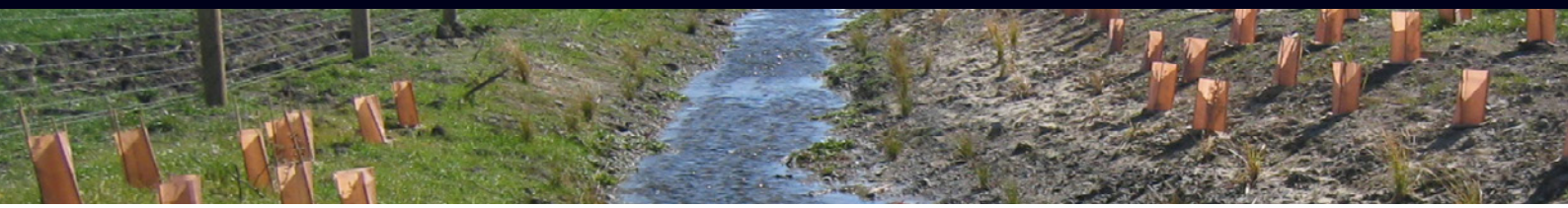
CAREX News

The CAREX project is funded by the Mackenzie Charitable Trust



Newsletter of the Freshwater Ecology Research Group

September 2015

Welcome to our September CAREX newsletter - here are some of the things that have been keeping the research team busy over winter.

Sand wand trial completed

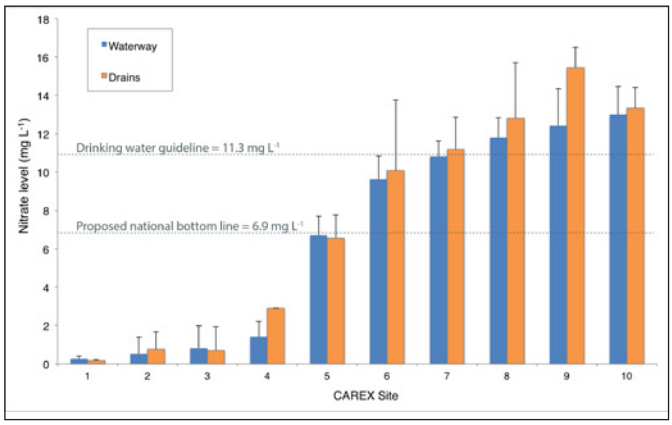
After a long wait we have finally used the sand wand, which is a tool that vacuums up sediment off the stream bed, with the help of Waimakiriri District Council staff in a stream near Rangiora. We were able to sand wand four sediment traps and several 10m reaches of the stream. In one large sediment trap, we removed 90% of the sediment and reduced the average sediment depth throughout the trap from 40cm to 2cm. We did, however, confirm a number of limitations of the sand wand. It is labour intensive and it does not work well when the water is too shallow (i.e., less than 20cm). Regardless, the wand is useful for patches of sediment and where digger access is difficult.

More on the sediment traps

Recently, we used a digger to clean out our large (12m long and 0.7 m deep) sediment trap, which has been in place for 8 months. One of our students was monitoring the amount of sediment collected in the trap and we estimate it has captured about 60-70% of the fine sediment entering this length of stream. Over the 8 month period, the trap filled in to an average depth of ~35cm deep. During our cleaning we removed about 4m^3 of sediment from the trap! The trap has proven to be very efficient and its success is due to it being long enough and deep enough to reduce the water velocity to less than 0.01ms^{-1}. This very slow water velocity is enough for very fine silt to drop out of the water column. We will continue to monitor this trap and several others over the next year. Our aim is to develop an "ideal" sediment trap design.

In-stream nitrate patterns

Nitrate is one of several freshwater health attributes that we have been monitoring regularly across the sites. Elevated nitrate levels are an indicator of pollution and can pose a risk to human health. CAREX waterways span a gradient of nitrate levels from 1mgL^{-1} to more than 16 mgL^{-1}. Since 2013, we have observed strong seasonal changes and spatial patterns. Nitrate levels tend to be highest in the winter and spring, and open and tile drains tend to discharge higher levels of nitrate compared to the main waterway.



Understanding how much nitrate loads vary across the waterways is a priority this season and will inform the next phase of the research on enhancing nitrogen removal using bioreactors.

