Resilient Wetlands Research Programme Update 7: July 2017 to June 2018

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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 2017 and June 2018.

O tu Wharekai wetlands relatively resilient to N-loading in the short term. Our 3-year fertiliser (N, P) experiment in a montane fen to determine the vulnerability of natural wetlands to agricultural inputs has now been completed. Olivia Burge led the data analysis and write-up of the journal paper, which has just been submitted. The catchment, on the foothills of the Southen Alps, is largely intact, with very low atmospheric nitrogen inputs. We found little evidence of community-level change after 3 years of nutrient addition, aside from increasing dominance in cover of the most abundant canopy species and decreases in species richness, in the highest N treatment (both nitrate-N and ammonium-N) plots. Species richness decreases were due to losses of both native and exotic species. Further work is required to assess the longer-term resilience of New Zealand wetlands to agricultural losses of N and P, the impacts of which have largely gone unstudied.

Final harvesting of a total of 8 replicated plots each of *Schoenus* (left), *Carex* (right), and *Chionochloa* (not shown) communities at O Tu Wharekai after 3 years fertilization with either nitrate-N, ammonium-N and phosphate-P alone or in combination. Photos: Chris Tanner and Nelson Boustead.

Hydric soil tool for delineating wetlands in New Zealand: We have developed a hydric soil tool to identify and delineate wetlands throughout NZ (soil tool). The approach follows the United States regulatory approach for delineating wetlands. A workshop was held for 25 regional council staff and other stakeholders in June 2018 to provide training and field demonstration of the tool. The hydric soil tool complements our wetland vegetation tool (vegetation tool), which was developed in 2014. Standardised national tools are important for identifying and protecting wetlands and their boundaries throughout New Zealand, especially in dispute resolution processes. The tools will also be used to inform policy development for the upcoming NPS–Indigenous Biodiversity.

Pedologist Scott Fraser testing the hydric soil tool in Northland gumlands with Lisa Forester, Northland Regional Council. Photo: Bev Clarkson

Northern Hemisphere peatland expert completes sabbatical research project. Professor Tim Moore, McGill University, undertook his third sabbatical with our wetland programme at Manaaki Whenua – Landcare Research. The main focus of his research was to compare peat and foliage chemistry in NZ and Canadian ecosystems and assess the utility of N, P and C stoichiometry in wetland functioning. We found that peat stoichiometry patterns were generally congruent for both ecosystems, i.e. C:N ratio decreases as peat decomposes, while the C:P ratio increases, as does the N:P ratio. This long-term collaboration contributes to our understanding of the 'cascade' of C and nutrients as plants transform into litter and peat under varying wetland conditions and what effect disturbance (e.g. drainage, climate change) may have on stoichiometry, C sequestration, and hence ecosystem resilience.

Extracting an 8-m peat core at Moanatuatua Bog for peat analysis, April 2018. Left to right: Scott Bartlam, Joss Ratcliffe, Tim Moore. Photo Bev Clarkson

Waikato bogs provide important research site for increasing peatland capability. The research sites at Kopuatai bog (since November 2011) and Moanatuatua peatland reserve (since May 2015) are still running well and providing quality datasets on ecosystem carbon balances and ecohydrology that are being incorporated into new outputs. Two current students have based their research at these sites. PhD student Joss Ratcliffe is writing up his thesis and will shortly be submitting a journal paper describing the contemporary CO_2 exchange processes of these two bogs, which are in contrasting hydrological condition. MSc student Connie Daws is comparing the water balances and water table regimes of both bogs in order to determine the key factors driving the deep water table at the Moanatuatua remnant. Data from a transect of nine recording water level sensors across Moanatuatua are a key component of this work. In addition, Clara Wilson is starting her MSc research on the recovery of *Empodisma robustum*-dominated bog vegetation from fire. In particular, she will be investigating plant successional processes at the site of the November 2017 lightning-initiated fire at Kopuatai bog, with support from Department of Conservation.

Kopuatai bog, March 2018. Left to right: Tim Moore, Dave Campbell, Connie Daws, Claire Eyeberg. Photo supplied by Dave Campbell.

Whangamarino kahikatea restoration experiment. Techniques for establishment of kaihikatea are being tested in former willow treatment (and control) sites at Whangamarino. Kahikatea is one of the few native wetland species that can overtop and hence outcompete willows; however, there is very little seed source remaining in Whangamarino Wetland. In wetlands in the wider Waikato region, shading by willow appears to be the main factor hindering kahikatea re-establishment. We set up the restoration experiment in 2015 and are assessing the value of regular clearance of light wells for establishment and growth of kaihikatea, and the planting of kahikatea in clumps compared with planting as lone trees. The project is a long-term collaboration with DOC's Arawai Kākāriki programme, with the aim of providing best practice for restoring large-scale, willow-invaded wetlands.

