

Biowastes Project

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Welcome

Welcome to the very first "Biowastes" newsletter! The purpose of the newsletter is to disseminate programme information and keep interested parties, collaborators and community groups informed of programme progress and activities and to build interest in the programme.

The newsletter will be produced quarterly and will include updates from each of the main science areas within the programme (Social/Cultural/Biophysical), a "featured" special interest article, notices of up and coming events, conferences, meetings and any other items of interest. The newsletters will be produced quarterly and circulated to the research team and members of our case-study communities in Kaikōura and Taupo. Please become actively involved and submit articles to Jacqui Horswell (Programme Manager) for inclusion, there is also an opportunity for the case-study communities to contribute to the newsletter and we strongly encourage this. This inaugural newsletter will be slightly extended and include information on background to the Biowastes programme and the research focus.

Biowastes Programme Background

The 'reduce, reuse, recycle' message from central and local government is a compelling reason for local government and communities to look at sustainable options for waste management, rather than disposing their wastes into landfill. Each year, New Zealanders send around 3.2 million tonnes of waste to landfill, that is over a tonne of rubbish per household. A large proportion of this is organic biowastes (food, garden and household wastes).



An important type of organic waste is the solid waste remaining after sewage treatment, known as biosolids. Biosolids are carbon-rich, contain valuable nutrients and can reduce dependence on artificial fertilisers. However, biosolids can contain a range of micro-contaminants such as heavy metals, pathogens and pharmaceuticals and personal care products (PPCPs). There is a significant body of knowledge on the risks of pathogens and heavy metals to human health and the environment, but there is limited information on the potential risks from pharmaceuticals and personal care products. This is an important focus for the biophysical science research being conducted in the Biowastes project.

The Biowastes project (FRST C03X0902) is a publicly funded research programme that has been developed to better understand the environmental risks and benefits, that can arise from applying biowastes (particularly biosolids) to land.

The programme is based on a strong scientific case that the application of biosolids to land is the most sustainable option for New Zealand, providing the risks are well managed and understood. However, the option of land application may, or may not be accepted by New Zealand communities. Ongoing uncertainties around social and cultural acceptability, possible emergent risks, and the challenges in determining costs for alternative reuse or disposal methods mean that local authorities continue to landfill biosolids/biowastes, rather than explore or promote more sustainable options.

Developing viable strategies for sustainable reuse of biosolids and biowastes hinges on better understanding a number of factors. This project aims to involve communities to explore these important social, cultural, economic and environmental considerations in tandem with the emerging scientific knowledge.

The research focus

The Biowastes project has a number of biophysical components, in addition to the social and cultural aspects. These include understanding what combinations of nutrients and contaminants are present in the biosolids samples; pot trials to grow plants in a biosolids-soil mix; laboratory based ecotoxicological experiments; and vermi-composting trials where worms are used to process the biosolids and other biowastes into compost. A key focus is to understand what happens to mixtures of micro-contaminants (metals, and new emerging contaminants, such as pharmaceuticals and personal care products) when they interact with each other and with the soil. We want to better understand what implications exist for human and environmental health, and how these risks and uncertainties can be best managed.

Two case studies, one in Kaikōura and one in Mokai, near Taupo, will integrate the biophysical and social science and support a shared-

learning process for end-users, Māori, and other stakeholders to develop viable strategies for biowaste reuse. In particular, we aim to better understand how a reuse decision is considered and debated by tangata whenua, Māori waste managers and other business operators, local government and the wider community. The case studies will help us search together for alternative disposal/reuse options that fulfil and satisfy social, cultural, economic and environmental criteria. Project planning meetings will alternate between Kaikōura and Taupo to support shared learning across the two localities.

In the future it is intended that the resources developed in the case studies will be used to support Māori communities and local governments in other regions to deliberate options for biowaste reuse, and consider the latest scientific knowledge, alongside cultural and other considerations. The project will be conducted over a four year period and is expected to be completed in October 2013.



Programme planning hui at Mokai Marae in Taupo



Jacqui Horswell

News from the Programme Manager

We are just over a year into the programme and it has been a busy 12 months. I returned from maternity leave on the 1st of August after an absence of one year. It is great to be back and exciting to see the progress being made in the programme.

The research work is going well in Kaikōura, Brett Robinson at Lincoln University has had a Masters student working on the Kaikōura biosolids – his research is this quarters 'Special Feature' so turn to page 4 to find out more.

