Issue No. 19 November 2018

Putting waste to work

A CENTRE FOR INTEGRATED BIOWASTE RESEARCH PUBLICATION

Centre for Integrated Biowaste Research www.cibr.org.nz

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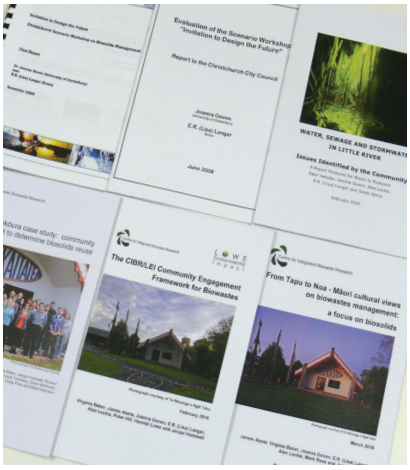


UPDATE FROM THE PROGRAMME MANAGER

Tēnā koutou katoa,

Ngā mihi o te wā, kua tau mai te kōanga ki runga i te whenua
Greetings to us all, spring has arrived and graced the land with its presence.

The highlight of our Spring newsletter is the CIBR annual workshop which took place on 23-24 August in Wellington, with 18 CIBR members participating. The workshop was highly productive, with each team's science leader presenting the history of their teams and the research undertaken up to present time. We also had the opportunity to reflect on the long term research that CIBR has done over the past ten years; what we have learnt, what we still need to investigate, what challenges and opportunities biowaste research in NZ is facing, and what we can expect to face in the future. Key themes identified in the workshop were:

CIBR is unique within the international biowaste research world and one key component that makes CIBR special is the incorporation of social and cultural research alongside biophysical research. The New Zealand cultural environment in relation to biowaste is both interesting and challenging, which adds a new dimension to research about reuse of biowaste, compared with overseas biowaste projects. The social and cultural team has investigated over the past ten years, different ways of understanding community views and expectations of how their biosolids are managed and used. This broadened over time to include the wider scope of biowaste. A snapshot of their results across this time can be seen on page 7.

Broadening of the research focus from biosolids to biowaste was a good opportunity for the team, but also a benefit for the country. Biosolids are just small portion of the biowaste produced in NZ, and they are not the only one which requires management in terms of environmental and health risks, as well as opportunities for the beneficial reuse.

Potential contaminants are one of the main concerns about reuse of biowaste, thus CIBR researchers see ourselves as the ambulance at the bottom of the cliff try to solve these issues. However, alongside investigating the environmental effects of those contaminants, we would like to determine where the contaminants originate and to how prevent them occurring at the source. This research started five years ago as "Up the Pipe solutions". To know more about this turn to page 4.

Jacqui Horswell has taken up a great position as Senior Lecturer at Massey University. Her role in CIBR will now change from Project Manager to Key Researcher. The CIBR team would like to acknowledge her work leading the programme over the years on page 5.

A new refreshed CIBR website is currently under construction. There, you will be able to check frequent updates about the exciting projects that the team is undertaking, such as The Pot (newsletter Oct 17 and June 18), Te Pā o Rākaihautū (newsletter May 17) native plants for farming run-off (newsletter Oct 17), Emerging Contaminants (newsletter Feb 18), or biowaste in mining restoration (newsletter May 17). Keep checking the webpage www.cibr.org.nz.

Ngā mihi nui
Maria Gutierrez Gines

RESIDUAL EFFECT OF LAND-APPLIED BIOSOLIDS ON FOLIAR NUTRITION OF RADIATA PINE PLANTATION AT THE RABBIT ISLAND IN NELSON

By Jianming Xue (Soil Science Group Leader)

Beneficial use of biosolids as a supplemental fertiliser and soil amendment is one of the most common options for biosolids management. In New Zealand, application of biosolids on forest land is preferred than on agricultural land because it can reduce the risk of contaminants entering the human food chain and it can also increase tree growth and subsequent economic returns. Treated biosolids from the Nelson Regional Sewage Treatment Plant have been applied to a 1000-ha radiata pine forest plantation at Rabbit Island near Nelson City since 1996. A research trial was established on the site in 1997 to investigate the long-term effects of biosolids application on soil and groundwater quality, tree nutrition and growth. Biosolids have been applied to the trial site every three years (1997, 2000, 2003, 2006, 2009 and 2012, respectively) at three application rates: 0 (Control), 300 (Standard) and 600 kg N/ha (High). Tree nutritional status and growth were monitored annually before 2011 and every 2-3 years afterwards, groundwater quality is monitored quarterly and soil properties every three years to determine both the risks and benefits and sustainable application rates as well. This biosolids research trial is unique both nationally and internationally due to the comprehensive and long-term assessment.

