aquifers

Scientists are investigating and modelling the transport of nitrate from agricultural land to ground water on the alluvial plains of New Zealand. The key questions to be answered are:

- How do nutrients from existing land use move through the soil to the aquifer and then through the aquifer system?
- What impact will land-use changes have on the quality of groundwater in the future?
- Will using best practice farm management techniques be enough to maintain acceptable ground water quality?

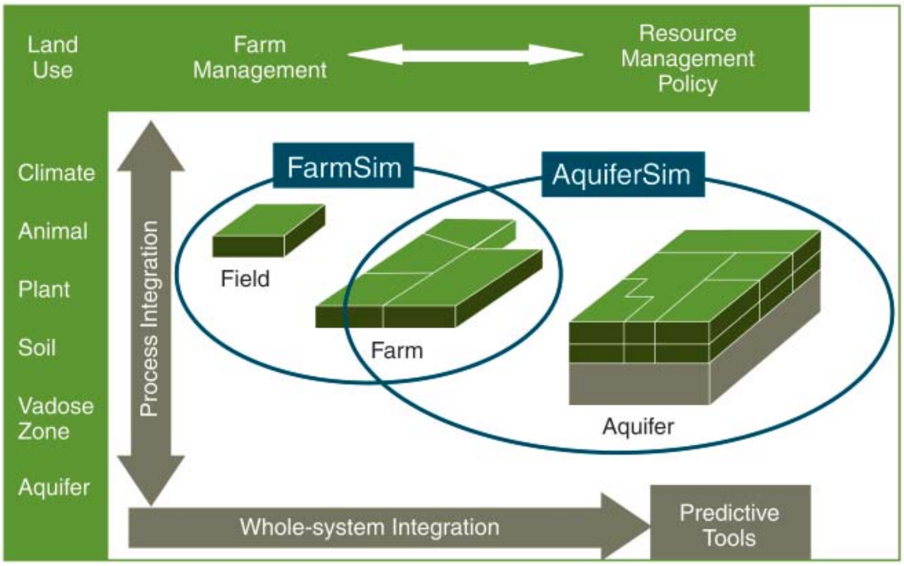


Figure 1: IRAP relates land use to groundwater quality

The collaborative project, named IRAP (Integrated Research for Aquifer Protection), includes Crop & Food Research, AgResearch, Dexcel, Landcare Research, ESR, Lincoln Environmental, Environment Canterbury, and Environment Waikato. The research is primarily funded by the New Zealand Foundation for Research Science and Technology.

FarmSim and AquiferSim

While IRAP includes some basic experimental research on nitrate movement in the root zone, and on vadose and aquifer properties, its major output is a set of software modules that form the building blocks of two end-user tools – FarmSim and AquiferSim.

FarmSim simulates the operation of cropping and pasture grazing (sheep and dairy) farms under differing management regimes in a manner that reflects the unique conditions of each individual paddock within the farm. It includes modules for soil-water movement, nitrogen cycling, plant growth, irrigation, fertiliser application, crop rotation, stock management, and an end-user interface. Simulations are conducted at individual paddock scale, taking into account farm constraints, and aggregated to the whole farm, providing time-series estimates of drainage fluxes and nitrate concentration leached from each farm.

