Fundamental shifts in aquatic systems following evidence Maori settlement in high country New Zealand

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Understanding aquatic ecosystem response to the first human impacts upon landscapes is often confounded by the long-term human habitation in many regions of the world. Due to its short period of human occupation, New Zealand is in a unique position to provide insights into lake response to initial human-induced landscape changes. Polynesians arrived in New Zealand ~800 years ago and settled rapidly across the country. Vegetation on the South Island was transformed, and in the Canterbury high country, the region of this study, native forests were converted to tussock grassland. We examined the diatom record from two small; Lakes Emma and Emily, and two medium sized lakes; Heron and Pearson, to explore aquatic ecological response to the aforementioned landscape change. The expectation was that smaller lakes would be more responsive to the landscape changes. The lacustrine response to deforestation within the catchment, however was more pronounced in Lakes Pearson and Heron. In Lake Pearson, diatom assemblages shift from both planktonic and benthic taxa to a primarily planktonic assemblage. In Lake Heron, there were major shifts between planktonic taxa Discostella stelligera and Aulacoseira ambigua, representing increases in nutrients. While lakes Emma and Emily experienced significant changes in diatom assemblages, these shifts were subtle, and were associated with changes between benthic and epiphytic taxa. This study, nevertheless, indicates that major ecological shifts have occurred in lakes in the Canterbury high country as a result of the first human activity in the area, while demonstrating the complexity of lake systems in the region.

Prospects for wetland recovery clouded by the long-term legacy effects of catchment development, the Murray Darling Basin.

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Australia's Murray Darling Basin hosts 30,000 wetlands, 16 listed under the Ramsar Convention. Recently, the Basin has become internationally renowned for massive fish kills, intense droughts and a highly contested $13B Plan that aims to take water allocations from irrigated agriculture to restore aquatic ecosystems. The wetlands that exist in the floodplain of the southern basin are among the most studied paleolimnologically and over 20 years of evidence has attested to considerable change over centuries. In particular the wetlands have suffered elevated sedimentation rates, eutrophication, reduced light environment and critical transitions in food webs leading to the collapse of submerged macrophyte beds and littoral fauna. The monitoring and management focus of the Plan is on returning water to benefit channel ecosystems and improve connectivity with wetlands. However, the sediment record suggests that the river is a major source of nutrients and fine sediments to adjacent wetlands. Further, to meet watering and allocation obligations, the main channel is being used to transfer large volumes of water leading to extensive bank collapse, augmenting causes of the high turbidity. The lesson from the past, that remains unheeded in this rush to restore, is that the management of water quality is central to the recovery of the light environment needed to rehabilitate the plant beds that hosted the diverse ecosystems that existed in Indigenous times.

Reconstructing historical cyanobacteria abundances from lake sediment cores: do pigments and DNA tell the same story?

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Understanding the historical onset of cyanobacterial blooms in freshwater bodies can help identify potential drivers. Lake sediments are historical archives, containing information on what has occurred in and around lakes over time. Paleolimnology explores these records using a variety of techniques but choosing the most appropriate method can be challenging. We compared results obtained from a droplet digital PCR assay targeting a cyanobacterial-specific region of the 16S rRNA gene in sedimentary DNA and cyanobacterial pigments (cyanopigments; canthaxanthin, echinenone, myxoxanthophyll and zeaxanthin) analysed using high-performance liquid chromatography in four sediment cores. There were strong positive relationships between the 16S rRNA gene copy concentrations and pigment concentrations, while differences were observed among lakes and sediment core depths within lakes. This is most likely due to differences in cyanobacterial species between lakes and over time within each lake. Because not all cyanobacteria species produce the suite of pigments analysed in this study, the relationships were more consistent when all pigments were summed. We recommend this approach when making inferences about changes in the entire cyanobacterial community. Each method had benefits and limitations which should be taken into consideration during method selection and when interpreting the data. Overall, the measurement of cyanobacterial abundance using sedDNA was comparable to measurement using sedimentary pigments and could be adopted in future paleolimnological studies.