The application of biosolids to this research trial was terminated after 2012 due to a kōiwi issue. However, this trial still has considerable merit to assess the long-term and residual effects of repeated biosolids application on tree growth, health, and soil and groundwater quality. We hypothesized there would be long-lasting beneficial residual effects of biosolids-derived nutrients on tree nutrition and growth and biomass C storage through improved nutrient cycling in the ecosystem. The latest foliage sampling of radiata pine at the Rabbit Island biosolids research trial was completed in March 2018 (Fig. 1). Here we update our recent findings on the residual effects of repeated biosolids application on tree nutrition.

Fig.1 Effect of long-term biosolids application on needle (left) and tree (right) growth of radiata pine at Rabbit Island in Nelson

Treatment means of foliar nutrient concentrations in 2018 are shown in Table 1. Biosolids application significantly increased foliar N and B concentrations, but reduced foliar Ca and Mn concentrations, which might be caused by growth dilution. In the Control treatment, foliar concentrations of all nutrients except N and Cu were in the "satisfactory" range of tree nutrition, indicating N was the main limiting nutrient for tree growth.

Table 1: Effect of biosolids application on foliar nutrient concentrations in March 2018.*

Treatment	N	P	K	Ca	Mg	Zn	Cu	B	Fe	Mn
	%					mg kg^{-1}				
Control	1.44 a	0.17 a	0.82 a	0.27 b	0.17 a	22 a	3.3 a	18 a	34 a	305 b
Standard	1.50 ab	0.17 a	0.85 a	0.21 a	0.18 a	22 a	3.7 a	20 b	33 a	178 a
High	1.54 b	0.16 a	0.83 a	0.21 a	0.17 a	21 a	3.7 a	21 b	34 a	200 a

**Values within a column followed by the same letter do not differ significantly (P = 0.05).*

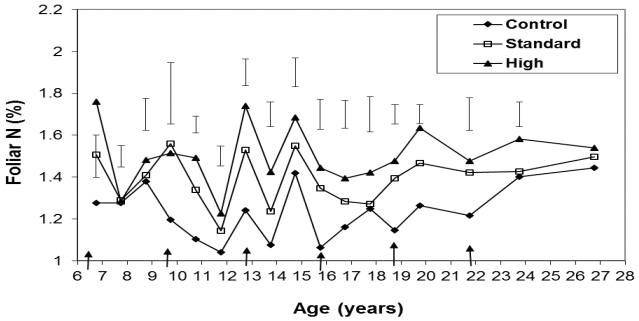
Foliar analysis has consistently shown that natural soil N supply in the Rabbit Island radiata pine was low, with foliar N concentration of the Control treatment (averaging 1.2% N) remaining consistently well below the satisfactory level of 1.5% N since monitoring began in March 1998 (Fig. 2). This indicates that without biosolids application, the radiata pine stand suffered from N deficiency and should benefit from N fertilisation. Overall, biosolids application significantly ($P < 0.05$) increased foliar N concentration of the Standard treatment to a marginal level (averaging 1.4% N) and the High treatment to a sufficiency level (averaging 1.5% N) (Fig. 2).

Successive applications of biosolids have produced a consistently positive response in foliar N concentration in the subsequent assessment when compared with Control trees (Fig. 2). The boost in foliar N generally declined over a period of several years following an application. However, this pattern was not so obvious during the period of last three applications. This could imply that the biosolids-derived residual N in the soil might become more influential than the freshly applied biosolids N on foliar N concentration. Following the last application of biosolids in 2012, foliar N concentrations in the Standard and High treatments were 0.21 and 0.26 percentage points respectively greater than the Control in 2013 (age 22) (Fig. 2). However, the N concentration differences among the treatments were getting smaller in 2015 and 2018 (age 27).

