

Biowastes Project

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News from the Programme Manager

– Jacqui Horswell

Welcome to the Summer "Biowastes" newsletter.

It has been a busy and productive year for the Biowastes programme. This quarter we have been developing our work plans for the next phase of the research. Much of next year will be spent writing up our Kaikōura case-study after the March 2012 hui. We will also be setting up some new soil lysimeters to investigate in more detail the impact of mixtures of contaminants in soils.

This year we also plan to strengthen links with our colleagues in Australia. We are holding a joint Australia New Zealand Biosolids workshop on Tuesday the 9th of April (see flyer insert). The workshop will be held immediately preceding the Land Treatment Collective Annual Conference in Blenheim. Aligning these two events will make it easier for delegates to attend both. The workshop will review the latest research, policy and guidelines, and provide an opportunity for cross-Tasman knowledge sharing. We look forward to fostering closer linkages within the Australasian biosolids industry, and we hope to see you all there.

Perhaps the biggest news of the year is our plan to form a 'virtual research centre'. In the last newsletter we talked about the new research streams that we have been developing to run alongside our biosolids work. Biowaste research requires expertise in many disciplines, and our inter-organisational collaborations across the length of New Zealand will be formalised as the Centre for Integrated Biowaste Research. The Centre will be launched at the Australia New Zealand Biosolids workshop in Blenheim in April next year.

And finally – a highlight of our work this quarter was the 'Up the Pipe Solutions' hui held on 26th of June at Takahanga Marae in Kaikōura. The hui brought together about 40 year nine students from Kaikōura High School, teachers, parents, members of the Council, Innovative Waste Kaikōura staff, local people actively involved in waste reduction, two elder women from the local rūnanga, and representatives from Enviroschools and the NZ Council for Educational Research. This successful interactive workshop took those in attendance on a 'ride' through the local waste stream, highlighting areas where contamination occurs, how contaminants can be reduced, why we purchase products that contain contaminants, and how we can reduce contamination by using alternatives. Two elder Māori women spoke of cultural cleaning methods from 70 years ago. Thanks to Raewyn Solomon and Sara Watson and the people of Takahanga marae for hosting us once again. The hui was a great success and we have since been inundated with schools wanting to take part in the 'Up the Pipe' programme!

On behalf of the Biowastes team I'd like to thank our case study communities, collaborators and research partners for their continued support of the research programme this year.

I hope that you have an enjoyable summer!

Jacqui



The biophysical science team at ESR, from left to right: Robina Ang, Andrew Van Schaik, Morkel Zaayman and Jacqui Horswell.

Up the Pipe' Education Intervention: engaging the community through high school students – Jacqui Horswell and Jinny Baker

The Ministry for the Environment Waste Minimisation Fund 'Up the Pipe solutions' project builds on successful existing partnerships with the Kaikōura District Council, Te Rūnanga ō Kaikōura, and the wider community formed through the multidisciplinary MSI (now MBIE) Biowastes project. Through this work we have also developed a good relationship with the local high school through science teachers Shelly Heald and Glenys Hanley and Principal Werner van Aswegen.

The project looks back 'up the pipe' to raise awareness, characterise behaviours, and provide learning resources that can support behaviour change in the use of household cleaning and personal care products. It aims to increase awareness of the ingredients that we put down the drain that ultimately end up in the environment. The project makes the children the 'investigators', thereby engaging both the school students and their families.

To engage the high school students and their community and collate information about how they use household products, a questionnaire was given to the Kaikōura High School students. The students were required to identify products in their laundry, kitchen or bathroom that had ingredients they did not recognise or were concerned about, and to interview the parent or caregiver who was the primary household shopper about their motivations for purchasing household cleaning or personal care products.

To support the survey we also produced a short film. The film is an excellent resource that helped introduce and explain the 'Up the Pipe' topic, and thus give greater grounding and context for the survey exercise. Made by dynamic young film maker Andrew Strugnell, the film features Tawa College students, a kaumātua from Ngāti Toa, and the Porirua City Council's wastewater management team. It is a humorous but informative look at what goes

down your household drain, what happens in an urban waste-water treatment system, and how this can impact on recreational and drinking water quality.