Recovery of lake communities following volcanic eruptions: evidence from the palaeoecological record

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The sediment of freshwater lakes can be used to track environmental change over short and long temporal scales. In New Zealand, lakes have been subject to a range of natural and human-induced perturbations over the last 1,000 years. There is limited data on how lakes respond to natural events, such as volcanic eruptions, and whether communities change in a similar manner to shifts observed after anthropogenically-induced impacts, or whether they recover to pre-disturbance condition. The catchment of Lake Okataina, in the Central Volcanic Plateau, is dominated by native vegetation making it an ideal setting to explore these questions. The 1886 eruption of the nearby Mt Tarawera, deposited a significant layer of ash into the lake and initiated a significant shift in the limnological and biophysical properties within the system. In the present study, a sediment core from Lake Okataina was analysed using suite of paleoenvironmental techniques including; environmental DNA, hyperspectral imaging, ITRAX scanning, morphological analysis of chironomids and pollen identification. These methods were used to assess and quantify the relative changes resulting from the volcanic eruption. Results will be presented and implications for lake management discussed.

Critical barriers, and responses, to achieving wetland restoration in New Zealand

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Wetland loss in New Zealand is continuing, and where remnant wetland systems remain, the impact of invasive species, hydrological modification and water quality contamination are extensive. Of the c.250,000 ha of inland wetlands that now exist it is estimated that some form of restoration, or conservation management, is underway for at least 30,000 ha (>12% by area). The degree that measurable and meaningful restoration outcomes are being achieved is however variable, or often not monitored. There is also limited knowledge on whether 'gains' from wetland restoration are greater than the 'losses' due to ongoing land and water development.

This paper provides a summary of the symposia on 'Advances in wetland restoration in New Zealand'. It presents a framework to 1) evaluate critical barriers that impede restoration outcomes and 2) establish landscape-scale action plans (responses). It draws on symposia conclusions that within New Zealand the primary ecosystem pressures are habitat loss, invasive species and catchment modifications, which give rise to secondary drivers that are often highly complex, including altered predator-prey interactions, fragmentation and interruption of peatland development.

A set of wetland restoration principles for New Zealand are presented – these principles emphasise investment in wetlands: that are rare, depleted or regionally significant; contain core habitat for threatened or taonga species; provide critical ecosystem and cultural benefits (services); deliver important landscape functions; and, critically, where ecosystem pressures can be effectively managed.

Up, up, and away – aquatic macroinvertebrate community responses to wetland rewetting

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Aquatic invertebrates are one of the most diverse and abundant faunal groups found in wetlands, and they play a pivotal role in the functioning of these ecosystems. Aquatic invertebrates are the primary trophic link between plant-based organic carbon (detritus, algae) and high vertebrates. However, hydrological alteration can adversely affect these communities, which in turn can have a major influence on the ecological structure and functioning of wetlands. Many wetlands have had drainage channels cut through them to lower their water tables for agricultural development. One such example, and the focus of this study, is Moawhitu wetland on Rangitoto ki te Tonga (d'Urville Island). This wetland forms part of a project, primarily led through a partnership between Ngāti Koata and the Department of Conservation (DOC), which aims to restore the mauri and wairua at this mahinga kai site. To help restore the wetland, a water level control structure was installed on the wetland outlet. This structure has resulted in increased water levels over large areas of the wetland. To assess the response of the invertebrate community to this rewetting, aquatic invertebrate surveys were undertaken at five sites throughout the wetland on three separate occasions: November/December 2018 (pre-install), February 2020 and 2021 (both post-install). These surveys, and the resulting data, have enabled us to quantify the response in wetland invertebrate communities to restoration efforts. Following rewetting, species richness increased, while the composition of the invertebrate community shifted towards that more indicative of a lentic habitat (more aquatic coleopterans and hemipterans, and odonates).

Wetland drainage and large-scale catchment modifications in New Zealand

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New Zealand follows a similar theme to the rest of the globe, large scale drainage of our wetlands over the last century. Remaining wetlands are often under pressure from wider catchment processes, including land clearance and agricultural intensification, which often leads to water quality degradation. This paper will discuss the importance of ceasing ongoing wetland habitat decline which may lead to irreversible change, and the complexity of wetland restoration.
Local case studies will be presented on wetlands that are currently impacted from hydrological and catchment modifications and how restoration is or could be approached in each of these environments. This will range from large Ramsar wetlands impacted by flood control schemes and wider catchment pressures such as farming, forestry and urbanisation, through to isolated wetlands in conservation reserves with minimal ongoing anthropogenic pressures. We observe that eco-hydrological restoration at each site is dependent on 1) an understanding of the necessary hydrological changes and potential ecological responses, 2) defining the end goal for restoration, and 3) identifying the limitations and trade-offs in implementing changes to hydrological regimes. Restoring wetlands takes time, effort and can be costly. Whilst it is important to undertake these restoration works, protecting our existing wetlands from ongoing threats (and reducing the need for restoration) should be at the forefront of wetland conservation works.