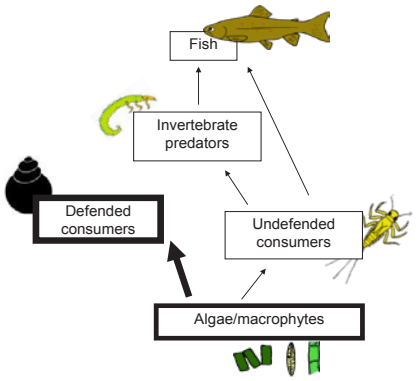
Bioreactors planned for installation

Woodchip bioreactor installation will begin at several CAREX sites in the Hinds area this spring. Bioreactors convert nitrate to nitrogen gas by enhancing denitrification, a process which naturally occurs in paddock soils, riparian zones, and stream sediments. Essentially, a bioreactor is a ditch that is filled with woodchips or other dead plant material and 'filters' excess nitrate and fecal bacteria. Bioreactors have been used in Europe, North America, and New Zealand.

We have consulted with groundwater scientists, engineers, and microbiologists to design bioreactors that are well-suited to the climate, soils and drainage on farms in the Canterbury Plains. The bioreactors must contain enough organic material (e.g. untreated pine woodchips) and be the right size to enhance denitrification without producing greenhouse gases as an undesirable side effect (e.g. methane). The bioreactors will be located to interfere minimally with crop and stock production and still maintain drainage. We will install some bioreactors to specfically target tile drain inputs.

Food web links need to be restored

Excessive amounts of nutrients, from fertilizers, animal wastes, and/or removal of riparian vegetation, associated with agricultural land-uses can flow into waterways and encourage the excessive growth of algae and macrophytes (or aquatic plants). We sampled invertebrates and fish and looked for changes in their diets in 18 waterways across a wide nutrient gradient. The more nutrient-rich waterways had a low diversity of invertebrates and were dominated by snails, which graze on algae. The high number of these hard-shelled, inedible snails (aka defended consumers, such as *Potamopyrgus* snails) created a bottleneck in the flow of energy from the algal food resources up to fish or other predators in the food web.



We hope to reduce the dominance of snails by reducing weedy macrophytes and adding more organic matter (e.g., leaves). Restoring links for energy flow within the waterways, will be an important step in rehabilitating nutrient-rich streams, along with increasing biodiversity, so that energy is available to support all organisms.

Spreading the word

In a well-attended public lecture given at the University of Canterbury in May, Jon Harding gave a talk that demythified agricultural waterway restoration. In the talk, he summarized the goals and science underpinning our 10-year Mackenzie Foundation-funded project. He focused on how we are working with landowners to find effective and practical science-based solutions for the restoration of agricultural waterways. It was great to see so many CAREX stakeholders and collaborators in attendance.

In July, Jon travelled to Europe and presented at an international conference on River Restoration in Wageningen (Netherlands). Jon presented on the tools CAREX is testing to improve restoration success. A number of researchers from Portugal, Germany and USA were particularly interested in our work.

Our revamped website - check it out!

Our website now gives an overview of the CAREX project, access to newsletters, and information on our rehabilitation trials. While you are there, have a look at the key findings, handouts, and other publications from the first phase of research programme (2008 – 2013). The work done in Phase 1 helped to frame the problems and identify likely solutions for lowland agricultural waterways that we are now testing in CAREX. Check it out at: www.biol.canterbury.ac.nz/ferg/carex

Helping with wetland protection

Through their involvement with CAREX, the Harris family discovered the regional significance of a small harakeke (flax) wetland on their property and are now working to establish it as a QEII National Trust covenanted wetland.


Harris covenants protect Asburton's natural treasures

For the full story, check out Open Spaces magazine (Issue 88, May 2015; PDF available at http://www.openspace.org.nz/Site/Publications_resources/Open_Space/).

By the numbers

Many thanks to those who participated in our on-line communications survey in July. The feedback was encouraging! We now know that:

60% say information generated by CAREX has **changed** their understanding of aquatic weed, sediment, and nutrient issues and management and rehabilitation tools in Canterbury

CAREX team news

Catherine Febria will be on maternity leave from October 2015 until March 2016. We wish Catherine and her family all the best on the arrival of their little one.

We welcome Helen Warburton to the CAREX team. Helen will be covering Catherine's position while she is on leave. In addition to organising the field teams and experiments this summer, Helen brings her statistical expertise to the team and will be taking over analysis of our growing data set. Helen has just completed her PhD at the University of Canterbury on factors structuring stream invertebrate and fish communities.

CAREX Canterbury Waterway Rehabilitation Experiment

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