The final stage of the project was an interactive hui at Takahanga Marae on the 26th of June 2012. The hui began with an 'icebreaker' – a scientific pot cleaning competition involving all the students. We used pre-prepared grubby baking trays where identical food had been burnt onto the tray then scraped off. A variety of natural cleaning product ingredients such as baking soda, vinegar and oil were presented. Scientists explained the potential cleaning properties of each of the 'natural' products, for example, "White vinegar can be used as a household cleanser, effective for killing most mould, bacteria, and germs, due to its acidity." Students worked in small teams and designed their ultimate cleaning recipe from the ingredients provided; they then nominated a chief scrubber and had a set amount of time and number of scrub strokes to see if their cleaning product would do the best job. The cleanest tray was judged by a panel of members of community and chefs from the Takahanga kitchen, and prizes were awarded for the cleanest tray. Through this activity the students learnt about the simple chemistry of some of the natural products and how they might be used in cleaning.

Following the icebreaker the students took part in a number of workstations. One hands-on workstation showed students how to make eco-friendly body care products such as foot powders and hand scrubs. The 'Becoming a critical consumer' workstation gave feedback to the students from the survey results and encouraged students to become more critical consumers. Tools and ways of thinking were provided to help students recognise 'need' as something deliberately created by advertising, be more resilient, and look for natural treats, rather than consumer fixes. A workstation on



Paul Hislop from the organic 'Hislops Café' tells the students how he cleans using 'green' cloths and no cleaning products!

'Alternatives for cleaning' involved community members sharing their approaches for natural cleaning and included a mātauranga Māori session led by local kuia Darcy Solomon and Haromi Taylor. Paul Hislop from Hislops café and Ted Howard talked about alternatives to domestic, personal care and industrial cleaning products. A huge 'thank you' to Paul, Darcy, Haromi and Ted for giving up their time to be involved in the hui. The fourth workstation was run by Jo and Ian from Cawthron and involved getting the students to think about 'What should we be doing with our sewage in 2030?'

Overall the project aims and resources have been incredibly well received by those involved. We are currently investigating how we can develop integrated web-based resources as outputs to encourage shared learning and enable a number of New Zealand schools to be part of this exciting and innovative initiative.



Left: With help from Dr Alma Siggins of ESR (centre), students from Kaikōura High school made their own cleaning products with natural ingredients such as lemon, vinegar and baking soda.

UPDATES FROM THE SOCIAL AND CULTURAL TEAM

March '12 Kaikōura hui: evaluation by participants

– Lisa Langer, Alan Leckie and James Ataria

Following our successful community hui at the Takahanga marae in March 2012, Alan Leckie conducted eight telephone interviews and one face to face interview with community participants, including Mark Solomon, Kaiwhakahaere, Te Rūnanga o Ngāi Tahu.

The feedback was overwhelmingly positive. The hui process was highly commended and it was seen as being inclusive of the Kaikōura community. Participants thought that their involvement in the hui was valuable for the community and that it was a really useful way of gauging what people think.

Community participants went as far as saying:

'... [it was] the best forum I have participated in with scientists because I understood everything you put on the table'

'the structure of the day was really well thought out and the scientists weren't too sciency'

'Certainly council and other organisations could take a leaf out of your book as far as consultation goes'

A series of five minute research presentations outlining the characteristics of their biosolids and the environmental, social, cultural and economic impacts of the biosolids reuse options most favoured by key stakeholders were particularly appreciated:

'I enjoyed all the presentations because I understood every word.'

'[They were] done very well from the scientist's point of view to explain it in layman's terms.'

'There was enough information and any more than that may have started to confuse people.'

'Because you left all your scientific terminology out and explained everything it was a simple hui to follow.'

The use of voting on the biosolids reuse options was supported by community participants:

'Voting was the fairest way to do it – it gives the community ownership.'

'Voting is a pretty democratic way of doing things.'

Participants rated the marae experience highly, saying:

'Māori have more concern about the environment than most people so that's a comfortable home.'

'Māori have always been open to comment or criticism... That is what a marae is for.'

Also when asked whether the hui changed the way they thought about waste and the environment responses included:

'This is a good starting point to get people doing more than they are already doing.'

'It definitely has changed the way I think about waste and the environment.'

Most importantly a number of people interviewed stated that, 'the views of people were definitely taken into account', showing that we achieved what we set out to achieve.