Indigenous and traditional knowledge can be the new foundation for Wise Use of wetlands

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This talk is based on the literature and observations on the pattern of engagement of traditional knowledge in wetland conservation. The Ramsar Resolution XII.2 recognised that the wise and customary use of wetlands by indigenous peoples and local communities could play an important role in their conservation and Wise Use. However, this talk claims that there has been a general consensus that in recent decades traditional and indigenous knowledge and participation by traditional owners have not been as much it should be. With the increasing damage that global wetlands are set to face under the Climate Change and Sea Level Rise scenarios, wetlands do need modern scientific knowledge, however, it is believed that the effectiveness and efficiency of modern tools can be much greater and time-efficient if combined with traditional knowledge. It is even plausible that some problems may only be overcome with traditional knowledge. It is proposed that much valuable traditional knowledge would have to be retrieved from various sources and their history. Increased and regular participation of traditional knowledge-keepers requires their willingness but most importantly, a need for creating a favorable environment so that they feel welcome, valued and involved. The talk also projects a probable mismatch between the format of traditional knowledge and modern technologies, which will be another future challenge to face.

Mekong University Network as a premiere training and research network for wetland management in the Mekong region

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In 2002, eight large public universities from Cambodia, Lao PDR, Thailand and Vietnam, with facilitation from the International Crane Foundation-USA, joined to create a network of universities with the primary purpose of advancing wetland ecology and management in the Mekong Region of Southeast Asia through teacher training and curriculum development. Since then, the "University Network for Wetland Research and Training in the Mekong Region" has facilitated annual training courses for teaching staff and young researchers, and the network's membership has grown to include 24 major universities from all six Mekong countries and Malaysia. To date, the Mekong Network has organized 16 regional and 4 country-level training courses, engaging more than 400 university lecturers and wetland managers in Southeast Asia. In addition to training, the Network facilitated regional research projects on subjects related to wetland ecology and biodiversity conservation. The largest study—which involved 10 Southeast Asian and 3 US universities and research institutes, with the participation of 120 researchers and technicians— operated at an unprecedented scale, sampling more than 450 wetlands across five countries of the Mekong River basin to evaluate the state of contamination by persistent organic pollutants in natural wetland ecosystems. By pooling the resources and expertise available among member universities, the Network provides high quality training at an affordable cost. The Network has also proven a good conduit for connecting wetland research and academic communities of the Mekong region with the world and provides an excellent model for advancing wetland training on other continents.

Revival The Theory of "Unity between Heaven and Man": Fit Traditional and Community Knowledge In Contemporary Wetland Conservation Scheme and Policy of China

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Among its glorious history of civilization, the theory of “Unity between Heaven and Man” is the core value of Chinese towards the relationship between man and nature. Numerous ancient philosophy books, government decrees and folk laws recorded how ancient Chinese protected and utilized the precious resources of wetlands. At an era of ecological civilization renaissance, China’s central government now put a great effort on wetland conservation and restoration among other green development measures. It is a challenge but also an opportunity to integrate ancient wisdom into contemporary wetland conservation scheme and policy. This paper reviewed Chinese traditional and community knowledge on wetland conservation and wise use, then compared with some of the ongoing wetland conservation practices to identify bonding points between traditional and community knowledge with current scientific practices. Then the paper presents a case study at National Wetland Park to show how indigenous people, the Ewenki nationality, conserve surrounding wetland, inherit their culture and develop ecotourism as an example of the implementation of “Unity between Heaven and Man” in modern society.

