

Resilient Wetlands Research Programme Update 8: July 2018 to June 2019

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Overview

Our Resilient Wetlands research programme is funded by the Strategic Science Investment Fund (SSIF) Crown Research Institutes from the Ministry of Business, Innovation and Employment's Science and Innovation Group (previously 'core' funding). The following update summarises the major outputs and successes between July 2018 and June 2019.

Wetland policy to protect and manage wetlands. Bev Clarkson was a member of the government's Freshwater Science and Technical Advisory Group (STAG), which was set up in 2018 to oversee the science evidence for freshwater policy development. The purpose of the Group is to support officials with science and technical advice on the Water Directorate work programme from 2018 to 2020. The Group will help ensure the interpretation of the science for policy development is accurate and assist with incorporating science into the policy process. A Technical Working Paper Draft was submitted to the Minister for the Environment at the end of June 2019 to be considered by Parliament for developing policy to manage New Zealand's freshwater ecosystems (rivers, lakes, wetlands, groundwater). The technical working paper will be used to develop attributes, limits, and guidance under the National Objectives Framework (NOF) of the NPS-Freshwater Management to protect and manage freshwater ecosystems, including wetlands.

***Tradescantia* biocontrol beetles enhance native species regeneration in swamp forest ecosystems.** A biodiversity field experiment incorporating biocontrol beetles and manual clearing in a range of swamp forest remnants invaded by tradescantia (*Tradescantia fluminensis*) on the Hikurangi floodplain was conducted over a 3-year period to provide best-practice techniques to enhance native biodiversity. Three biocontrol beetle species were used, each of which targets different parts of the plant. The beetles (*Neolema ogloblini*, which feed on the leaf, *Lema basicostata* (stem), and *Neolema abbreviata* (tip); Fig. 1) were sourced from Brazil and, following host-range testing that indicated they were safe to release in New Zealand, were approved for release by the Environmental Risk Management Authority (ERMA). These species had previously been released separately in New Zealand; however, the Hikurangi experiment was the first release of the beetle species as a trio (Fig. 2). Results showed that, after a slow start, the biocontrol beetles were effective in reducing tradescantia biomass and promoting regeneration of native canopy forest species replacements. Removal of tradescantia by hand produced more immediate results, but this technique is much more labour intensive and requires on-going control. The biocontrol beetle source populations have now increased sufficiently in size to be able to be harvested for wider distribution in the region following correct protocols for collecting and transferring the beetles as outlined in web-based best-practice guidelines. The experiment has been a collaboration with the Biological Heritage National Science Challenge and the Fonterra–DOC Living Water Programme, and involved a large team for the final sampling (5 from MWLR, 4 DOC, 3 NRC).



Figure 1 Biocontrol beetles: L–R: stem *Lema basicostata*, leaf *Neolema ogloblini*, tip *Neolema abbreviata*. Photos: Quentin Paynter



Figure 2 Biocontrol beetle release in Hikurangi Floodplain sites, February 2016. Left- right: Tony Hegh, Quentin Paynter, Corinne Watts, Danny Thornburrow, Bev Clarkson. Photo: Katrina Hansen.

Significant contribution to 2018 National Wetland Restoration Symposium. Wetland programme members were well represented at the national wetland restoration symposium, held this year in Napier (Fig. 3). This is the main gathering for sharing our research with, and receiving feedback from, community groups, landowners, iwi, scientists, wetland managers, and students throughout New Zealand. Programme members contributed 6 presentations and 2 workshops (listed below), as well as chairing sessions and being on the organising committee. It was really pleasing to see the tools we have developed being used and appreciated by wetland stakeholders around the country (e.g. condition monitoring, wetland delineation).



Figure 3 MWLR wetland team members and collaborators at the Wetland Restoration Symposium. Back L–R: Bev Clarkson, Scott Fraser, Yvonne Taura, Danny Thornburrow, Jamie Wood. Front L–R: Corinne Watts, Mahuru Wilcox, Olivia Burge. Photo: Bev Clarkson.

Partnership with Ngāti Hauā Mahi Trust. Yvonne Taura and Mahuru Wilcox have co-led a project working with Ngāti Hauā Mahi Trust (NHMT) and developed a Wetland Mauri Framework with whānau from Waimakariri and Te Iti o Hauā Marae. The framework identifies their key values, indicators, and goals for the restoration and monitoring of wetlands, gullies, and streams. The framework has been developed to help plan appropriate methods for future monitoring programmes. Yvonne and Mahuru supervised an intern (3 months), a young researcher nominated by NHMT, to co-develop the framework. Waikohu Keelan showed a keen interest in research and the restoration of wetlands within the Ngāti Hauā rohe. Her duties were to arrange interviews with whānau participants, attend interviews, and help with data analysis and a literature review. Since her internship, Waikohu has expressed a desire to study a Masters degree in Environmental Management. We will continue to support Waikohu with her future endeavours.