Alan is completing similar interviews with participating scientists. The next steps for the social and cultural team include dialogue with the Kaikōura District Council to work with them to move the community recommendations from the hui into council decisions, as well as moving into paper writing mode.

Updates from the Soil and Micro group – Jianming Xue

In collaboration with ESR, Landcare Research, Plant and Food Research, Lincoln University, and Whenua Biz, the soil science team is conducting the second glasshouse pot trial at Scion to investigate if vermicomposting will be effective in converting septic tank waste into a high-value fertiliser rich in plant nutrients, but with reduced organic contaminants and bioavailability of metals.

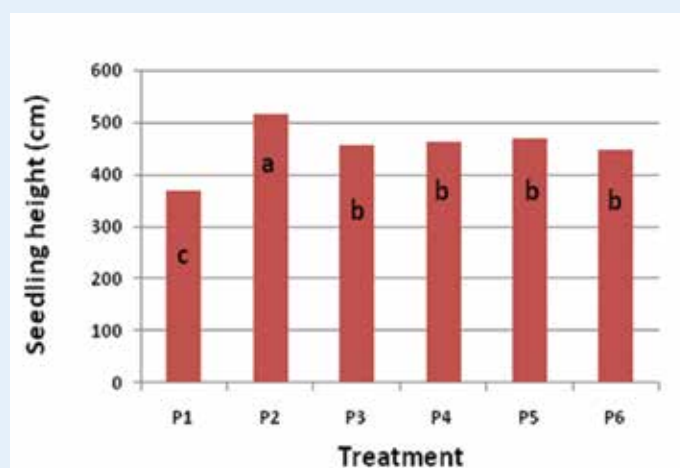
The preliminary results from this ongoing pot trial have demonstrated that application of both conventionally composted and vermicomposted septic tank wastes improved the seedling growth of radiata pine (see the photo and figure to the right and below) and mānuka (data not shown) species when compared to the soil-only control. Although vermicomposted septic tank waste appeared to be better than the conventionally composted septic tank wastes in improving plant growth, the differences between them were statistically not significant.

To date, seedling growth is best in the treatment applied with chemical nitrogen and phosphorus (P2). It will be interesting to see if the differences will increase over time among the treatments. Information on bioavailability of soil nutrients and heavy metals and their uptake by plants will be reported in the near future.

The results from our long-term biosolids trial at Rabbit Island in Nelson have demonstrated that repeated biosolids application over 14 years significantly improved soil fertility, tree nutrition and site productivity, significantly increased C sequestration in the forest and soil, and had no significantly detrimental impact on groundwater and soil qualities.



Above: Radiata pine seedlings during the pot trial.



Right: P2 (chemical nitrogen and phosphorus) seedlings showing strong growth

UPDATE FROM THE SOCIAL AND CULTURAL TEAM

Taupo/Mokai case study

– Jinny Baker

The Taupo-based work for the programme has many strands. We are working hard to ensure the Biowaste project adds value in the best possible way for the Mokai community, and is relevant to many other small communities throughout New Zealand.

Exploring waste auditing and future waste management strategies

Richard Yao and Mark Ross have been busy doing interviews with key Mokai community stakeholders to 'audit' and get a clearer picture of the different waste streams produced in the area. These waste streams include greywater and septic tank sludge and liquids. Meetings with resource management and technical advisors have contributed information on different options available for small communities to consider for future waste management scenarios. Data on local and daytime visitor population fluxes will reveal potential stresses for Mokai waste systems, as will identifying future population and business growth trends. The team is aiming for this mahi to inform a hui early next year, where a Waste Management Strategy for Mokai will be developed to support different household, community, and business led initiatives for sustainability. Some news alongside this work is that an upgrade to Mokai Marae toilets and septic system is currently in progress with assistance from the Tūwharetoa Settlement Trust.

Exploring cultural views on the transition from tapu to noa

Mark and Jinny have been very grateful for the kōrero and tikanga shared in the



People involved with waste management processes at Mokai.

interviews they have done with kaumātua and kuia to explore cultural understandings and frameworks (traditional and contemporary) for the transition of biowaste from tapu (a spiritual and physical state of restriction or prohibition) to noa (non-restricted or free). The team is in the process of writing these interviews up, and believes that these important cultural values can inform other parts of the programme that connect with policy makers, local councils, industry and operators so that any future risk management approaches and strategies for land application will be inclusive of and better reflect local tikanga.