Fig. 2. (right) Cumulative effect of five biosolids applications on foliar N concentration. Arrows indicate time of biosolids application. Error bars show least significant differences (P < 0.05) for comparisons among the treatments.

As a result of improved N nutrition, application of biosolids significantly increased tree diameters and consequently tree stem volume (data not shown) since the first biosolids application in 1997 of radiata pine. Stem volume remained significantly greater in plots with biosolids applied than those with no biosolids application. In June 2015, at tree age 24 years, stem volume of the High treatment (658 m^3 ha^{-1}) was 26% greater than the Control (523 m^3 ha^{-1}), and stem volume of the Standard treatment (632 m^3 ha^{-1}) was 21% greater than the Control, indicating a substantial gain in productivity.

We concluded that repeated application of biosolids to a plantation forest on a poor site could significantly improve soil fertility, tree nutrition and site productivity without causing significant adverse impact on the environment. There were significant residual effect of biosolids applied in 2012 and before. Further monitoring is warranted to assess the long-term fate of biosolids-derived heavy metals in the receiving environment.



New Zealand Land Treatment Collective

CONFERENCE

3-5 April 2019, Invercargill

30 YEARS

1989 - 2019

PRIMARY PRODUCTION AND LAND TREATMENT




WEDNESDAY 3 APRIL

Fieldtrip (Queenstown to Invercargill)

Delegates will be asked to travel to Queenstown airport by 10am on Wednesday 3rd April from which the fieldtrip will travel to these locations:

- Queenstown: municipal wastewater discharge to land
- Garston: meatworks waste discharge to land
- Edendale: diary factory waste discharge to land

Since the bus will be sourced from Invercargill, delegates do have the option of travelling to Invercargill on Tuesday 2nd April and catching the bus up to Queenstown early on Wednesday 3rd April to meet the rest of the conference delegates for the fieldtrip.
Lunch and tea breaks will be provided along with in-bus commentary and entertainment.

At the end of the day delegates will arrive at the Ascot Park Hotel in Invercargill and enjoy a celebration of 30 years since the formation of NZLTC with an 80's inspired event including music, beer tasting and local food.

THURSDAY 4 APRIL

Ascot Park Hotel

Delegates will be welcomed to the conference by local iwi followed by presentations from our keynote speakers and local representatives.

Keynote speakers:

- International Speaker on Mycoplasma bovis: Implications for NZ agriculture and land treatment
- Dairy sector speaker

Conference presentations

Lunch and tea breaks will be provided.

5pm: NZLTC AGM

6pm onwards: NZLTC Conference Dinner at the Bill Richardson Transport World

Includes a 1 hour self directed tour of the Transport Museum (6—7pm)

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FRIDAY 5 April

Ascot Park Hotel

Conference presentations

Lunch and tea breaks will be provided.

3pm: Delegates start departing for Invercargill airport

Sponsors

environment SOUTHLAND REGIONAL COUNCIL Te Taiao Tonga

ESR Science for Communities

LOWE Environmental Impact

SPONSORSHIP PROSPECTUS

For information on sponsorship options during the NZLTC conference please see our prospectus on the NZLTC website

https://nzltc.wordpress.com/events/nzltc-annual-conference/

REGISTRATION

Early bird registration:

- member $525, non-member $850

Register here:

https://nzltc2019.lilregie.com

ASCOT PARK HOTEL ACCOMODATION OPTIONS

- Superior room $160
- Deluxe room $180
- Apartment $180 (x1 queen, x1 single plus the option of a sofa bed in the lounge for an additional $25 per night)

(cheaper motel rooms are also available)
For bookings please contact Cheryl Melrose 03 219 9076 or ascot@ilt.co.nz