Te Reo o te Repo in demand. Stats from the MWLR website showed that the complete version of Te Reo o Te Repo: The voice of the wetland was downloaded over 550 times, along with individual chapters being downloaded up to 60 times each. 300 hardcopies were printed, and given as koha to those who expressed interest in the handbook – these included each marae (68) within the Waikato-Tainui tribal rohe, whānau undertaking wetland restoration, council and government agencies, and international researchers. This proved that the handbook was popular and far-reaching. In March 2019, we were supported by Waikato-Tainui to create a second edition, which Yvonne is keen to do. An agreement was made to contract Cheri van Schravendijk-Goodman as an editor and writer, and Abby Davidson (NZLT) as graphic designer. We decided to add 10 chapters to the next edition, with 9 confirmed contributors ranging from whānau/marae/iwi led wetland restoration projects to academic research. The next edition promises to be a very helpful guide for those embarking on wetland restoration as well as highlighting the importance of mātauranga Māori and whānau involvement in these processes. The printing of hard copies will be funded through the support of Waikato-Tainui Taiao Grant and MWLR.



Figure 4 Minister of Conservation Eugenie Sage is presented with a copy of Te Reo o Te Repo by Mahuru Wilcox, Yvonne Taura, and Bev Clarkson at the National Wetland Symposium, Napier (26-28 September 2018). Photo: Yvonne Taura.

Repo Roopu pānui (Wetland Group Newsletter). The Repo Rōpū have received 3 pānui throughout the 2018–2019 year. The subscription includes members interested in Te Reo o Te Repo, wetland restoration, and whānau led initiatives. The pānui includes: profiles of members, profile of an iwi led project, funding opportunities, upcoming conferences, spotlight on a native wetland animal or plant, and a spotlight on a chapter from Te Reo o Te Repo. These pānui are written and edited by Yvonne and Cheri, with contribution from Mahuru. Below are the links to the panui we sent out this year:

[He Pānui Te Reo o Te Repo Issue 4](#)

[He Pānui World Wetlands Day 2019](#)

[He Pānui Te Reo o Te Repo Issue 3](#)

[He Pānui Te Reo o Te Repo Issue 2](#)

Issue 3 contains details of our involvement in the the National Wetland Symposium. We see these pānui as an important way to communicate and update our members on wetland matters. They have been well received by our members, and have even been shared by members on social media.

International peatland restoration expert in Waikato peatlands. Shane Grundy, peatland restoration practitioner, from the Blue Mountains, NSW, Australia, and a member of the International Mire Conservation Group (IMCG) Main Board, was invited to New Zealand to investigate practical approaches for managing and restoring Waikato peatlands. The exchange (19–24 November 2018) was co-funded by MWLR and DOC. Several peatlands were visited, including Kopuatai, Moanatuatua, and Whewells Bush, and a workshop was held at MWLR, Hamilton to discuss restoration technique approaches. Partners and stakeholders involved in the events included DOC, Ngati Hako, UOW, MWLR, dairy farm managers, and blueberry farm owners. As a result of Shane’s visit, practical approaches to restoration have now been incorporated into the Moanatuatua restoration plan, and other options are being followed up. There was also agreement with DOC and other partners to coordinate and organise a NZ IMCG symposium on Waikato peatlands in 2021 to showcase our peatlands and get advice on international best-practice management in the face of impending climate change issues.



Figure 5 Shane Grundy standing next to a tall invasive horticultural blueberry plant growing in the south-west corner of Moanatuatua Bog. Photo: Bev Clarkson.

Whangamarino Wetland study – kahikatea establishment. This study, investigating the potential to establish kahikatea as a native canopy in place of invasive grey willow, has been sampled for a 4th year of proposed 5 samplings for the first phase of the experiment. Treatments include clearance of light wells versus non-clearance ('dark'), and planting kahikatea in clumps versus individual trees. Data have been compiled in a database and preliminary statistical assessments have been undertaken. The project is a long-term collaboration with DOC's Arawai Kākāriki programme, to provide best practice for restoring large-scale, willow-invaded wetlands.