Working with Tirohanga School

Jinny, Jamie and Mark have been working with Donna Andrews the absolutely wonderful Principal of Tirohanga School. The work with Tirohanga School is part of a spin off project that sits within the wider project called 'Up

the Pipe', funded by the Ministry for the Environment's Waste Management Fund. This project looks at innovative ways to engage young people in thinking about how they can reduce household waste, focussing especially on what goes down the drain. Donna has been doing some fantastic work to develop a primary school level curriculum module that raises awareness and supports student to creatively inquire and explore ways to reduce the contaminants that households put into the waste stream.

To conclude, there are many different threads to our ongoing mahi with the Taupo/Mokai community. The Social and Cultural team is very grateful for the time, commitment and goodwill from all whom we have talked to in the Taupo/Mokai community. We will keep you informed about the hui in Mokai early next year that will help pull these many threads together.

Staff changes



Joel Bowater (above) has recently joined the Cawthron Coastal and Freshwater group as a Lab

Technician for the Ecotox team.

For Joel, it's a steep learning curve, but he considers himself lucky to have a job at a place where everyone seems so happy to be coming to work! He is working with zebrafish and copepods to relieve Louis and Olivier of the lab work they are busy with. A local from Nelson, Joel spent 3 ½ years studying at Otago University and completed his degree majoring in Chemistry and Pharmacology in June

last year. He has recently returned to New Zealand after a year working in Boston.

We also introduce Marie Dennis (right) who is now working in the Biowastes programme developing methodology for an earthworm immune cell bioassay and taking over from Sean Taylor.

Marie spent 10 years at Scion working on aspects



of wastewater treatment, and in 2008 was part of a University of Waikato FRST funded subcontract to develop methodology for

a rapid counting method of algal populations in Rotorua Lakes.

This involved the use of flow cytometry, a method that is more commonly applied to haematology. Marie submitted her Master's thesis at the end of 2011, which investigated the possible relationships between viruses, bacteria and environmental factors in freshwater lakes.

Marie is also the Technical Manager of the New Zealand Land Treatment Collective.



Dr Jill McKenzie

The Advisory Group provides guidance into the long-term direction of the programme. They are a panel of industry, Government, and non-Government representatives with a keen interest and/or expertise in the Biowastes area.

What is your interest in the Biowaste programme?

My interest is to apply a public health lens over the research into biowaste use in NZ and to provide feedback from a human health perspective. I am lucky to have a number of colleagues in Public Health Services around the country that I can keep informed about the programme and receive feedback from to take to the advisory group. These contacts ensure the local connections are made with the programme projects.

Safe and sustainable management of waste presents significant challenges for our communities to ensure we preserve and improve the integrity of the ecosystems where we live. Healthy communities rely on healthy ecosystems. Waste management impacts on freshwater and marine environments and land. Poor management of waste can result in negative impacts on health via microbiological or chemical contamination of resources such as drinking water sources or water bodies used for recreational contact. In addition to the physical effects of exposure to contamination, health can be impacted by non-physical effects of poor waste management. Aspects such as the impact on whānau, spiritual and mental well-being are broader aspects of health recognised by Māori. Working alongside iwi to address these impacts is key to successful outcomes.

A particular strength of this research programme is the joining of the biophysical and social science aspects, which will strengthen the outcome. Often we develop the scientific evidence but don't spend enough time translating this for the communities we need to work with. Without community support and engagement the implementation of research findings would not be possible. This community engagement is also a way of ensuring there are no unintended consequences of new ways of managing waste, and that we address the broader aspects of health.

How do you see the information produced being useful to you and to NZ?

There are challenges for waste management in both our rural communities and large urban areas. Small rural communities have particular challenges to exploring land-based disposal

options to improve freshwater ways and protect groundwater and soil. All of this needs to be achieved with a small rating base and little capital resource.

Evidence-based guidance around the best ways to manage land-based disposal of waste will be of great value in minimising environmental contamination. This research programme supports strengthening the evidence base but also addresses the implementation of the findings by exploring social aspects of proposed actions.