Kerry Costley undertaking manual clearance of a light well around an establishing kaihikatea plant. Photo James Sukias.

Wetland International Internships enhance wetland restoration initiatives. Two international interns, Sybil Beliez, France, and Yvonne Sabuga'a, Germany, undertook a 6-month and 3-month internship respectively, based at MWLR, Hamilton. They worked on National Wetland Trust restoration initiatives with Karen Denyer, and MWLR projects with Robbie Price, Scott Bartlam, and Bev Clarkson. Sybil completed a project on the feasibility of returning pateke (brown teal) to the Waikato peat lakes and wetlands, and Yvonne assisted with ecological monitoring, and possible release of geckos at Lake Rotopiko wetland. These internships are very important in contributing towards improving restoration approaches, sharing wetland knowledge, increasing wetland capability, and developing international collaborations with wetland researchers.

Our two 2018 wetland interns: Yvonne, left, from Germany, and Sybil from France. Photo: Bev Clarkson

Repo Roopu (Wetland Group) making great progress. Yvonne Taura and Mahuru Wilcox organised our second Repo Roopu hui in July 2017. The Repo Roopu, comprising our iwi partners working with our wetland programme researchers, are steering wetland maatauranga Maaori priorities and have identified potential research projects, including a wetland communication network, increasing iwi capability through training waananga and whaanau/hapuu restoration projects. Wetland information is now shared via an E-paanui organised by Yvonne, which profiles members and the mahi being undertaken in their repo. The second newsletter in the series has recently been distributed to group members.

Lake Rotopiko BioBlitz significantly increases knowledge of species present. The National Wetland Trust (NWT) and Manaaki Whenua Landcare Research (MWLR) hosted a wetland Bioblitz on 16–17 Feb 2018 at Lake Rotopiko, south of Hamilton. The event was coordinated by Monica Peters, who won a MWLR-sponsored Bioblitz prize, and nominated the NWT as recipient. The event involved many schools and organisations (e.g. MWLR, NWT, Department of Conservation, Waipa District Council, Waikato Regional Council, Mercury, Waikato University, Waikato Institute of Technology, Forest & Bird), as well as our wetland programme members. Highlights included drone footage by MWLR, streamed footage of epiphytes from professional tree climbers, and finding new species of plants, animals (vertebrates and invertebrates), fungi and bacteria to add to the species lists. Postings include a video and on-line articles, e.g.: https://www.youtube.com/watch?v=Fe3ghfz5QpU; https://www.nzherald.co.nz/the-country/news/article.cfm?c_id=16&objectid=12007372. The BioBlitz provided a fun-filled platform to increase connections between science and the public, which is fundamental for increasing public appreciation and understanding of New Zealand's wetlands.

Peter Madison and Grace Hall identifying invertebrates at the Lake Rotopiko BioBlitz. Photo Bev Clarkson

Increasing public awareness of peatland ecohydrology. UW contributed datasets and expert knowledge to assist Waikato Regional Council and DOC evaluate the possible role of the Kopuatai peat dome during the severe flooding of the Lower Piako River basin in 2017. Dave Campbell presented on the hydrological functions of the peatlands during this intense sequence of floods, at a workshop in Paeroa. Dave also presented on "Valuing Kopuatai Wetland" at a Waihau-Piako Dairy Group workshop at Te Aroha.

Snippets

- UW has also contributed datasets from Kopuatai bog to a satellite remote sensing project, in association with NASA and the Centre for Space Science Technology, Alexandra. The EcoSTRESS instrument (https://ecostress.jpl.nasa.gov/) was deployed on the International Space Station in June 2018, and will deliver unprecedented detail on the response of plants to water stress. Kopuatai could become a key calibration/validation site for this instrument and lead to ongoing collaborations.

- MSc student Callum Douglas has completed most of his fieldwork at Otakairangi wetland in Northland, partly funded by the Living Water Programme. The primary research aim is to investigate the ecohydrological characteristics to determine the influence of bisecting and surrounding drainage systems on the natural hydrological processes, peat degradation state and vegetation composition.

- UW was invited to join the Global Methane Project based at Stanford University and funded by the Moore Foundation. This project aims to provide novel insights into the controls and timing of wetland CH_4 emissions. There are relatively few high-quality methane flux datasets available from wetlands globally, so Kopuatai is a rare case of a well-researched Southern Hemisphere peatland.

- In November 2017, Dave Campbell was invited to present a symposium paper on the carbon balance of NZ peatlands, at the Wageningen Centre for Wetland Ecology, titled "New Zealand bogs persist as strong carbon and GHG sinks during droughts and artificial water table lowering".

Graduate field trip to Kopuatai bog, March 2018. Photo: Dave Campbell

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