The Taupo case-study has been more challenging and we took the hard decision of going 'back to the drawing board' to re-consider our research plans so that they fit with community needs. In late October we held a hui at Mokai Marae with the local community, district and regional council representatives and other interested parties. We now have some good ideas about how to help the Trust and the Mokai community find a more holistic solution to deal with all the waste they produce (not just their biosolids). This is an exciting opportunity for the scientists in the programme so watch this space.

This quarter I have also been travelling around the country holding small programme planning meetings – it has been great to meet with the individual members of the programme and see the enthusiasm and great science being undertaken. I have also been holding small Advisory Group meetings and each quarter we will profile a member of the Advisory group and their views on the programme and how the research outputs will provide potential benefit.

Updates from the Social and Cultural Team

– Lisa Langer and Jinny Baker

The social/cultural research aims to ensure that the Biowaste programme delivers research that is meaningful and relevant to our two case-study communities in Kaikōura and Taupo. We also have a role in making sure that social/cultural and biophysical research is ‘integrated’ and brought together. At our most recent hui at Mokai Marae in Taupo, one participant named a process of ‘weaving’ - where we can work different knowledges together to strengthen our insights and understandings. Most importantly we need to negotiate how different knowledges can inform robust and effective risk management frameworks for iwi, local and regional government to consider in developing future waste management strategies that may include beneficial reuse of biosolids.

So far we have held several planning hui, and have completed a cycle of scoping interviews at each case study location. We launched the programme and participated in our first planning meeting at the Takahanga marae in Kaikōura in October last year, and subsequently have held two smaller planning hui at Mokai marae in Taupo.

Some good suggestions at these hui have already helped shape the biophysical science. At our first hui in Kaikōura, it was suggested that the biophysical work not just focus on pine trees, but look at native species also. As a result some of our pot trials now focus on mānuka as well/instead of pine. Requests have also come from our second hui that there is a need for the research to provide information about how septic tank waste might be managed on site. This has prompted the biophysical scientists to incorporate treated septic tank in future laboratory work.

On behalf of all staff in the biowastes programme, we would like to thank our Māori research partners, Te Rūnunga o Kaikōura and Tuaropaki Trust for their superb hosting and manākitanga for these hui, and for their support, engagement and invaluable contribution to the research so far.



Updates from the Soil and Micro group

– Dr Hailong Wang

As biosolids are carbon-rich and contain valuable nutrients, and plantation forests have been identified as possible areas for land application of municipal biosolids, research has been conducted to assess tree growth in a forest near Nelson. Biosolids from the Nelson regional wastewater treatment plant have been applied to a 1000-ha radiata pine plantation on Rabbit Island since 1996 offering Scion scientists an excellent opportunity to establish a long-term research trial in 1997. Research at this trial has focussed on investigating the effects of biosolids applications on tree growth, nutrition, and the ecosystem. Biosolids have been applied on five occasions since then and most recently in 2009, at three application rates: 0 (control), 300 (medium) and 600 kg N ha⁻¹ (high). In general, biosolids have been greatly beneficial to the plantation trees. Effectively they have transformed it from a relative low productivity to a moderately high productivity forest site. Recently, Scion colleagues completed the 2010 annual foliar nutrition analysis and growth measurement. They found that there has been a significant increase in the accumulated stem volume in biosolids treated trees. This was attributed to the enhanced supply of nitrogen on this otherwise nitrogen



Updates from the Ecotox Team

– Dr Louis Tremblay

Ecotoxicology is the integration of toxicology and ecology, studying behaviour and adverse effects of chemicals on organisms and their ecosystems. Biosolids can contain residual chemicals that survive the sewage treatment process and the aim of the Ecotox Team is to characterise their potential risk to the environment and ultimately on human health. Some of the studied chemicals are considered as “emerging contaminants” like pharmaceuticals and personal care products (PPCPs) and there is very limited information on their effects. Biosolids will likely contain a variety of chemicals and one of the key features of the research undertaken by the Ecotoxicology team is looking at the effects of complex mixtures of contaminants and the role they may play in the overall toxicity. The current approach is to test some key contaminants, both individually and in mixtures, and biosolids from study sites (Kaikōura, Taupo, Rabbit Island). Animals used are the springtail (surface living organism) pictured above, and the tiger worm, on front page, as they can be in contact with contaminants in soil by contact, breathing and ingestion. We will be studying the effects of various chemicals on the reproduction of our test species as it reflects the impact on populations (OECD/ISO standards).