What else would you like to see in the programme?

I'd like to see the programme explore utilisation of frameworks such as health impact assessment (HIA) before decisions are made on which approach to use for waste management for a community. It is likely that many aspects of HIA are already being addressed within the current case studies in Kaikōura and Taupo. However, the application of frameworks like HIA will strengthen the work already being undertaken and can be used for future research projects with communities. HIA frameworks are a useful way to identify unintended consequences and ensure benefits of new research and programmes are enjoyed equally by all members of our communities.

If you had a million research dollars, how would you spend them?

I think the most important thing we can do is to raise awareness of how our waste generation impacts our environment and future generations. A social marketing campaign would be useful to raise awareness amongst the general public of the impact that everyone has on waste generation, how this affects the environment, and how to reduce this impact. Many people are unaware of what goes down the drain and the options of how to manage this waste. Increased public awareness will facilitate the implementation of any evidence-based solutions. Generation of robust public debate can improve the understanding of how different world-views could affect implementation of solutions. Furthermore, the debate could highlight who in our community would need more support to reduce their impact on waste generation, ensuring no group is potentially disadvantaged while advantaging others.

A fully informed public will facilitate the development of innovative solutions to waste management. At the same time the public will be aware of potential risks to health from new solutions and know how to mitigate these. An example of this is use of greywater systems and the understanding that there is still a risk for microbiological contamination if systems are not installed, used and maintained with appropriate care.

'I think the most important thing we can do is to raise awareness of how our waste generation impacts our environment and future generations.'

Jill McKenzie is a Medical Officer of Health at Regional Public Health, a regional service based in the Hutt Valley District Health Board that serves the greater Wellington Region. She works to improve the health and wellbeing of our population and to reduce health disparities.

Update from the Ecotox group

— Louis Tremblay

One approach to characterise the toxicity of biosolids is the use of in vitro bioassays. This methodology uses cell lines or bacteria to assess whether a chemical or an environmental extract works through a specific mechanism of toxicity.

Biosolids samples from the two case studies (Kaikōura and Mokai) and from other representative sources were extracted and tested. The results confirmed that all samples tested contain estrogenic and detoxifying enzyme activity. In addition to natural hormones, there are contaminants with estrogenic activity commonly known as endocrine disrupting chemicals (EDCs). For instance components in the anti-contraceptive pill are highly estrogenic and can be found in the waste water stream. Other results showed that there was no indication of mutagenic activity in the samples. Mutagens are chemicals that can interact with genetic material and causing genetic mutations. All samples were cytotoxic, meaning that

they were killing the cells used in the bioassays at high concentrations which is expected when working with such complex mixtures.

Characterisation of the toxicity of mixtures of chemicals commonly found in biosolids is also important. The reason for these investigations is that contaminants are most likely to be found in complex mixtures, and there is very limited data describing their toxic interactions. Research is being conducted on three selected chemicals including the plasticizer Bisphenol A, the widely used anti-microbial agent triclosan, and carbamazepine, a psychiatric drug. The toxicity of those chemicals was assessed using an internationally recognised standard earthworm test where survival and the production of neonates are monitored to provide an indication of toxicity. Now the chemicals are being tested in the same assay in binary combinations. The results should provide information about whether the effects of mixtures of chemicals modulate their toxic effects.

Waikato Regional Council moving ahead with biosolids

— by Barry Campbell, Senior Resource Officer, Waikato Regional Council



Above: Photo of the Rotowaro remediation area. The biosolids trial area is in foreground, and the fertiliser-only area is in the background.

Biosolids disposal onto land has a reputation for being difficult to get a consent for in NZ, but this is not the case in the Waikato region. The Waikato Regional Council has granted 8 consents since 2008, all non-notified.

The consents have ranged from small-scale trials to very large-scale use of biosolids. Council consent staff have developed sufficient expertise in assessing environmental effects to process the applications with minimal fuss. The contributions of Council science staff such as Matthew Taylor and Nick Kim (now working for Massey University) have significantly added

to this expertise. Consents officers involved with these consents were Trisha Simonson, Perry Empson, Jorge Rodriguez and Barry Campbell.