WWT – engaging local people for sustainable wetland conservation

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Steart Marshes, UK, is a major project creating nearly 500 ha of salt marsh from existing arable land to mitigate for sea level rise. WWT employed staff with the skills to engage and consult with local people, and this has resulted in a positive project that has been welcome by local communities.
With the impacts of climate change being increasingly felt in the UK, particularly extreme weather events and flooding, we cannot continue to rely in traditional built flood structures. WWT staff skilled in outreach are working with farmers and land managers to put in place more natural flood management approaches.
In urban areas, WWT employs consultative techniques to raise awareness of wetlands and SuDS (Sustainable Drainage Systems) as positive elements of the urban environment. Work with schools, community groups, local authorities and park managers has raised awareness and led to creation of wetlands in urban areas.
WWT's 10 wetland centres now welcome over one million visitors a year across the UK. Many of our visitors have little or no knowledge or experience of wetlands. We use formal and informal techniques to raise awareness and support learning.
Citizen science has been used at WWT for decades, with our members and the public sending in reports of sightings of wetland birds to inform our long-term reporting on numbers and distribution of key species.
In conclusion, a vast range of techniques can be employed to engage local stakeholders, leading to positive acceptance of change and proactive support for wetland creation and conservation.

Cultural, local community and Indigenous peoples' issues for a Declaration of the Rights of Wetlands

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Concurrent 4D, October 12, 2021, 1:00 PM - 3:00 PM

Much of the recent growth in contemporary formal recognition of the rights of nature draws on improved understandings about the belief systems and traditional practices of Indigenous peoples and local communities (IPLCs). The cultural and linguistic heritage of IPLCs contributes to the world's diversity. Their knowledge and practices have enhanced respect for the environment and natural resources, often offering models of sustainable approaches to water security, food security, health and well-being. Rights of wetlands can be an important component of enlightened and holistic approaches of this kind, which see the human species as part of the ecosystem rather than apart from it. Increasing evidence suggests that land demarcated as Indigenous Lands protects the natural environment through reduced rates of wetland degradation and deforestation, less habitat conversion and lower greenhouse gas emissions compared to surrounding areas. Traditional knowledge and management practices often play a significant role in protecting crucial habitats and the socio-ecological systems they support. The United Nations Declaration on Rights of Indigenous Peoples addresses the most significant issues affecting indigenous peoples - their civil, political, social, economic and cultural rights. A declaration of wetland rights needs to fit with this philosophy, and to support the wisdom and rights of IPLCs with respect to the landscape and their relationship with wetlands. This paper sets out some key ingredients of the required approach.

Declaration on Rights of Wetlands: changing our paradigm to improve wetland outcomes;

Prof Max Finlayson[1]

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The loss and degradation of wetlands has continued despite the development and successes of the Ramsar Convention on Wetlands over the past 50 years. This worrying outcome has led to an investment in alternative or complementary approaches to wetland management that focus more on the active participation of people, both local communities and those from further afield. This has include seeing wetlands as settings for human wellbeing, and by linking wetlands to the extinction and climate crises. The key features of these approaches are explored and placed in the context of the developing impetus to establish a universal declaration on the rights of wetlands. As this has developed it is being seen more and more as a next step in the campaign to ensure the wise use of wetlands and not just as complementary to the noble goals expressed by established multi-lateral environment agreements. It does build on these but also raises questions about the conservatism of existing international mechanisms and the seeming weaknesses in approaches that focus on the rights of communities and the rights of nature to exist. A new paradigm is in place, and now needs impetus to fill the well identified gaps in existing mechanisms.

Notes of Struggle: Legal and Ethical Strategies to Recognize Nature as a Living Being

Ms Patricia Gualinga[1]
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In this presentation Patricia will discuss the Sarayaku's struggle to achieve the recognition of the Amazon, including its wetlands, as a Living Forest. From grassroots organizing in the Amazon, to lobbying of legislators and meetings in the Vatican, this presentation will discuss the range of strategies the Sarayaku people have deployed to bring about the awareness of the Amazon as a Living Forest and support the creation of legislation that recognizes the right of key ecosystems, such as wetlands and forests, to exist insulated from human presence and interference. Patricia will discuss ways in which the Sarayaku have used modern communication technology to create international networks and educate and communicate with local and global publics, while staying connected to their ancestral knowledge, culture, and daily practices in the heart of the Amazon. The presentation will analyze the key lessons from successful and less successful efforts and reflect on possible new avenues for effective local to global collaboration and action. This talk will also provide fertile ground for out of the box brainstorming for effective international collaborations to make the Living Forest and the Rights of Nature, including wetlands, integral to the strategies for restoring and preserving global ecosystems.