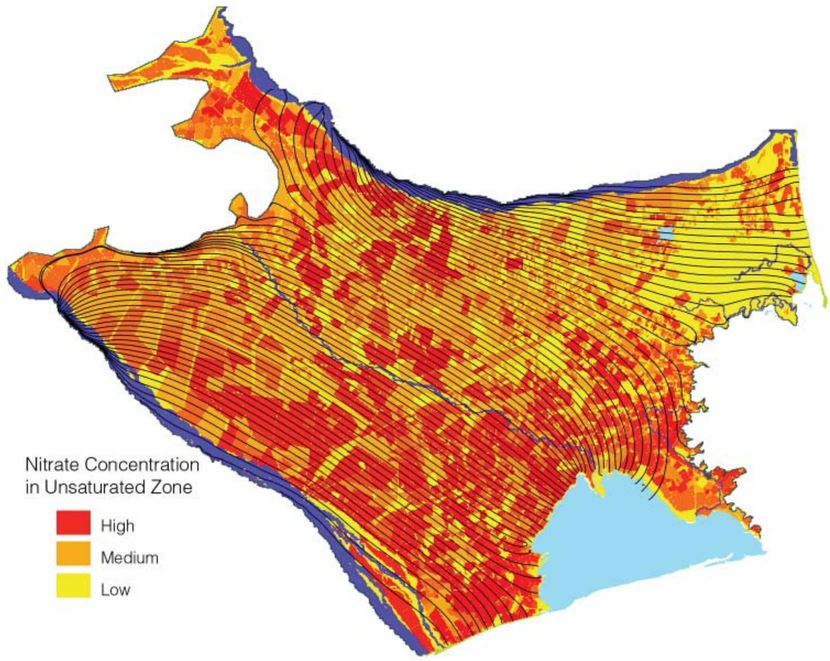


Figure 2: Groundwater pathlines overlying land use in Central Canterbury, flowing SE toward Lake Ellesmere (lower right)

The AquiferSim tool integrates the effects of the nitrate-contaminated drainage estimates from FarmSim, and provides information about their resulting horizontal and vertical distribution in the aquifer. It comprises a geographic information system (GIS) to manage the various data layers and annual farm-scale drainage and nitrate flux data provided by FarmSim. In addition, users can define what-if catchment-scale scenarios and then view model outputs. These outputs include the piezometric surface, contaminant flowpath, and simulated transport within the aquifer.

Work on these tools is underway. Further information on IRAP can be obtained from www.irap.org.nz.

Linda Lilburne
03 321 9850
LilburneL@LandcareResearch.co.nz

It's an old problem but it's not going away

We have probably all heard about nitrate in ground water, and the problem it causes for water quality and algal blooms, but it seems the problem could become even more of an issue in the future. Most of the nitrate reaching our waters comes from the breakdown of soil organic matter and from animal urine. Soils can store huge amounts of nitrogen in organic matter, and then release it slowly as plant nutrient. But recent work by scientists at Landcare Research in Hamilton suggests many soils are now reaching their limit to store any more nitrogen, and won't be able to store much more in organic forms. If that happens, then nitrogen from urine, nitrogen-fixation and fertilisers, will get converted to nitrate and could be leached from the soil. This is bad news when inputs of nitrogen to intensively used pastures are increasing as a result of higher stocking density, more imported feed, and greater use of nitrogen fertilisers.

Figure 1: Lysimeters established to investigate nitrogen storage and leaching processes

John Scott and colleagues are trying to understand how nitrogen is stored in soil, particularly how nitrogen is held in organic forms. Can we manage the soil to store more nitrogen? To test this they have set up a lysimeter experiment to study nitrogen storage and leaching from soils with low and high nitrogen status (Figure 1). A range of nitrogen inputs in the form of urea and urine are being applied to soils from the high and low phosphorus fertility treatments at Ballantrae. As part of unravelling the nitrogen saturation story John and his colleagues want to know in what form the nitrogen is stored and where it is in the complex soil matrix. Knowing this in relation to land use and management may enable improved management practices to be developed.

Figure 2: Method to separate diiferent soil fractions

Figure 2 shows a simple method to separate potentially different soil functional pools. It shows previously separated particulate organic matter from within macroaggregates but outside microaggregates floating in a dense solution of sodium polytungstate. The denser microaggregates, containing particulate organic matter that is more physically protected from soil microbes, rest on the bottom of the tubes. By subjecting such physically separated soil fractions to further chemical analyses scientists gain a greater understanding of how land use and management affect the nature of soil nitrogen storage and saturation.

John Scott
07 859 3739
ScottJ@LandcareResearch.co.nz

Introducing John Scott

John Scott, soil scientist, has recently joined Landcare Research in Hamilton to help unravel the complexities and environmental implications of nitrogen and phosphorus storage in and leakage from soils. John, a sheep farmer and farm advisor before turning to research, has also spent some time lecturing in Ohio, USA. He has now accepted the challenge of researching and linking the biogeochemistry of soils with related environmental issues.

Capability development in soil science

The soil science community in New Zealand is an aging group with a number of recent retirements and others reducing their working hours. These people have enormous experience and have contributed greatly to New Zealand's development. It is inevitable that retirements happen and we continuously need to develop new and energetic talent if we are to continue to use New Zealand natural resources wisely.