IMPORTANT DATES

Registrations open: 5 Oct 2018

Call for abstracts: 5 Oct 2018

Abstract submissions close: 1 Feb 2019

Authors advised: 15 Feb 2019

Early bird registrations close: 28 Feb 2019

Full papers due: 15th Mar 2019

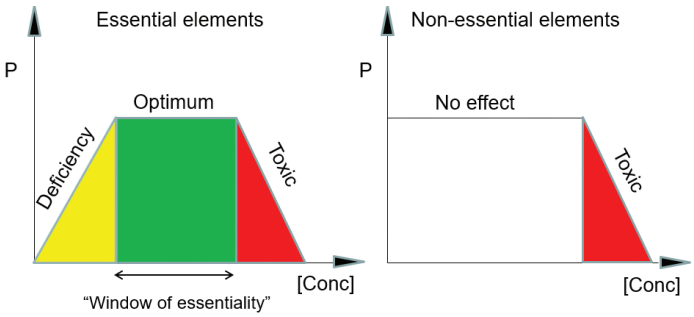
METALS LEACHING FROM PLUMBING MATERIAL – A SOURCE TO BE MANAGED

Louis Tremblay and Grant Northcott

Example of a common metal bathroom tap

A common barrier for the land application of biosolids is the high level of metal residues they can contain, principally chromium, copper, nickel and zinc. Metals are often classified as pollutants, but it is important to recognise they are widespread in nature and some are necessary for sustaining life. Metals become pollutants through anthropogenic activities such as mining, that mobilise them in the environment at concentrations that can be toxic and cause damage to exposed ecosystems. Metals are classified under two categories, the essential and non-essential metals. For instance, zinc is an essential element as it is a key component in many enzymes while copper is essential for the normal function of the enzyme cytochrome oxidase. Deficiencies in these elements can be detrimental to health. Cadmium and lead are examples of non-essential metals. However, even essential metals can be toxic at higher concentrations, both copper and zinc levels must be within suitable dietary or soil concentrations to ensure normal growth and reproduction. This is the concept of "window of essentiality" as exposure to high metal concentrations become detrimental to health (Figure 1). For instance, high levels of copper will lead to its binding to proteins in cells which deactivates their biological activity. Therefore, threshold concentrations have been derived for metals in both water and soil guidelines to manage their potential risk. Metals are challenging to manage in biosolids and biosolid amended soils as they are not biodegradable and unless there's uptake through natural processes, for example uptake into biota, they will remain where they are indefinitely and accumulate with continued inputs.

The key to reduce the accumulation of metals in biosolids and the environment is to manage their principal sources. Metals



P= performance: survival, growth, fecundity

Figure 1. Graphical representations of the concept of window of essentiality (optimum) and toxicity for essential and non-essential metals. This is a good example of the dose makes the poison as both deficiency and high levels of essential metals can pose a risk to health.

are common components of industrial processes, found in some personal care products, and in foodstuffs. While industrial sources of metals into waste water treatment plants are controlled by Trade Waste regulations and monitoring, this is not the case for domestic sources of metals. For example, Zinc is the main active ingredient in anti-dandruff shampoo and a common trace element in many food products and dietary supplements. A CIBR review document identified leaching of copper and zinc from plumbing materials into domestic water as a significant source of these metals into biosolids in New Zealand. The review referenced studies identifying alloys, such as brass used in tapware and galvanised steel, that have the potential to leach copper and zinc into municipal wastewater (Ang 2012). Metals commonly found in New Zealand drinking water include nickel, cadmium, copper and antimony. This contamination process is referred to as plumbosolvent waters as the water in plumbing pipes can dissolve small amounts of copper and other trace metal contaminants from the surface of water piping materials. All water from domestic water piping systems are plumbosolvent but the resulting concentrations of dissolved metals depend on physico-chemical properties of the water (pH, ionic strength and composition) and the quality of metals in plumbing materials. For example, plastic piping systems used in conjunction with high quality brass tapware should leach minimal amounts of copper and zinc, whereas lower grade copper piping and brass tapware will leach significantly higher amounts of metals.

To minimise health risk by reducing the exposure to metals in drinking water, the Ministry of Health encourages consumers to flush a small volume (500 mL is recommended) of water from the tap before drawing water for drinking, cooking or oral hygiene. This practise protects the health of humans consuming domestic water, but the metals still end up in the waste stream and ultimately keep accumulating in biosolids. To better manage this source of metal contamination, there is a need to raise awareness about the role of plumbing systems in the contamination of domestic wastewater, and critically, the quality of plumbing materials. The CIBR review recommended that all metallic materials in new plumbing systems should be of a high quality and used only under conditions to which they are suited as an effective way to reduce the leaching of metals and contamination of plumbosolvent waters. This conclusion is confirmed by Ministry of Health recommendations to:

i) Establish standards for the composition of materials that may be used in the manufacture of plumbing fittings.

ii) Adjust the chemistry of reticulated water to minimise its plumbosolvency.