Rights of Nature and Wetland Rights: Responding to the Scientists' Second Warning to Humanity

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The World Scientists' Warning to Humanity: A Second Notice (2017) and The Second Warning to Humanity – Providing a Context for Wetland Management and Policy (2018) outline stark warnings about the trajectory that humanity and the planet are on and specific actions that wetland scientists can take in response. Driven by human activities, climate destabilization and biodiversity loss pose existential threats to wetlands, ecosystems and society. In response to these crises, a growing global Rights of Nature movement provides a promising paradigm shift that reframes the human-Nature relationship, shifting it from one of exploitation and depletion to one based on:

- reciprocity;
- recognition of the inherent and inalienable right of natural systems to exist and to avoid degradation;
- recognition of the legal and living personhood of Nature;
- recognition of the ethical and legal responsibility humans have for ecosystems and biodiversity;
- recognition of the dependence of human health and well-being on healthy ecological function.

Rights of Nature and the living personhood of Nature have been recognized throughout human history and across cultures around the world, and particularly by Indigenous and local communities. A group within Society of Wetland Scientists proposes a Universal Declaration of the Rights of Wetlands that encompasses all wetlands as defined by Ramsar. This presentation will articulate the context for the proposed Declaration, will outline what the Declaration entails, how it differs from existing rights of Nature declarations, and how the Declaration can be utilized to further conservation, protection and restoration of wetlands globally.

The Living Forest Worldview

Ms Patricia Gualinga[1]
[1]*Tiam Foudation, Worcester, Ecuador*

Concurrent 4D, October 12, 2021, 1:00 PM - 3:00 PM

This presentation will focus on Sarayaku's Declaration of the Living Forest and highlight its relevance to the protection and restoration of wetlands. During the presentation, Patricia will discuss the Sarayaku People's ancestral knowledge of the Forest as a multidimensional ecosystem constituted by both physical and non-physical intelligences and address subtle aspects of deeper ecological damage that are not yet clearly understood. She will also discuss the moral and epistemological reasons why key ecosystems have the right to exist in perpetuity, free of human presence and interference. This novel call to consciousness and action grounded on ancestral knowledge of Nature's beingness, presents a fresh paradigm for a balanced and respectful relationship between humans and Nature and the pursuit of ecological and wetland restoration and conservation.

The Rights of Wetlands in support of a safe climate and effective wetland restoration – The charter model

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Wetlands are an integral component of the global ecosystem that connects through gas exchange with the atmosphere. Wetlands sequester carbon dioxide and respire both carbon dioxide and methane. They support biological diversity including migratory birds that connect local wetlands to global biodiversity. Current attempts to declare that wetlands have a fundamental right to exist can learn from previous declarations based upon the charter model. We will examine the World Charter for Nature (WCN) (1982) and the World Charter (WC) (1999), and determine if either provides a suitable model for a declaration of the rights of nature.

WCN is a UN document that declares the value of nature and defines five principles for conserving it, but does not declare rights for nature..
The Earth Charter is a civil society initiative that has been endorsed by UNESCO and many societal groups including indigenous people and some representatives from government including mayors and other officials. It was proposed by Maurice Strong and Michael Gorbachev as the World Commission on Environment and Development was drafting Our Common Future in 1987, the report that defined sustainable development. In many ways it provides a template for more recent proposals for the Green New Deal in the United States and the Green Deal in Europe. Like those efforts, at creates a global order that links environmental conservation with socio-economic issues.
This analysis seeks to determine whether either of these two charters provide a useful structure or precedent for a Declaration of the Rights of Wetlands.

Wetlands: a necessity - not a gratuitous possibility

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The 12.8 million km2 of today's wetlands are 13% of those existing in the 1700s, and will be about 0.1 ha per capita by 2100, assuming no more losses. They are less than 10% of the inhabitable land mass, but hold one-fifth of the world's soil carbon. The rising concentrations of nitrogen, phosphorus and sulfur in air and water may compromise the climate benefits of carbon burial in wetland soils that produce 15-40% of the global methane and N2O emissions. Results from multi-year field experiments demonstrate that increased nutrient availability and higher temperatures may cause a decline in below-ground biomass, weaken soils, enhance greenhouse gas emissions, and decrease resilience to hurricanes. The global reach of wetland influences on a multitude of ecosystem attributes thus extends far beyond a regional landscape perspective and are a fertile aspirational ground for a collective global valuation that wetland conservation/restoration needs and humanity requires.