Earth and Ocean Sciences at the University of Waikato have had a number of excellent collaborations with Landcare Research and SLURI that have helped develop talent. There are two means by which students gain experience within Crown Resaerch Institutes: short-term work placements as part of their BSc (Tech) programme, and as graduate (MSc or PhD) students undertaking collaborative research with the active researchers. Research organizations benefit from being able to explore new and risky opportunities that are strongly aligned with their ongoing research. They can also get to know students who could be future employees.

Top students can apply for a range of MSc and PhD scholarships and are generally attracted by the nature of the project. However, funding often needs to be sought from other sources in conjunction with University supervisors. The logistic support a research organisation can provide for a student is often of immense value to the student.

Profile examples

Natalie Watkins conducted an MSc thesis aligned with Dexcel and Landcare Research. As part of their FRST programme, Landcare Research was measuring rates of soil denitrification at Dexcel's Resource Efficiency trial. Natalie's project examined whether application of DCD (a nitrification inhibitor) would enhance denitrification rates in one of the treatments. Landcare Research and Dexcel shared resources and provided facilities for Natalie during her thesis work, providing a real-world experience for Natalie and getting additional findings from her work.

Undergraduate students, Louise Fisk (BSc tech placement) and Marie Heaphy, worked with staff from AgResearch and the University of Waikato to subsample and analyse more than 250 archived soils samples from the Whatawhata trial near Hamilton. The project goal was to determine whether soil carbon and nitrogen had changed on hill country during the last 25 years. This study was aligned with Landcare Research's Soil Services programme and the SLURI initiative examining the large losses of carbon and nitrogen from pasture soils during the past 20 years.

With this approach we have achieved a number of successful and rewarding projects. It is a privilege to work with students who are developing enthusiasm for a new subject. The students I have come across have the ability to take New Zealand forward–they just need our support to help them learn the ropes.

Louis Schipper
07 856 2889
schipper@waikato.ac.nz

A chat room for young New Zealanders

The Long Song is a website for conversation about Earth initiated by a group of young New Zealanders who are deeply interested in working toward a sustainable future for New Zealand.

The Long Song began when the group, who were participating in the Future Leader's Course with the Auckland Business School, joined with the Digital Earth Society of New Zealand and AnewNZ to help 100 youth attend the Digital Earth Conference in August 2006. This Conference was partially sponsored by Landcare Research. As part of their attendance, each person had to describe their vision for the future of New Zealand.

Since then, a number of the group have also contributed to the Digital Earth conference in San Francisco. They have a diverse range of backgrounds and work environments but collectively provide a very influential leadership force for the country's future, intending to influence at policy and political levels.

"Our focus is the fusing of cultural, scientific and practical actions concerning sustainability, global warming, digital mapping, information freedom and other planetary matters.

But it's a website and so much more! The Long Song began at the 2006 Digital Earth Summit on Sustainability in Auckland New Zealand when a specially formed youth delegation saw that the conversation was too big to rush. As a result, our community is full of bright young sparks from New Zealand.

While we can't always meet in person, we can collaborate here, any time.

And we'd love to have you join us. If we're going to save the world we need all the help we can get."

http://thelongsong.com/ thelongsong.com

Change of address

Q. Christie in Molloy, 1998

Please let us know if:

- your address/details have changed
- you wish to be removed from the mailing list
- you know of someone who would like to be added to the mailing list

New address/details

Name:..

Position: ....

Address:...

....

....

OR Please remove my name from the mailing list: YES ☐

Please cut and return to: The Editors
Soil Horizons
Landcare Research
Private Bag 11052
Palmerston North 4474
New Zealand

or email: soilhorizons@LandcareResearch.co.nz

Key contacts

Editors: Carolyn Hedley, Anne Austin and Graham Sparling

Layout: Nicolette Faville

Published by: Landcare Research New Zealand Ltd
Private Bag 11052
Palmerston North 4442

View online at: http//:www.landcareresearch.co.nz/publications/newsletters/soilhorizons/index.asp

Unless otherwise stated, funds for the research described in this newsletter were provided by the Foundation for Research, Science and Technology.

Printed on recycled paper