Integrated Constructed Wetlands. Two full-scale integrated constructed wetlands have been established and planted on dairy farms in the Waikato Region. The project was led by Suzanne Lambie and funded by the MfE Community Environment Fund, supplemented by our wetland programme. The wetlands receive runoff with elevated nutrient levels from the surrounding agricultural land. The study design has allowed the single cell wetland on one site to have a mixed planting, while at the other site, the four-cell wetland has different native species in each cell. In May 2019, Suzanne organised a community workshop with c. 50 participants, including students, teachers, and parents from Taupiri Primary School, tribal members from Taupiri Marae, Eugenie Sage, Associate Minister of Environment and Minister of Conservation, local landowners and land managers, and MfE staff. The day focused on educating children and the local public on the values of wetlands, and the importance of ICWs in assisting in water clean-up and wetland restoration. The children (and the Minister) also enjoyed the hands-on experience in planting of native wetland species in the new ICW located on a local dairy farm (Fig. 6).



Figure 6 Eugenie Sage, Minister of Conservation and Associate Minister for the Environment planting harakeke at Whangamare Integrated Constructed Wetland site with Suzanne Lambie. Photo: Bev Clarkson.

In addition, a biodiversity study of five established constructed wetlands (Mangakaware, Baldwin's Putaruru, Lake B, Owl Farm. and Toenepi) was led by Brandon Goeller and James Sukias, NIWA. The wetlands span the range from low planting diversity, small size and few nearby hot spots of biodiversity, up to wetlands with high planting diversity, large size and nearby hot spots for biodiversity. Sampling included vegetation types, aerial drone mapping, bird call recordings, tracking tunnels for rodents, insect drop traps, fish trapping and aquatic invertebrate sampling. This will complement the integrated wetland study, where full biodiversity is unlikely to be apparent until several years after planting has been completed.

PhD studies untangle carbon accumulation processes in modified and intact bogs. Joss Ratcliffe is aiming to complete his PhD thesis by mid-July 2019. His research examined the processes and factors that affect rates of carbon accumulation in restiad peatlands. In the first published paper from his PhD (Ratcliffe et al. 2019), he compared the CO₂ exchanges of the chronically dry Moanatuatua peatland remnant and the hydrologically pristine Kopuatai bog. Moanatuatua was a smaller net annual CO₂ sink than Kopuatai but it had much larger gross primary production and ecosystem respiration. Joss has recently submitted a second paper that compares CO₂ exchange processes at Moanatuatua across a 16-year interval. His final paper, still in preparation, steps back in time (literally) by carrying out high-resolution carbon dating at Moanatuatua to map the carbon accumulation rate across a 900-year period starting with the Taupo eruption depositing volcanic tephra into the wetland. Joss found enormous differences in carbon accumulation rates that appear to have been driven by phosphorus inputs to the bog. There are important implications for present-day peatlands because of how humans are affecting global nutrient cycles.

Wetland International Internship enhances wetland restoration initiatives. Alex Seliger, from Greifswald University, Germany, was our international intern for 2019, based at MWLR, Hamilton for 2 months (Fig.7). Alex worked on National Wetland Trust (NWT) restoration initiatives with Karen Denyer, and MWLR projects with Bev Clarkson, Scott Frase, and Scott Bartlam. Projects that Alex contributed to included fauna monitoring, pest detection, soil sampling and analysis, bat audio analysis, and report writing. He also engaged with local primary school students to carry out a small research project into mouse lures, to progress pest management in New Zealand. These internships, in association with NWT, are very important in contributing towards improving restoration approaches, sharing wetland knowledge, increasing wetland capability, and developing international collaborations with wetland researchers.



Figure 7 Our 2019 wetland intern, Alex Seliger with National Wetland Trust collaborator, Karen Denyer. Photo: Bev Clarkson.

Snippets

- Connie Daws completed her Master of Environmental Sciences degree with a thesis titled *Factors contributing to the unnaturally low water table of Moanatuatua Scientific Reserve, Waikato, New Zealand*. Connie utilised 3 years of water level data from a transect of sites across the Moanatuatua peatland reserve, along with water balance data collected from the eddy covariance research tower that formed a base for Joss Ratcliffe's PhD thesis. Her results suggested that the deep drains bordering Moanatuatua affect the margins but not the central regions of the bog remnant. Higher

evaporation rates from the late-successional vegetation at Moanatuatua compared to the *Empodisma robustum* vegetation at Kopuatai bog contributed the lowered water table.