Interrelations between hydro-geomorphological and biological factors in floodplain wetlands of semi-arid regions in New South Wales, Australia

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Studies of hydro-geomorphological and biological factors focus on the interrelations between organic and inorganic components of ecosystems. In wetlands, they drive patterns and processes of wetland functioning. In this talk, we present a summary of our findings from multidisciplinary studies undertaken over the past 10 years in floodplain wetlands of semi-arid regions (primarily Macquarie Marshes) that investigated the interrelations of nutrients, carbon, bacteria, algae, zooplankton and kangaroos with hydro-geomorphological factors. Our findings highlight the importance of holistic studies and monitoring at various temporal and spatial scales to manage a bio-diverse, sustainable structure and function of floodplain wetlands in semi-arid regions.

Reproduction and dispersal in aquatic plants - the role of sexual and asexual reproduction in Eleocharis acuta (common reed) and Marsilea drumondii (common nardoo)

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Vegetative or clonal reproduction, involving the production of genetically identical individuals, is an important reproductive strategy shared by many aquatic plants. Asexual reproduction in aquatic plants has been suggested to be an assurance for population maintenance, while sexual reproduction is responsible for population restoration from extreme events at an evolutionary timescale. This would suggest that asexual reproduction is more common than sexual reproduction within populations and that dispersal of seeds rather than asexual propagules occurs infrequently between populations. Understanding the role of sexual and asexual reproduction in aquatic plants improves our ability to manage them and predict potential risks around changes to flow-regimes. Recent advances in genomic tools have allowed the differentiation of individual plants and the extent of clonal growth. We collected leaf samples from three wetlands on the Lachlan River, of two widely distributed and important wetland plants in the Murray-Darling Basin, Eleocharis acuta (common reed) and Marsilea drumondii (common nardoo). Both species are rhizomatous aquatic plants with varying sexual reproductive strategies. DNA was extracted and genotyped using DarTseq platforms. Sexual reproduction and dispersal appears to be important within and between wetlands, with few clones occurring. Long-distance dispersal i.e., between wetlands appears to be rare, with high genetic differentiation between wetlands. Genetic differentiation increased with geographic distance, even over very short distances (< 5 m) suggesting seed dispersal is most common over very short distances. As seed dispersal between wetlands is rare, the maintenance of aquatic plant communities rather than restoration is recommended.

Understanding the impact of artificial flood schemes on an endangered wetland specialist species: the Australasian bittern

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Wetlands are complex, dynamic systems that form a critical part of our natural environment. To protect these systems internationally, conservation efforts rely on in-depth knowledge about how different hydrological regimes impact wetland health, wetland composition and the needs of wetland specialist species.

Here we characterise water level requirements of an endangered wetland specialist bird (the Australasian bittern) at a RAMSAR site actively managed as part of a flood storage regime (Whangamarino wetland, North Island, NZ). We used a digital elevation model, and river stage records, to model how different management regimes impact water levels in bittern breeding and feeding habitats. We were able to demonstrate that bitterns have specialist feeding requirements (mean water depths = 17.56 cm in areas with reeds and rushes), and that current flood regimes are negatively impacting these habitats. Further scenario work will examine how anthropogenic pressures impact the area available to bitterns at Whangamarino wetland, and how regularly these impacts have occurred over the last 70 years. This knowledge will enable us to better understand how to manage water levels at Whangamarino wetland, to provide more habitat for bittern, particularly during critical periods when feeding or breeding habitats are otherwise limited. This will enable us to start reversing declines and promote population growth in Australasian bitterns. Results and methods are applicable to any wetland with any endangered species that has specific water level and habitat requirements.

