Developing transboundary collaboration in the Yellow/West Sea region of East Asian – Australasian Flyway Partnership (EAAFP)

Miss Hyeseon Do

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Following the China and Republic of Korea's successful stories on the inscription as the World Nature Heritage in the Yellow/West Sea region, we expect a continuity of this momentum for the next decades on conservation of intertidal wetlands and migratory waterbirds depending on them. Addressing the ongoing threats including climate change, pollution and spread of invasive species, national governments will strengthen their measures for conservation. Nonetheless, more immediate regional cooperation and dialogues based on knowledge base at the flyway, governmental and local level are pivotal.
The East Asian-Australasian Flyway (EAAF) for migratory waterbirds extends across 22 countries from their breeding as far north from Russia Far East and Alaska via East Asia to their non-breeding grounds as far south as Australia and New Zealand. The EAAF is home to some 50 million migratory waterbirds. It is the most threatened of the nine global flyways worldwide, supporting some 36 globally threatened species. Along the EAAF over 1000 internationally important sites for migratory waterbirds are under threat of habitat loss and degradation. While the Yellow/West Sea region provides critical habitats for migrating waterbirds, 65% loss of the tidal flats has been documented over the past five-decades. Hence, the migratory waterbird population has declined, particular those dependent on the Yellow Sea tidal-flats The EAAFP was established to build regional cooperation among various stakeholders to conserve migratory waterbirds and their habitats. This presentation will explain how transboundary and international collaboration can be enhanced by sharing knowledge, science, and management lessons across the EAAF, particularly in Yellow Sea region.

Migrations of bar-tailed godwits around the east Asian-Australasian flyway – threats and responses

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The population of the Alaskan-breeding Bar-tailed Godwit Limosa lapponica baueri, endemic to the East Asian-Australasian Flyway, is in steep decline – having dropped 12.7% in New Zealand over the past four years. This population spends the non-breeding season (austral summer) in New Zealand and eastern Australia. Godwits migrate north, undertaking a direct 10,000km flight to the Yellow Sea, where they stage for 4-6 weeks before making a 6,000km flight across the Bering Strait to their Alaskan breeding grounds. After breeding both adults and juveniles fly over the central Pacific to New Zealand – a nonstop 11,500km flight taking some 8-9 days and nights – the longest sustained flight migration of any bird. Godwits require rich feeding grounds to enable the build-up of fat and protein reserves to fuel these remarkable flights. It is thought that massive land claim around the Yellow Sea, which has resulted in a loss of 68% of tidelands in the past 5 decades, mostly in China and South Korea, is driving significant population declines in many migrant shorebird species – the more a species relies on the Yellow Sea the greater the rate of population decline. We will discuss ongoing problems of coastal loss and degradation, and highlight various positive actions, including China's 2018 ban of most coastal land claim and moves to achieve a trilateral World Heritage site.

Raising the awareness of environmental security through collaboration to share knowledge, science, and management lessons of wetlands across boundaries

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There is an increasing need for better science communication and more effective broader impact activities to both conserve and wisely use wetlands globally. As an important habitat for migratory birds, wetlands in Northeast Asia are a bottleneck for various migrating species along the EAAF between Alaska, Russia, China, and Mongolia in the North and Oceania in the South. Therefore, the region is in strong need of more knowledge and further studies for the conservation and wise use of its wetlands. Recently, the Ramsar Convention has entered into force in DPRK with its two wetlands designated as such closing gaps that persisted, which opens up an opportunity to understand the ecology of the region better. This presentation focuses on the background of the symposium and reviews the state-of-art knowledge of wetland ecology and management that has been established mostly based upon the experiences in Europe and North America. It will facilitate much-needed discussion on how we can establish a network of collaborators and knowledge across boundaries to better conserve and wisely use the wetlands in Northeast Asia with a special attention to DPRK.