- Callum Douglas completed his MSc degree with a thesis titled *Ecohydrological characterisation of Otakairangi Wetland, Northland*. The primary goal of the research was to characterise the wetland's condition and the ongoing impacts of hydrological interactions with its agricultural headwater catchment via the deep central wetland drain. Despite many decades of modification through fire and drainage, there were strong indications of vegetation recovery and the early stages of peat accumulation under expanding areas of *Empodisma robustum*. These results provide impetus to improve land management practices to reduce sediment and nutrient runoff, and may pave the way to reintroduction of the locally extinct *Sporadanthus ferrugineus*.
- For her MSc, Clara Wilson is researching the recovery of peatland vegetation following fire at Kopuatai bog, using a vital attributes approach, and is being co-supervised by Chris Lusk and Dave Campbell. She has carried out surveys and sampling at the site of a lightning strike burn in November 2017 and has spent a great deal of time trying to tie down the exact locations of historic burn sites.
- Our Ashburton Lakes/ O Tu Wharekai wetland study examined the potential effects of nearby cropping agriculture on low nutrient hill country fens by a nutrient addition experiment over 3 years. A paper led by Olivia Burge has been submitted to *Freshwater Biology*: Response of an austral fen to nutrient additions and predictive ability of the vegetation N:P ratio.

References/ Papers (selection):

Clarkson B 2019. Wetlands: Recent research and current initiatives. MWLR/MfE LINK seminar presentation, 13 March 2019. MfE, Wellington. Available: [wetland Link Seminar](#)

Clarkson BR 2018. Wetland delineation protocols. Landcare Research Contract Report LC3354 for Tasman District Council. 6 p. Available: [report](#)

Clarkson B, Sorrell B 2018. New Zealand wetland condition monitoring. In: Dorney J, Savage R, Tiner R, Adamus P eds Wetland and stream rapid assessment: development, validation, and application. Elsevier, USA. ISBN: 978-0-12-805091-0. Pp. 511–520.

Daws CM 2019. Factors contributing to the unnaturally low water table of Moanatuatua Scientific Reserve, Waikato, New Zealand (Thesis, Master of Environmental Sciences). The University of Waikato, Hamilton, New Zealand. <https://hdl.handle.net/10289/12635>.

Douglas CM 2019. Ecohydrological characterisation of Otakairangi Wetland, Northland (Thesis, Master of Science). The University of Waikato, Hamilton, New Zealand.

Hughes JMR, Clarkson BR, Castro-Casellon AT, Hess LL 2019. Wetland plants and aquatic macrophytes. In Hughes JMR ed. Freshwater ecology and conservation: approaches and techniques. Oxford University Press. Pp. 173–207.

Moore TR, Alfonso A, Clarkson BR 2018. Plant uptake of organic nitrogen in two peatlands. Plant and Soil. doi.org/10.1007/s11104-018-3851-y

Ratcliffe JL, Campbell DI, Clarkson BR, Wall AM, Schipper LA 2019. Water table fluctuations control CO₂ exchange in wet and dry bogs through different mechanisms. Science of the Total Environment 655: 1037–1046. <https://doi.org/10.1016/j.scitotenv.2018.11.151>.

Restoring Wetlands Symposium 2018 presentations:

Burge OR, Clarkson BR, Moore T, Fitzgerald N, Bartlam S 2018. Can common wetland plant species predict soil nutrient levels?: findings from the New Zealand wetland plant tissue database. Oral presentation..

Clarkson BR, Watts CH, Thornburrow D, Bartlam S 2018. Sustainability of a restiad bog remnant in an agricultural landscape. Oral presentation

Fraser S, Singleton P, Clarkson B 2018. A hydric soil tool for wetland delineation. Workshop.

Ratcliffe J, Campbell D 2018. Ecosystem functioning and CO₂ exchange for a remnant peatland, within an agricultural landscape, compared to that of a large peatland in a near-natural state. Oral presentation.

Tanner C, Burge OR, Clarkson BR, Bartlam S, Bodmin K, Sukias J, Robertson H 2018. Resilience of a montane fen to agricultural nutrient additions and predictive ability of the vegetation N:P ratio. Oral presentation.

Taura Y, Wilcox M, van Schravendijk-Goodman C 2018. Te Reo o Te Repo: Giving a voice to wetlands – collaboration with Māori. Workshop.

Watts CH, Clarkson BR, Thornburrow D, Thorpe S, Hoare R 2018. Invertebrates in a remnant peat bog amongst a living landscape. Oral presentation.

Wood J, Wilmhurst JM, Richardson SJ, Burge OR, Clarkson BR, Robertson H 2018. A DNA-based wetland assessment and monitoring tool. Oral presentation.

Several symposium presentations are available on the National Wetland Trust website

<https://www.wetlandtrust.org.nz/what-we-do/symposia/>