deficient site. For example, mean foliage nitrogen concentrations were 1.40% and 1.48% in the medium and high biosolids treated plots respectively, which were significantly greater than that in the control plots (1.15% N) following an application of biosolids in 2009. Currently, scientists from Scion, ESR, Lincoln University, Landcare Research and Plant and Food Research are evaluating the effect of the repeated biosolids applications on the chemical, physical and biological properties of the soils at the trial site. The multidisciplinary team also is assessing how vermi-composting can be used to modify the biosolids before land application. Results will be reported in the coming issues of this newsletter.

Advisory Group Feature:

The role of the Biowastes Advisory Group is to provide guidance and direction 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. This quarter we feature Matthew Taylor from Environment Waikato. Matthew is a soil scientist for Environment Waikato and formerly worked on the Biowastes programme with Landcare Research.

Q and A

What is your interest in the Biowastes programme?

Providing a regional council perspective on the sustainable use of biosolids in ways that benefit New Zealand

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

Each year I provide advice on several consent applications for the discharge of human biosolids or animal biowastes to land. The main concerns from the public over biosolids are maintenance of human and environmental health. This program will produce information directly useful to councils on the environmental risks and the social, cultural and economic considerations that need to be thought through, for policy and for regulation



What else would you like to see in the programme?

Important to regional council's sustainable management of biosolids are thresholds of human and environmental health for contaminants. The use of new pharmaceutical products and their impacts on the environment are of concern to the general public. Quantifying what is safe or not allows council's to set sensible policy.

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

My main interest is in soil quality. Soil Quality monitoring in New Zealand has become an important state of the environment reporting

tool, confirming sustainable land use activities and identifying potential soil issues before they become reality. My research programme would focus on investigating the value of soil ecosystem services other than productivity, including critical thresholds for biota, and using several indicators of soil quality in a multifactor approach to quantify complex soil quality issues. Soils can't be disconnected from the wider environment as what goes on the land will eventually end up in water. Elemental fingerprints for various land uses would be established and these fingerprints used to quantify the soil-water connection and related environmental issues.

Special Interest Article – Dr Brett Robinson

Countries with sewage treatment plants produce some 27 kg of dry biosolids per person per year. Many biosolids are placed in landfills or burned because of concerns about pathogens and, in some cases, their high concentrations of heavy metal and organic contaminants. Yet biosolids represent a valuable source of soil nutrients, including phosphorus, of which global supplies are dwindling. Moreover, the heavy metal concentrations in biosolids are comparable to those found in some phosphate fertilisers. Some of the metals in biosolids, such as zinc and copper, are essential Trace Element Micronutrients (TEMs) for plants and animals.

We grew food and fodder crops in soils amended with biosolids. Biochar, a form of charcoal that is added to soil was used to manipulate the balance of essential trace elements and leaching of nitrates, which can contaminate waterways. We sought to reduce plant uptake of non-essential trace elements and other contaminants that may compromise fodder quality, while simultaneously augmenting the concentrations of TEMs. Some food and fodder crops produced on biosolids/biochar amended soil contained no more heavy metals than biomass from an un-amended soil, while levels of some TEMs were increased by up to 300%. Sheep trials demonstrated the transfer of TEMs from the fodder crops to blood serum. This may improve stock health. The addition of biochar to the biosolids halved the leaching of nitrates from the system. Our findings thus far indicate that biosolids/biochar amendments may be used to produce valuable food and fodder crops on degraded lands, while reducing some of the negative effects normally associated with biosolids addition to soil.

UP AND COMING EVENTS

- A Hui is planned in Kaikōura for 13th/14th February 2011 to feedback the preliminary programme research results to the local community, formulate biosolids management options and plan the next phases of work.
- The New Zealand Land Treatment Collective (LTC) annual conference will be held in Palmerston North from March 23rd – 25th 2011. The LTC is a national organisation whose membership includes Regional and District Councils, Ministry for the Environment, CRI's, and Universities. This conference represents an important conduit for the programme to transfer research results and engage with stakeholders and end-users. This year the LTC has expressed an interest in hearing about the emerging contaminants work we are undertaking in the programme.

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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