Securing a future for endangered cranes and wetland biodiversity along the East Asian Flyway

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Four endangered crane species – Siberian, Red-crowned, White-naped, and Hooded Cranes – migrate long distances across East Asia where they face increasing threats due to water diversion/regulation, wetland conversion to agriculture, urban expansion, invasive species, fires, powerlines, and poisoning. The future of these imperiled migrants requires a whole-of-flyway conservation approach, with strategies that address needs at every stage of the annual migration cycle. On their breeding grounds, cranes disperse widely to territories that offer essential conditions for nest success: security from predators, adequate food, and optimal water conditions. As the impacts of climate change and land use change increase, we focus on protecting key wetlands that sustain substantial numbers of nesting cranes within their overall breeding range. Along their migration routes, cranes require multiple wetlands for stopover and staging to meet their feeding and roosting requirements. Natural drought and flood cycles, exacerbated by climate change, requiring us to conserve a strategic network of stopover sites and implement best management practices across those sites—aimed at ensuring that sufficient suitable habitat always will be available, despite conditions that can change unexpectedly from year to year. In the winter, cranes form large flocks, and the wintering sites must support large concentrations of birds for months at a time. Unique flyway conservation opportunities include Mongolian wetland/grassland complexes, the fragile Korean DMZ, and China's Poyang Lake, the most important freshwater wetland in East Asia. We draw on the deep cultural and spiritual connection that cranes inspire to safeguard these spectacular birds and wetlands.

The Yellow Sea working group- an innovative regional platform to support the conservation and management of the intertidal wetlands and associated species in the Yellow Sea

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The Yellow Sea ecosystem of intertidal wetlands, associated habitats and the biodiversity that depends on them, encompassed by People's Republic of China (PRC), the Democratic People's Republic of Korea (DPRK) and the Republic of Korea (RoK), is among the ecological wonders of the world. It represents the largest area of intertidal flats on the planet. It provides an important number of vital ecosystem services including fisheries, tourism, disaster risk reduction, blue carbon storage and climate change resilience, which profoundly underpin socio-economic development. Furthermore, this ecosystem provides a major contribution to the global natural heritage as well as that of the three Yellow Sea nations. It is the most important staging area for migratory waterbirds in the East Asian-Australasian Flyway (EAAF) with millions of waterbirds using these wetlands.

These Yellow Sea intertidal and associated coastal wetlands are critically threatened by a wide range of pressures, resulting in their degradation and destruction, especially through unprecedented rates of conversion; around 66% of intertidal wetlands in the Yellow Sea have been lost in the past 50 years. Consequently, fisheries and other coastal natural resources dependent livelihoods are at risk and populations of a number of migratory bird species have recently declined sharply. Considering the transboundary nature of the Yellow Sea, the interrelation between coastal and intertidal areas and species (e.g. birds, fish and shellfish) and the interdependency of coastal dependent livelihoods in the three countries, successful management and conservation are reliant on an informed and coordinated approach among the countries.

The need for the establishment of a regional cooperation mechanism in the Yellow Sea was discussed and identified as part of several national and regional workshops organised by IUCN and partners. During the International Symposium on the Conservation and Management of Intertidal Wetlands of the Yellow and Bohai Sea, held in Yancheng, China in December 2017, participants from the three countries agreed to participate in a joint working group for the conservation and management of the intertidal and associated coastal wetlands of the Yellow/West Sea, or Yellow Sea Working Group (YSWG). It is facilitated by IUCN, the EAAFP and the RRC-EA and implemented under the umbrella of IUCN World Conservation Congress Resolution 26 on the Conservation of intertidal habitats and migratory waterbirds of the East Asian-Australasian Flyway, especially the Yellow Sea, in a global context.

This working group, gathering government representatives and NGOs from the three Yellow Sea countries, is the first of its kind and ensures a coordination at regional level, to harmonise and catalyse national and joint actions on the conservation and management of the intertidal wetlands and associated species in the Yellow Sea.