We should all try to reduce the stress we put on our ecosystems and the use of higher quality plumbing materials that contain lower amounts of contaminant metals and are more resistant to corrosion and leaching is a good start.

Ang R. 2012. Up the Pipe: A literature review of the leaching of copper and zinc from household plumbing systems. CIBR report, 54 p.

PERSONNEL UPDATES – JACQUI HORSWELL LEAVES ESR

Jacqui and the CIBR team at the LTC conference in 2016

On the 16 July, Jacqui Horswell, our CIBR Programme Manager left ESR after 20 years of research in the field of environmental microbiology and biowaste management, to become a Senior Lecturer in Water and Waste in the School of Health Sciences at Massey University, Wellington. With this change, she also left her role as CIBR Programme Manager after 10 years. The role of CIBR Programme Manager now passes to Maria J Gutierrez-Gines, ESR Biowaste Lead Scientist.

Jacqui led the biowaste programme at ESR in 2008, after Tom Speir's retirement. In 2009, during a planning meeting, the ESR "Sewage Biosolids" programme and the Scion "Waste to Resource" programme joined together to work collaboratively on the challenging problems of the sustainable reuse of biosolids. Together, ESR, Scion and Landcare Research started a collaboration that has been growing over the years. The team's interest in finding safe, sustainable and multi-approach solutions for NZ biowaste management (broadened from the earlier biosolids focus) has been a role model for the biowaste research in this country, and ultimately resulted in the creation of the Centre for Integrated Biowaste Research, which was launched in 2013. Jacqui played a huge role in designing, leading and championing CIBR. Currently, CIBR includes scientists from ESR, Scion, Landcare Research, Cawthron Institute, University of Canterbury, Northcott Research Associates, Kukupa Research and Lowe Environmental Impact.

Many projects have been completed since the collaboration started. A long-term project led by Scion started in 1997, applying biosolids to a *Pinus radiata* plantation on sandy, low-fertility soil of Rabbit Island, near Nelson. Monitoring trees, soil and groundwater over 25 years has shown that biosolids application has significantly improved soil fertility, tree growth and site productivity without any obvious adverse effect to the soil and groundwater quality. Another project was one led by ESR investigating whether vermicomposting is an effective method to reduce pathogens in biosolids while still retaining beneficial nutrients and organic carbon. The very successful "Up the Pipe" project has been focused in raising awareness about where the contaminants in the biowaste come from. Research was conducted on consumer behaviours related with the use of cleaning and personal care products. From this, the CIBR team developed learning resources

Jacqui (right) at an education festival with Sarah Quaife (left)

Jacqui at Lake Waikare during the planting sessions held in June 2017

for schools to support behaviour change in the use of products that might contain organic contaminants.

Understanding the communities' points of view, and engaging with them in the sustainable reuse of their biowaste is a strong focus for the CIBR team. Building on earlier engagement with communities in Christchurch, Little River and Porirua to name a few, the CIBR team worked with two communities – Mokai, near Taupō, and Kaikōura[1] – on the real time and real issue of what to do with their sewage sludge. The team's research focussed on further understanding the social and cultural concerns surrounding land application of biowaste. Jacqui's leadership was evident at the multiple hui with the Kaikōura community, and her support was fundamental for the Social and Cultural team in their efforts to engage successfully with the community. The social and cultural research ultimately led to the development of a framework for community engagement for biowaste reuse, enabling key stakeholders to play a role in decision making and allowing sustainable biowaste solutions to be found[2].

With the community input to encourage CIBR to work with NZ native plants, as well as exotic pine species, begun with Jacqui's supervision of Jen Prosser during her master's thesis, which investigated whether mānuka could be grown in waste-amended soil to mitigate microbial contamination[3,4]. Results demonstrate the time taken to achieve 90% reduction of *E. coli* in the soil was just 5 – 8 days for mānuka and kānuka, compared to 93 days for rye grass. These results are currently being utilised in real world settings looking at reducing the impact of farming activities and the land application of biowaste on water quality of rivers and lakes. Field trials have been established in the last year at Lake Waikare[5], Lake Wairarapa[6] and Levin[7].