Solid Energy Ltd was granted a consent to carry out large scale trials using North Shore biosolids to remediate part of the Rotowaro open-cast coal mine site. The biosolids application rate is up to 400 kg N/ha/yr. There has been a significant improvement in grass and pine tree growth using biosolids at this application rate, compared to just using fertilisers (see photo above).

The unique catchment in which the biosolids was applied allowed near total capture of runoff and seepages through a single monitored outlet; N losses were about 8 kg N/ha/yr, which is very favourable compared to many other Waikato land uses. The trial had the support of local iwi. The trial area is relatively isolated, and there is no public access. Solid Energy has recently applied for a full-scale remediation consent.

Gardon Ltd was granted a consent to apply 6000 tonne of aged biosolids from Taupo WWTP. The biosolids had been stockpiled for several years. Gardon Ltd is a private farm of

about 1300 ha, 15 km north of Taupo, with dairying, drystock and cropping. The biosolids was applied at a maximum rate of 200 kg N/ha/yr, some of which was onto dairy land. The consent required the biosolids to be disked into the soil, a crop grown (not fed to dairy cows) and the land re-sown in pasture before cows were allowed back. The landowner found that additional nitrogen had to be added to grow a crop.

The largest biosolids consent granted was for Noke Ltd, to vermicompost up to 28,000 tonnes/yr biosolids with up to 119,000 tonnes/yr other organics (predominantly primary and secondary wastewater treatment solids from the Kinleith Pulp & Paper Mill). The vermicomposting had the support of local iwi. Application rates vary from one-off 1330 kg N/ha/yr to annual rates of up to 200 kg N/ha/yr. This consent has the potential to utilise most of the biosolids produced by the Hamilton, Rotorua and Taupo WWTPs.

A trial consent was granted to Envirowaste Services, to divert up to 3000 tonnes/yr biosolids received at their Hampton Downs

landfill, and to apply to nearby pasture at up to 1330 kg N/ha/yr, as a one-off rate. Envirowaste are trialling ground injection of the biosolids, primarily to minimise odour.

A consent was granted to Thames-Coromandel District Council to compost up to 1,500 tonnes/yr of Whitianga and Pauanui WWTP biosolids and 5,500 tonnes/yr of greenwaste, in a Rotocom in-vessel unit. The finished compost is to be applied to TCDC's parks and reserves for an initial proving period and then sold in bulk supply. The consent was processed non-notified with full support from neighbours and iwi. The consent process followed a trial operation run at the Tairua Refuse Transfer Station, which achieved full compliance with the Biosolids Guidelines verification testing for Aa biosolids and the trial consent. TCDC then decided to move the composter to Whitianga as a result of neighbours concerns and issues with the site's designation.

Apart from the TCDC consent, the other seven consents had common factors: the biosolids applications are onto relatively isolated land, with few or no close neighbours, and the

applicants had a good technical appreciation of the risks and benefits of using biosolids. None of the biosolids was of "Aa" grade, some were "Ab", some were "Bb", however the initial grading was not a major factor in processing the application.

Another biosolids land remediation project did not succeed after staff deterred the potential applicant, due to significant local features such as the DOC wetland next door and neighbouring houses 100m away.

Iwi consultation and support was necessary for several of the consents (to be non-notified), but was not required for the Gardon and Envirowaste consents. There appears to be no discernible difference between iwi views, and those of the wider public.

Council staff consider that using a nitrogen load limit in the consent appears to be a successful method to ensure that other parameters do not contaminate the land. The trials to date indicate that only about 12-15% of the total nitrogen is nitrogen available for plant growth in the first year.