Assessing the effectiveness of protected areas as ‘safe havens’ in the face of natural disasters and climate change

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Area-based conservation approaches include parks, protected habitats, seasonal closures, harvesting controls, wilderness areas and strict nature reserves. Their continued effectiveness is a fundamental necessity challenged by a fast-changing environment and associated habitat and resource shifts. Here we showcase empirical studies assessing the implications of natural disasters on freshwater and coastal protected areas that are sensitive to hydrological change. Widespread land mass displacement generated by earthquakes in Christchurch and Kaikōura provide rare opportunities to observe the actual effects of relative sea-level changes and draw analogies with climate change. Subsidence in estuarine saltmarsh resulted in wetland losses that require compensatory areas to be designated and restored. Major shifts in whitebait spawning grounds illustrated the impact of salinity perturbations on other habitats sensitive to change. Robust planning requires a combination of monitoring, buffer areas and adaptive responses to maintain the effectiveness of protections over time. In a case of lowering sea-levels, the uplifted Kaikōura coastline developed new wetland ecosystems in areas where accommodation space had previously been limited by infrastructure or topographic constraints. New wetlands meet the definition of rare and threatened ecosystems that trigger statutory protected requirements under law. Yet with progressive sea-level rise these ecosystems are likely to be lost with the return of coastal squeeze. These examples show how rare ecosystems can be formed and lost, providing insights for techniques such as translocation and assisted migration that will help ensure the longer-term effectiveness of protected areas as environmental conditions change.

Determining the hydrological functioning of palmiet wetlands in the Eastern and Western Cape of South Africa

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It is estimated that about 50% of original wetland area in South Africa has been lost and 65% of wetland ecosystems are regarded as threatened. Palmiet wetlands are a particularly threatened wetland type in South Africa. Palmiet (Prionium serratum) is a robust perennial plant endemic to wetlands and rivers located in the Table Mountain Group (TMG) geology in the Eastern and Western Cape. Palmiet is described as an ecosystem engineer because of its ability to alter its environment and create large valley-bottom wetlands. The Krom River catchment, an important water source for the city of Port Elizabeth, has been impacted by considerable palmiet wetland loss.

Despite significant investments into palmiet wetland restoration, knowledge gaps in our understanding of palmiet wetland structure and functioning remain, particularly regarding the hydrological functioning of these systems. This study investigated the hydrology (surface and groundwater) behind the Krom River wetland systems and found that the hydrological functioning is closely linked with high sub-surfaces discharges typically associated with TMG aquifers. The results suggest that the occurrence of palmiet as the dominant species is due to the sustained low flows related to catchment geology (aquifers with high storativity) and high hydrological connectivity between the catchment and the wetland enabled by large preferential sub-surface flow paths. In addition, geomorphology was determined as another clear system driver with erosion gullies found to be a natural part of system functioning. The results of this study have resulted in a major shift in restoration programmes for palmiet wetlands.

Exploring the limits of drought resilience in New Zealand's peatland carbon sink

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Concurrent 1B, October 11, 2021, 11:00 AM - 12:45 PM

Peatlands have served as persistent carbon sinks throughout the Holocene, leading to a net cooling effect on global climate. With the increasing inter-annual variability of precipitation and consistent warming caused by climate change, the stability of this sink is uncertain. However, New Zealand peatlands are uniquely equipped to maintain relatively large rates of annual carbon uptake, even during extreme drought years. We have shown the net carbon balance of Kopuatai Bog, an undisturbed New Zealand peatland, to be roughly 130 gC m-2 yr-1 during dry years, which is larger than most published rates for northern hemisphere peatlands during their strongest carbon sink years. Much of this is a function of water table regulation by the conservative evaporation regime of the main peat forming vegetation, Empodisma robustum, and of the year-round growing conditions here. Kopuatai water table depths rarely drop more than 30cm below the surface even during the most extreme summer droughts. This allows respiration rates to remain fairly constrained, albeit elevated during dry conditions. Here we expand on some of our previous work in this area by analysing a longer continuous record of carbon fluxes, capturing a greater range of variation in hydrologic conditions. With this work we aim to determine how stable the strong New Zealand peatland carbon sink may be in the face of future warming and more frequent drought years.