Jacqui will continue as a key collaborating researcher at Massey University for CIBR's on-going programme and future projects and will retain an active role working in multiple CIBR projects at Lake Waikare, Lake Wairarapa, The Pot, EOCs[8] and the Biosolids Strategy[9]. We also hope to have Jacqui's input towards the future vision and direction of CIBR as a member of the CIBR Advisory Group.

1 Langer, E.R., Ataria, J., Leckie, A., Baker, V., Horswell, J., Yao, R., McDevitt, J., Goven, J., Solomon, R., Tremblay, L., Northcott, G., Xue, J., Ross, C., Robinson., B. 2013. Kaikōura case study: community engagement to determine biosolids reuse. Centre for Integrated Biowaste Research. CIBR Report May 2013.

2 Baker, V., Ataria, J., Goven, J., Langer, E. R., Leckie, A., Hill, P., Lowe, H., Horswell, J. (2016). The CIBR Community Engagement Framework. Report for local government staff, engineers and consultants in the waste and wastewater sector. CIBR Report No. 16-02.

3 Prosser, J.A., et al., Can mānuka (*Leptospermum scoparium*) antimicrobial properties be utilised in the remediation of pathogen contaminated land? Soil Biology and Biochemistry, 2014. 75: p. 167-174. Prosser J A, et al., The potential in-situ antimicrobial ability of Myrtaceae plant species on pathogens in soil. Soil Biology & Biochemistry, 2016. 96: p. 1-3.

4 Prosser, J.A., et al., Can mānuka (*Leptospermum scoparium*) antimicrobial properties be utilised in the remediation of pathogen contaminated land? Soil Biology and Biochemistry, 2014. 75: p. 167-174. Prosser J A, et al., The potential in-situ antimicrobial ability of Myrtaceae plant species on pathogens in soil. Soil Biology & Biochemistry, 2016. 96: p. 1-3.

5 Projects funded by Waikato River Authority, Waikato Regional Council, CIBR, and Vision Mātauranga Capability Fund. See CIBR newsletter No 16 Oct 2017.

6 Collaboration with Greater Wellington Regional Council and Ngati Kahungunu ki Wairarapa.

7 Project led by LEI and funded by MfE-Freshwater Improvement Fund and Horowhenua District Council. See CIBR newsletter No 16. 16 Oct 2017.

8 Project led by Louis Tremblay, Cawthron. Emerging organic contaminants – managing risk for a safer NZ. See CIBR newsletter No 17 Feb 2018.

9 Project led by LEI and funded by MfE Waste Minimization Fund.

CIBR WHAKAPAPA STATEMENT – JULY 2018

E tu kahikatea. Hei whakapae ururoa. Awhi mai awhi atu. Tātou tātou e!
The kaihikatea stand strong, their roots interconnected strengthening each other against the storm, together we are strong.

Foremost, we would like to acknowledge our long-standing Iwi partners for their directives in developing the scientific research on mānuka and other native plant species.

The whakapapa of this change in research direction lies in our foundational relationships and early hui with the Kaikōura community where a representative of Te Runānga o Kaikōura encouraged researchers within the programme to move beyond it's 'business as usual focus' on Pinus radiata as the preferred model species for study and benchmarking of data.

This initial invitation to better explore the functions of Aotearoa-NZ endemic plant species has been extended in the relationships with the Mokai community (Tirohanga School and Mokai Marae), with whānau in the Tairāwhiti, Horowhenua regions, with more recently with Ngāti Kahungunu ki Wairarapa in the Wairarapa area, and with Iwi/whānau in Lake Waikare area (Ngā Muka Development Trust, Te Riu o Waikato, Nikau Farm Estate/Matahuru Marae).

We are grateful to the support of our many Iwi partners and whānau who continue to work alongside us in shaping this kaupapa. Their involvement is integral to growing and sharing new knowledge to better understand and promote native plantings in restoring eco-system health.