Wetland monitoring on a blue planet with rapidly shifting baselines

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In the Ramsar Convention context, it is recommended that wetland monitoring is based on data collected through inventory, surveillance, and assessment activities and guided by hypotheses, for example on the outcomes of management and/or restoration efforts. In this presentation, I will discuss the process and ongoing evolution of wetland monitoring.
The Ramsar Convention generally recognizes that the ecological character of wetlands have natural 'non-static' baselines, as these ecosystems have a degree of natural variability. Establishing the appropriate reference conditions for wetland management may be problematic, especially for ecosystems heavily affected by human activity. On our blue planet undergoing ecological and climatic crises of unprecedented proportions, the conservation, management, and/or restoration of wetlands need to rely on the best available knowledge, including quantitative and qualitative data and observations and modelling outputs. To solve these challenges, ecological forecasting can be used to predict future environmental conditions and their impacts on wetlands and can thus support their wise use through adaptive management. However, the path from data gathering to decision making is often long and complicated. A key issue is the lack of sufficient recognition and funding for wetland conservation and restoration. Moreover, monitoring and evaluation should include the level of involvement of local people in wetland management and its impact on decision making. Indeed, local traditional knowledge can co-inform wetland management, alongside scientific insights, to ensure we have wetlands that better support people and nature.

Wetland restoration: A sustainable strategy to restore lost ecological functions of wetlands

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Wetland restoration has been implemented globally to regain the lost ecological functions once provided by natural wetlands. Abandoned agricultural lands in coastal areas are promising candidates for restoration through tidal reinstallation. Wetland restoration on agricultural lands could provide water quality improvement benefits by removing nitrogen through denitrification. However, the same conditions present a potential environmental trade-off by promoting the production and emissions of greenhouse gases (GHG) such as methane (CH4) and nitrous oxide (N2O). Therefore, measurement of denitrification and CH4 and N2O from main sources like soil and vegetation is important. We present GHG budgets and nitrogen removal potential of a freshwater restored wetland to show the restoration of disused agricultural lands as a sustainable strategy for water quality improvement and GHG mitigation. Our findings will help scientists and policymakers to understand the development of restored wetland functioning as compared to agricultural land uses.

Wetland waterbirds: Where, when and why they need water

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River floodplain wetlands provide critical waterbird habitats, however the quality and availability of these sites are influenced by our water and vegetation management decisions. Protecting and maintaining suitable feeding and nesting habitats both between and during rain and flood events is essential to maximise waterbird recruitment, maintain populations, and conserve biodiversity. The use of valuable 'environmental water' within Australia's Murray-Darling Basin has often been focused on supporting completion of waterbird breeding events at nesting sites. However managers and policy-makers are becoming increasingly conscious of the need to also manage feeding sites and food sources at Basin scales. Appropriately managing environmental water placement is critical to facilitating the recruitment of juvenile birds into waterbird populations. Yet we lack basic knowledge of how water flows interact with other factors such as predation, weather extremes and food abundance to influence recruitment. For most species we also lack knowledge of the movements of adults and young during and between breeding events – where do they go, and why? Filling these knowledge gaps is key to improving the efficiency of environmental water management – applying water to the right places at the right times – and ensuring the success of future breeding events and waterbird recruitment. The Waterbird Theme of the Murray-Darling Basin Environmental Water Knowledge and Research Project (MDB EWKR) began filling these knowledge gaps and aspects of this research are now being continued as part of the Commonwealth Environmental Water Office's Basin-scale Monitoring, Evaluation and Research Project.

Delivering mahinga kai outcomes within a catchment wide, multi-party wetland restoration programme

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ABSTRACT:
Delivering mahinga kai outcomes within a catchment wide, multi-party wetland restoration programme.
Presenters: Dean Whaanga (Te Runanga o Awarua and Whakamana Te Waituna)

Waituna Lagoon sits at the bottom of a small (approximately 20,000 hectares), intensively farmed catchment. A RAMSAR registered site, it has high ecological habitat diversity, a unique macrophyte community, internationally important birdlife, and large areas of relatively unmodified wetland and terrestrial vegetation hosting nationally significant ecosystems.
Kai Tahu whanui have utilised resources of the lands and waters in the Waituna in ways that sustained healthy ecosystems and livelihoods. Access to the abundance of resources was accompanied by a responsibility to care for the lands, the waters and resources.
Over the past 150 years, however, human use has damaged the Waituna catchment, causing the degradation of water quality, water quantity, and habitat. Some species are in decline, habitats are in jeopardy, and food webs are changing. Waituna has undergone profound changes.

Presentation will focus on restoring Waituna as a mahinga kai, which is part of Whakamana te Waituna - a collaborative restoration effort that includes multiple partners representing agencies, Manawhenua, sector interest groups, landowners, and NGOs.