Monitoring wetland cover and landscape fragmentation changes in Ramsar sites over the past three decades

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The Ramsar convention was created as a direct response to large scale wetland loss. Five decades on, and threats towards wetlands have not lessened regardless of the protection levels implemented. Previous studies of Ramsar sites generally focused on a relatively small selection of study sites over a relatively short time period and investigated topics such as wetland classification, ornithological surveys, risk and impact assessment. However, there have been a lack of global study of wetlands over an extended period. Addressing this challenge, we undertake a global wetland study to not only investigate the changes in land cover and their distribution within Ramsar sites but also identify their impact on fragmentation and habitat loss. We analyzed the annual changes in land cover and surface water from 1992 to 2018 using the ESA CCI 300 m land cover dataset and the JRC Global Surface Water - Yearly Water Classification History dataset. The degree of fragmentation was then evaluated in terms of landscape metrics such as patch size, number of patches, patch boundary length and boundary to area ratio. Finally, habitat alterations were identified from the changes in land cover and surface water with the aid of a land cover change matrix. These changes were additionally analyzed through a series of nested internal buffers and an external buffer to compare the changes internally with the area surrounding the site.

Restoring peatland in a regional park

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Concurrent 1B, October 11, 2021, 11:00 AM - 12:45 PM

Greater Wellington Regional Council has a goal to become carbon positive by 2035. As part of this objective, grazing on the regional parks is being phased out and restoration of indigenous ecosystems are now being prioritised in areas that were previously farmed. One of these restoration projects will involve the re-wetting of 90ha of peatland in Queen Elizabeth Park. The goal is to raise water levels on the drained site to provide optimal conditions for the re-starting of the peat forming process and re-establishment of peat forming species. The peat is up to 4m in depth in places, but has been grazed for many decades. One of the biggest challenges for the project is the hydrological re-design, as changing water levels in the park may impact on neighbouring properties, storm water systems and roads. Progress on the project will be described.

Can invertebrates be used to assess wetland health?

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Concurrent 1C, October 11, 2021, 11:00 AM - 12:45 PM

The urgent need to preserve New Zealand's remaining wetlands demands that environmental managers have informative monitoring tools. Freshwater invertebrates are widely used to assess the ecological condition of rivers and streams. However, how wetland invertebrates respond to human induced environmental change remains unclear. Research on 14 freshwater wetlands in the lower North Island of New Zealand including urban lagoons, agricultural swamps and protected lacustrine wetlands, revealed no link between the composition or diversity of macroinvertebrate assemblages and wetland condition. Nevertheless, freshwater wetlands are highly biodiverse ecosystems that are a priority for conservation. Between 2017 and 2020 macroinvertebrate communities were monitored in an Oxbow Lake in Palmerston North to assess the potential impacts of increased stormwater on the wetland. This example illustrates the challenges that remain for assessing protection of wetlands using invertebrates.

Flood Mitigation Benefits of Western Coastal Wetlands in Taiwan

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Concurrent 1C, October 11, 2021, 11:00 AM - 12:45 PM

The continuous increases of carbon dioxide concentration in the atmosphere have gradually raised the intensity and frequency of extreme climate occurrences around the world. Meanwhile, heavy rainfall and rising sea levels have caused huge floods in various countries. Because Taiwan is located in an active area where tropical cyclones are formed, floods occur almost every year and seriously threaten to damage the lives and property values of coastal residents. Especially the southwestern coastal area has faced floods even worse than other areas due to the land subsidence problem. This paper aims to estimate the flood water reduction and the flood mitigation benefits for 22 western coastal wetlands in Taiwan, with the whole area of 26,420 hectares. First, we reviewed literature and carried out field surveys to investigate the soil and plant flood mitigation per hectare in the chosen 6 wetlands, which cover 7 different vegetation types. Then, we applied the benefit function transfer to other 16 wetlands. The results show that the highest floodwater reduction of per hectare wetlands is 17,214 m3 for 'fish ponds' wetlands, and the lowest is 514 m3 for 'mangroves' wetlands. The floodwater reduction was 26,500 metric tons in total, and the flood mitigation benefit is NT$ 0.12 billion estimated with reservoir construction cost or NT$ 21.8 billion estimated with the detention pond construction cost. These results provide useful information to help the public and policymakers wisely choose whether to preserve or develop coastal wetlands.