THE HISTORY OF SOCIAL AND CULTURAL RESEARCH – FROM W2R TO CIBR

Alan Leckie, Lisa Langer, Jinny Baker, Joanna Goven, and Jamie Ataria

The social and cultural research team of CIBR focusses on research relating to sustainable reuse solutions for biowastes in communities. Stakeholder and wider community consultation is recommended for the Resource Management Act (1991) consenting process and by the Local Government Act (2002) when making decisions on behalf of the community. The Treaty of Waitangi (1840) guides partnerships with Iwi for environmental management. Therefore, Iwi are primarily a Treaty partner, but Māori are also a key stakeholder which underpins their very keen interest in being involved in biowaste, water and environmental decision-making in waste management issues. Particularly where there are often a number of technical criteria and a limited number of sustainable reuse options available to both local authorities and communities.

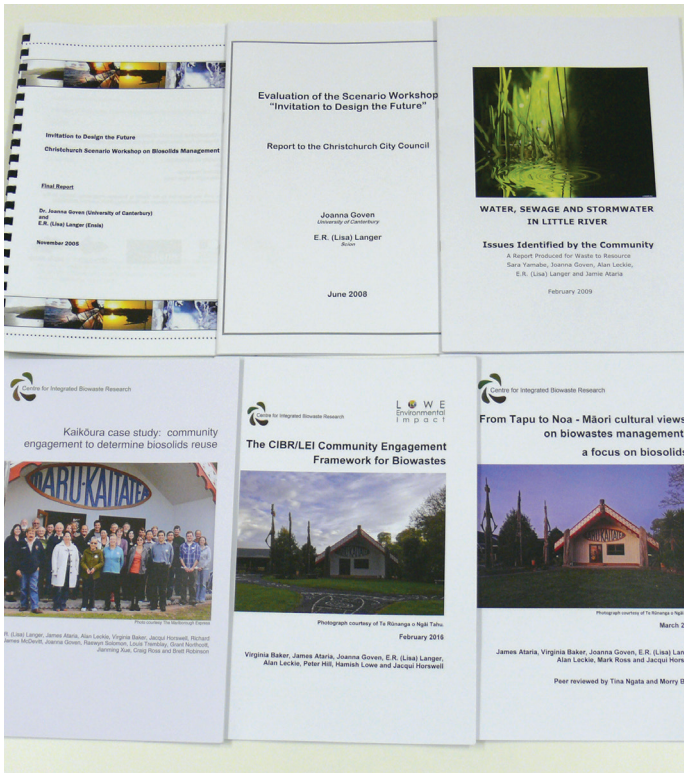
The social and cultural team have implemented a number of community engagement methods and have evaluated them for their ability to support integrated decision-planning and to improve science, policy and community engagement since 2003. The team has members from Scion (Lisa Langer & Alan Leckie), ESR (Jinny Baker), Cawthron (James Ataria), and Kukupa Research (Joanna Goven).

The team's approach emphasises facilitating community discussion of, and collective reflection on, relevant issues, goals, and values as a path to arriving at solutions that best meet community needs as understood by the communities themselves.

Over the last 15 years CIBR, and the earlier team of Waste to Resource (W2R) research programme, have used this process to enable communities to choose options to sustainably reuse their biowastes that also satisfy both regulatory and environmental requirements.

The team's first major project entailed developing and implementing a series of scenario workshops in 2005 that asked a number of groups in the Christchurch area questions about the sustainable reuse of the city's biosolids (treated and stabilised human waste). These workshops brought together five distinct groups within society: rural, urban, Iwi, business and regulators. Following a deliberative process, the participants voted in support of the future strategy that Christchurch's biosolids should be used for energy and only be applied to the land if was deemed to be sufficiently safe after assessing the components of the biosolids (including emerging contaminants) and their environmental effects. A report (Invitation to Design the Future: Christchurch Scenario Workshop on Biosolids Management) was completed and presented.

In 2007, W2R's social and cultural team led a study of the water and waste issues in Little River on Banks Peninsula. There were various long-standing issues in the community that needed to be addressed. The water supply and sewage and wastewater disposal were priority issues, with the town's ecology and the deterioration of Te Roto o Wairewa (Lake Forsyth) identified as being important issues if a reticulated sewerage system was installed. W2R attended the A&P Show, interviewed 70 members of the community, met with elected members of the council and the residents' association, and held a hui at the local marae. A report (Water, Sewage and Stormwater in Little River: Issues identified by the community) was produced. Within



All reports produced by the social and cultural research team

12 hours of the marae finishing the Christchurch City Council contacted W2R and addressed the most pressing matters highlighted by the community.