Outputs from the Biowastes team this year

Journal papers

- Müller, K., Duwig, C., Prado, B., Siebe, C., Hidalgo, C., Etchevers, J. 2011. Impact of long-term wastewater irrigation on sorption and transport of atrazine in Mexican agricultural soils. *Journal of Environmental Science and Health, Part B*, 47, 30-41.
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- Goven, J., Langer, E.R., Baker, V., Ataria, J. Leckie, A. 2012. Community engagement in the management of biosolids: Lessons from four New Zealand studies. *Journal of Environmental Management*, 103: 154-164.
- Anderson CWN, Robinson BH, West D, Clucas L, Portmann D 2012. Zinc-enriched and zinc-biofortified feed as a possible animal remedy in pastoral agriculture: animal health and environmental benefits. *Journal of Geochemical Exploration*. In press. *Journal of Geochemical Exploration* (February 2012), doi:10.1016/j.gexplo.2012.01.009
- Black, A., McLaren, R.G., Reichman, S.M., Speir, T.W., Condron, L.M. and Houliston, G. 2012. Metal bioavailability dynamics during a two-year trial using ryegrass (*Lolium perenne* L.) grown in soils treated with biosolids and metal salts. *Soil Research*, 50, 304–311
- Xue, J.M.; Wang, H. and Wilks, P. 2012. Effect of long-term biosolids application on soil properties and tree growth. A full conference paper accepted for the Joint SSA and NZSSS Soil Science Conference in Hobart, Tasmania, Australia, 2-7 Dec 2012.
- Van Schaik, A, Horswell, J., Prosser, J., Graham, D, Ross, M. and Xue, J. 2012. Worms and waste: uncovering a potential partnership. Biosolids reuse in New Zealand – assessing the impacts of chemical cocktails on the soil ecosystem. AWA Biosolids and Source Management National Conference, 18-20 June 2012. Gold Coast, Queensland, Australia.
- Horswell, J., Van Schaik, A., Prosser, J., Northcott, N., Ying, L., Ross, C., McGill, A., Champeau, O. 2012. Biosolids reuse in New Zealand – assessing the impacts of chemical cocktails on the soil ecosystem. AWA Biosolids and Source Management National Conference, 18-10 June 2012. Gold Coast, Queensland, Australia.
- Northcott, G. 2012. The status of knowledge and current research on emerging organic contaminants in New Zealand biosolids. AWA Biosolids and Source Management National Conference, 18-20 June 2012. Gold Coast, Queensland, Australia.
- Paramashivam, D., Robinson, B.H., Clough, T., Buchan, G., Bishop, P., Horswell, J. 2012. Biochar to mitigate nitrate leaching from biosolids-amended soils. New Zealand 2012 Biochar Workshop: From Science to Stakeholders, 9-10 February 2012, Massey University
- Robinson, B.H., Gartler, J., Contangelo, A., Knowles, O., Portmann, D., Anderson, C.W.N., Clucas, L. 2011. Biochar combined with biosolids to biofortify plants with zinc while mitigating nitrate leaching. 11th International Conference on the Biogeochemistry of Trace Elements (ICOBTE). July 3 - 7, Florence, Italy.
- Siggins, A., Williamson, W., Baker, J., Weaver, L., van Schaik, A., Lowe, H., Beecroft, K., Roberts, S., Thompson, B. and Horswell, J. 2012. The impact of greywater diversion on domestic septic tank systems. ISME14, Copenhagen, Denmark. August 19-24th.

Conference papers

- Xue, J., Graham, D., Ross, M. 2012. Response of radiata pine and tōtara seedlings to the addition of biosolids and vermicomposted biosolids under glasshouse conditions. In Proceedings of the 2012 New Zealand Land Treatment Collective annual conference, Gielen, G., Heaphy, M. (ed.). 28-30 March, Tauranga, New Zealand.
- Xue, J.M.; Kimberley, M.; Wang, H.L.; Wilks, P. 2012. Biosolids application improved tree nutrition, growth and carbon sequestration of radiata pine plantation in a sandy soil. A conference paper accepted for the International Conference on Sustainable Forest Management Adapting to Climate Change, Beijing, PR. China, 13- 16 October, 2012.

Client reports

- Xue, J., Wang, H., van der Colff, M., Kimberley, M. 2011. 2011 Annual Report on the Biosolids Research Trial at Rabbit Island. Client Report No. 48757. Scion, Christchurch.

Can we continue to beneficially reuse biosolids in New Plymouth district? – Kimberley Hope, Manager Compliance, Water and Wastes, New Plymouth District Council

The New Plymouth District Council has treated biosolids from the New Plymouth WWTP through a thermal drying facility for over 10 years, and successfully established a market for the end product, Bioboost®. Bioboost® is sterilised, and formed into a dry pelletised fertiliser that is safe, stable and has excellent application characteristics.