Restoration requires a long-term commitment with increased focus on protecting habitat and managing land development and use in the catchment, to ensure that restoration efforts outpace habitat loss and begin to accelerate the recovery trajectory of Waituna, especially the wetlands and lagoon.
Manawhenua know the challenge is complicated by how climate change and stresses of changing ocean conditions will affect Waituna.

Native or cultural ecosystem restoration? Insights from the wetland archaeology of Aotearoa

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Wetland restoration efforts in Aotearoa/NZ have been focused on reconstructing 'pristine pre-human' ecosystems with less attention placed on the dynamic cultural ecosystems that Māori constructed prior to European colonization. The vast kūmara (Ipomoea batatas) production networks, for example, that once connected pā (fortified village) and kāinga (households) across the extensive and fertile flood plains of the Waikato River revealed by archaeological excavations, provide clues to the former extent of past cultural ecosystems that supported large populations. These monumental cultural landscapes are unique and should be acknowledged with World Heritage status. Kūmara gardens based on puke (mounds) and rua (borrow pits), have been well described across Aotearoa, but little is known of the cultural wetland ecosystems that buffered the margins of forests, lakes and rivers, now areas that are targets for ecological restoration. Here, insights for wetland restoration are drawn from fossil records obtained from sedimentary deposits, capturing the last 1000 years of ecological change, both from sites in the Waikato, but also from the offshore islands. Working jointly with researchers examining the archaeology of lake pā construction in the Waikato, as well as the archaeology of irrigated taro (Colocasia esculenta) garden networks on the offshore islands, a clearer picture of these dynamic wetland ecosystems that connected and sustained different communities is drawn. Together with mātauranga Māori, ecological data captured from these lake and swamp sediments provides a baseline for restoration projects, further informing stakeholders of both the cultural and ecological heritage of wetlands.

Restoring mauri and enhancing the wellbeing of Lake Waiorongomai and surrounding wetlands

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Lake Waiorongomai and surrounding wetlands is a sacred site of great significance spiritually and culturally to local whānau, hapū and iwi. The land blocks remain in Māori ownership. This coastal dune lake is recognised by local government as a regionally significant ecological site because of its habitats for wetland species. These habitats persisted, even though they had suffered ecological decline from deforestation, hydrological modifications and destructive farming practices.

A hapū-led restoration project used a synthesis of Māori and Western restoration and research methods to bring about transformative change that had positive effects on physical, cultural, social, psychological and spiritual wellbeing. Ecosystem restoration is not only about the application of a remedy to a degraded ecosystem. It is equally about the reinstatement of whānau and hapū to their rightful place as kaitiaki in Te Taiao, as well as the reciprocity of giving back to the generosity given to us by Atua and tūpuna. Through the use of tikanga and kaupapa activities in the wetlands that aligned with the star patterning guidance of Atua.
As above, so below.

Who is eating who? Complexities of fish restoration attempts in New Zealand

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Sports fish were introduced to New Zealand over 150 years ago and have since woven themselves into the country's cultural and ecological fabric. With their superior requirements for clean and abundant fresh water, sports fish and their habitats are formally protected under New Zealand legislation and provide overarching protection for all aquatic ecosystems where they reside. While it is acknowledged that several native fish species have experienced population reductions and range restrictions since sport fish introductions, only one native species, the grayling, has become nationally extinct and causes of extinction remain unclear. Despite this fact, some nativists continue to actively persecute sports fish with the ideological belief that simply removing sports fish from aquatic systems will restore native aquatic communities to pre-human states. This view negates or simply ignores the impacts of habitat loss and land-use intensification and these naive approaches have had catastrophic impacts to native fish assemblages as 150 years of ecological and evolutionary fabric is torn apart.

Here we present data on dietary components of New Zealand's two aquatic apex predators, the shortfin and longfin eel (tuna), a taonga to local Maori, using stable isotope analysis and show the value of sports fish to tuna populations. Further, we critique the results of a sport fish removal experiment from a 7.5 ha shallow lagoon in the Lake Wairarapa complex and hypothesise mechanisms behind the avoidable decimation of the tuna populations and poor native fish recovery. Future management of freshwater fish assemblages are also discussed.