Optimising scale & objectives of lowland agricultural stream restoration: the CAREX approach

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Overcoming barriers to stream restoration

Many stream restoration projects fail to achieve expected results. The reasons for many of these failures have been well documented in the literature. The Canterbury Waterway Rehabilitation Experiment (CAREX) has focussed on developing solutions and tools to improve lowland agricultural stream restoration success.

Fundamental to the CAREX approach:

- Building strong partnerships with landowners, stakeholders & management agencies. These partnerships are built on open communication, trust and delivering promises.
- Identifying clear restoration objectives.
- Understanding and identifying the sources of multiple stressors.
- Developing and trialling tools to treat multiple stressors at multiple scales.
- Active communication of scientific findings through multiple media to stakeholders and communities.

Facts & Figures

23 Landowners

9 km of waterways *across 14 farms*

Instream tools tested *with more to add* **14**

40+ Stakeholders involved and four councils

Fifteen researchers

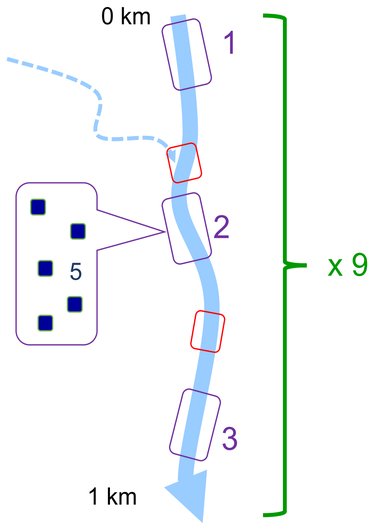
ONE EXPERIMENT

Addressing stressors at multiple scales

Stressors vary and often need to be addressed at different scales. We are testing restoration tools applied in different combinations at different scales to address sediment, nutrient, macrophytes and biodiversity issues. We have shown that excessive macrophytes can be driven by reach-scale factors, whereas, high nutrient loads are often driven by whole stream or catchment conditions.

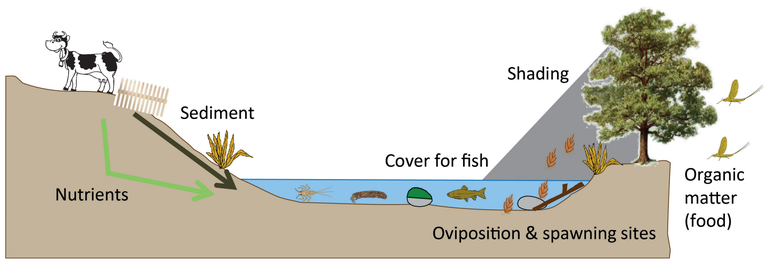
Multiple scales:
1. Waterway (1 km)
   - 9 in CAREX project
2. Reach (20m)
   - 3 in each waterway
3. Small sampling unit (<1m)
   - ≥ 5 in each reach

+ Hotspots (<20m)
   - type and location differ in each waterway



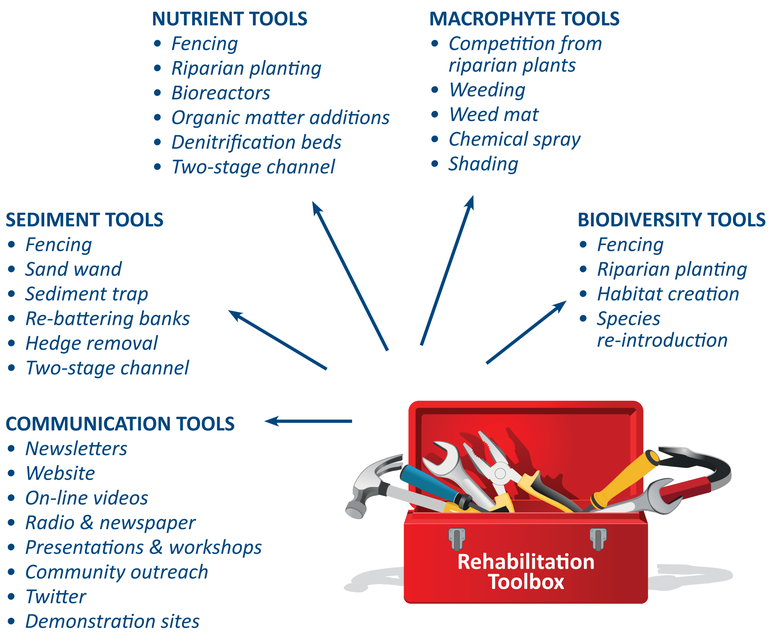
Riparian management to achieve function

Many stream restoration projects use "generic" planting guides which incorporate native vegetation and are aesthetically pleasing, but do not necessarily provide the full functions needed to improve stream health.



Developing an effective toolbox

We are trialling multiple tools that can be used alone or in combination to address mutiple stressors at multiple scales and communicating our knowledge with diverse audiences.



Trialling the restoration tools: rebattering the banks, organic matter additions, shading macrophytes, and creating in-stream habitat.

Sharing our science and knowledge: community planting days, school outreach, public presentations, stakeholder workshops.

Reduce fine sediment

Excessive fine sediment can clog stream beds, enable macrophyte growth, and reduce habitat. Fine sediment enters waterways from numerous sources, including livestock trampling; run off from paddocks; bank erosion; and sub-surface and open tile drains.

Rebattering is one tool to stop bank slumping and erosion. When combined with weed mat, rebattering can reduce erosion while riparian plantings grow.

Reduce in-stream nutrients

In lowland agricultural streams in Canterbury, nitrate levels can reach as high as 15 mg/L. Nitrate enters the waterways from the groundwater, sub-surface tile drains and to a lesser extent from surface run-off.

Denitrifying bioreactors provide a carbon source (wood chips) and suitable conditions for microbes to convert nitrate to nitrogen gas, which can reduce nitrate levels flowing into waterways from tile drains.

Reduce macrophyte cover

Nuisance macrophytes can fill waterways, raise water levels, and accumulate sediment, potentially flooding adjacent productive farmland.

Full shading that extends across a waterway stops excessive macrophyte growth. Weed mat can be used as an interim solution while riparian plants grow to provide shade and cover banks to prevent weed establishment.

Improve in-stream habitat

Important habitat features for freshwater biota are often missing from agricultural waterways.

Boulders and wood add valuable habitat and cover for invertebrates and fish. These habitats have been used as oviposition sites for invertebrates and as habitat by small fish.

Actively communicate findings

Using multiple media approaches has been an important mechanism for communicating our scientific findings, restoration tools and solutions to landowners, stakeholders and communities. We aim to inform and engage and ultimately make a difference to waterway management.

Acknowledgements

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CAREX Canterbury Waterway Rehabilitation Experiment

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Take home messages

Agricultural stream restoration success will be improved by:

- **Setting clear restoration objectives**
- **Starting restoration at the headwaters of the catchment**
- **Fixing "leaky" plumbing i.e. hot spots of sediment and nutrient inputs**
- **Planting riparian plants to fulfil a range of functions**
- **Addressing in-stream legacies, such as excessive fine sediment & poor habitat**
- **Improving in-stream physical habitat**
- **Recognising that one restoration tool will rarely be sufficient, and that a tool box of multiple tools might be needed to improve water quality, habitat and overall waterway health.**