New Plymouth District Council sells this pelletised fertiliser to a local company, Bioboost Limited that has expertise in fertiliser application, marketing and distribution. Having developed the market over the last 10 years, this fertiliser is distributed and sold throughout New Zealand, both in bulk to businesses such as golf courses, maize cropping, and through retail outlets in 25kg bags for both the horticultural and home market use. Bioboost® is unique to New Zealand and has gained a successful growing reputation as a great slow release fertiliser.

Bioboost® currently complies with the highest ('Aa') grade as defined in the Guidelines for the safe application of Biosolids to land in New Zealand (NZWWA, 2003) and as such is able to be used on an 'unrestricted' basis (i.e. a resource consent is not required).

The Council has undertaken a programme to significantly reduce metals in the district's wastewater to a level that will consistently achieve the 'a' contaminant grade in the biosolids. This has been very successful; however, copper, zinc, cadmium and mercury contaminant limits in the current guidelines are due to reduce from 1 January 2013 providing a challenging environment for the continued beneficial reuse of biosolids in Taranaki.

Having reduced the contribution of metals discharged by industry, the domestic reticulated wastewater is now the largest contributor of metals such as copper and zinc. Copper and zinc are the only contaminants in the Bioboost® that will not comply with the revised 'a'



grade levels from 2013. Due to the 'diffuse' nature of domestic waste contaminants, further reduction in these contaminants is likely to be small, gradual and occur as a result of change in consumer awareness and behaviour. It is also unlikely that any changes will ensure compliance with the 2013 metal limits in the short or medium term.

The Biosolids Guidelines have worked for NPDC in their current form, allowing more flexibility on the use if the biosolids are of a high enough grade, provided there is a robust quality system to ensure high quality product is maintained. However, the reduced metal limits from 2013 will have a significant impact on being able to market and sell Bioboost® as we currently do. From 2013 Bioboost® will become an 'Ab' grade product, and the Biosolids Guidelines suggest a resource consent may be required for application to land. This has highlighted a limitation of the guidelines which do not cater for a fertiliser type product (typical uses include dewatered sludge used as a soil replacement or conditioner). Bioboost® has similar characteristics to fertilisers in relation to application methods. The impacts on soil metal concentrations are therefore significantly reduced compared to that for total soil replacement or conditioning. For example at recommended application rates of 200kg N/ha/year, this equates to 1 mg/kg dry wt of zinc and 0.5 mg/kg dry wt of copper in addition to background

levels; well below soil limits (300 and 100 mg/kg respectively) in the guidelines.

The Council does have concerns that the change in guidelines will have an adverse effect on beneficial reuse in the Taranaki region, and nationally. From our perspective, a review of the guidelines is urgently required in order to continue to promote sustainable use, while ensuring protection of soils, plants and animals (including human health). Metal limits particularly should also be practicably achievable and based on latest research.

While the guidelines have certainly driven improvements for New Plymouth, the 'Aa' grade has been less achievable elsewhere in New Zealand (for undiluted biosolids). Reducing the levels is unlikely to improve this situation and therefore may not encourage further improvement in biosolid reuse in New Zealand. With other legislation such as the Waste Minimisation Act 2008 now driving more sustainable waste management, there is an increasing requirement to beneficially reuse biosolids. An up-to-date robust guideline could aid the transition for many councils currently having to improve biosolids management.

NPDC is currently reviewing the long term strategy for biosolids, and the change to the metal limits next year is a significant driver for this. We have also been in discussions with the Taranaki

Regional Council about applying for a certificate of compliance to ensure that Bioboost® can continue to be used without resource consent in the region. If this approach is successful, other regional councils will be approached in a similar way, taking into account local conditions and regional plan rules.

The key to any successful guideline will be maintaining a robust guideline document based on good science which will improve public perception, while still allowing it to be applied in a practical, achievable way considering application methods and end land use. The Council has made significant progress improving public perception through the use of Bioboost® and would like to see this continue.

Up and coming events

The NZ Centre for Integrated Biowaste Research will be launched at a **Joint Australia New Zealand Biosolids workshop** preceding the Land Treatment Collective Annual Conference on Tuesday 9th April 2013, 10am-5pm.

The New Zealand Land Treatment Collective (LTC) annual conference will be held in Blenheim 10-12th April 2012.

If you would like further information on the programme or have any questions please contact a member of the Science Leadership Team:

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