With W2R and ESR funding finishing in 2009 a meeting took place at French Pass in Marlborough in 2008 to plan for future collaborations with all those involved. A successful bid brought in more planning for a research strategy and the introduction of a distinct Social & Cultural team led by Lisa Langer of Scion.

A meeting between Scion and the CEO of the Kaikōura District Council (KDC) led to an integrated research project in Kaikōura. A member of Te Rūnanga o Kaikōura was seconded onto the social and cultural team for this research. Four hui were held, decisions on the sustainable reuse options were provided by the community, participants were interviewed on the process, and a report was presented to the KDC. During this hui process members of the community demanded that if the biosolids were to be used to supplement potting mixes then native trees (mānuka and totara) should be part of this experiment. This outcome was seen as the community having both a consultative, involved and collaborative input into their own decision-making process.

In 2013 the social and cultural team tabled their Kaikōura research case-study report (Kaikōura case study: community engagement to determine biosolids reuse) that provided recommendations at the full council meeting where it was accepted. A further newspaper report appeared in the local newspaper and a full presentation was made to Te Korowai o Te Taio Marokura (the Kaikōura Coastal Guardians) at a monthly meeting. Subsequent to these meetings, and following a change in personnel, the KDC explored other options for the stockpiled biosolids beyond the recommendations of the community engagement process.

Aligned with this community-based research was a closely linked programme called 'Up The Pipe', funded by the Waste Management Fund, where biophysical and social and cultural scientists looked at methods of reducing the number and volumes of contaminants being released into the wastewater stream from homes. Discussing this with high school students from Kaikōura and the local MP, brought the issue into the younger community's minds. A hui was held where discussions on the origin of household pollutants took place; a number of alternative ways of reducing home chemical use were practiced and displayed, and the high school students could look at the results of the different options and make decisions for the environment.

Two documents were produced in 2016. The first, the 'CIBR/LEI Community Engagement Framework for Biowastes' which provides a clear and manageable process for engagement. It shows that different factors that support 'good practice' and processes can satisfy regulatory and environmental requirements of preferred options found using community engagement. The second, 'From Tapu to Noa – Māori cultural views on biowaste management: a focus on biosolids' states that tapu and noa are key cultural constructs that were central to traditional Māori society and continue to inform thinking and practice in Māori society today. The document provides some insight, generic language and frameworks about how these concepts might be considered in biowaste management.

Currently, the social & cultural team is progressing research at Te Pā o Rākaihautū, a special character pā wānanga in Ōtautahi (Christchurch). This research will focus on exploring the cultural framework of sustainability that characterises Te Pā; efforts to improve sustainability in the use of cleaning products and other chemicals; and the production, reuse, recycling and disposal of organic wastes. Interviews with key members of the Board of Trustees and other staff members are shortly to be carried out; these will inform research on the cultural framework as well as laying some groundwork for a collaboration with experts in Māori education.

This exciting collaboration, with the University of Canterbury Māori Research, is progressing towards a bid for a Marsden Fund following a successful scoping research application to Ngā Pae o Te Māramatanga. The social and cultural team have attended four hui to discuss the topics of kaitiakitanga (sustainability and guardianship) and decolonizing methodologies for Māori succeeding as Māori. This scoping study is a rare opportunity to find collaborative research questions that fit the expertise of the social and cultural team is the areas of waste and UoC Māori Research with their expertise in education.

The social and cultural team has extensive expertise in qualitative social research. Incorporating public participation into decision-making on issues involving science and technology and supporting sustainable Māori development and cultural aspirations through scientific research enables an understanding of the interface between science, policy and diverse stakeholders in the community. Communicating science through community engagement strengthens the connections between the researchers and the stakeholders for the future.

Copies of any social and cultural publication are available from CIBR. Please contact Alan Leckie (alan.leckie@scionresearch.com).

If you would like further information on the programme or have any questions, please see our website www.cibr.org.nz or contact a member of the Science Leadership Team:

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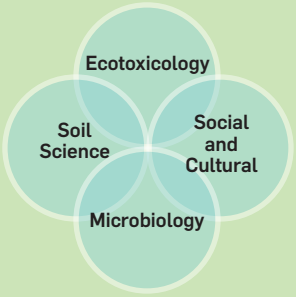

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