Key Words: coastal wetlands, flood mitigation benefits, benefit function transfer,

GROUNDWATER DISCHARGE INTO COASTAL LAGOONS: INSIGHTS FROM A WAITUNA-TYPE LAGOON IN NEW ZEALAND

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Concurrent 1C, October 11, 2021, 11:00 AM - 12:45 PM

Coastal lagoons are important wetland environments found on every continent except Antarctica. These lagoons serve various ecosystem functions including providing habitat, aquatic food sources, sediment retention, flood mitigation and nutrient processing. Despite their significance, coastal lagoons are degraded worldwide from anthropogenic activities such as intensive agriculture, urbanisation and wetland drainage. Groundwater processes can impact coastal lagoons in a variety of ways including providing baseflow during dry periods, transporting and cycling of chemical species (e.g., nutrients), and driving ecological processes. Yet, groundwater input into lagoons is a poorly understood component of water budgets. This study explores several aspects of groundwater discharge to a coastal lagoon in Canterbury, New Zealand – Te Waihora/Lake Ellesmere. Large-scale airborne thermal imaging surveys and radon-222 (a natural groundwater tracer), conductivity and temperature measurements revealed locations of potential groundwater inflow to the lagoon primarily on the margins, confirming locations found in earlier studies, as well as identifying previously unknown locations. We calculated a radon mass balance to quantify the total groundwater discharge to the lagoon, which included an in-depth consideration of analytical and conceptual model uncertainties. The mass balance model revealed groundwater seepage to the lagoon 2-3 orders of magnitude higher than previous estimates. Lastly, we carried out a hydrochemistry survey, measuring major ions, nutrients and stable oxygen isotopes to resolve groundwater seepage sources to the lagoon and shed light on the hydrological relationship between the lagoon and the mixed sand and gravel barrier than separates it from the sea.

Sediment properties & denitrification capacity in seepage wetlands in pastoral hill country

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Concurrent 1C, October 11, 2021, 11:00 AM - 12:45 PM

Seepage wetlands are a common feature on pastoral hill country landscapes in New Zealand and offer the potential for nitrate-N attenuation through denitrification. Manipulating this naturally occurring feature may offer a relatively easy and cost-effective method of managing nitrate-N. However, this first requires a greater understanding of the physico-chemical factors influencing attenuation capacity, in order to allow optimization of seepage wetland function.

This study undertook a geographic information system analysis within the Manawatu and Rangitikei catchments to identify broad hydrogeological classes associated with seepage wetland areas. From the most commonly occurring hydrogeological classes, four sites were then identified, for sediment sampling to characterize the denitrification potential (DP), and how the potential varies across and along the wetland. Soil cores were taken to a maximum depth of 1 m. The influence of sediment characteristics on DP was assessed by examining their physico-chemical properties (e.g. dissolved organic carbon, redox condition, nitrate-N concentration, sediment texture). Sediment DP is also influenced by the rate of nitrate-N input and wetland hydrology. Therefore, water quality and flow are being monitored to help understand the dominant hydrological processes associated with the wetland. Flow is measured at the wetland inlet and outlet using an ultrasonic doppler instrument. Piezometers have been installed along the wetland at depths of 0.5, 1.0, and 1.5 m. Surface and subsurface water samples, collected bi-monthly, are analyzed for nitrate-N.

Preliminary results will be discussed within the context of nitrate-N attenuation in hill country seepage wetlands, which is important to help guide their future management.

Seepage wetlands: Valuable assets in our farmed landscape

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Concurrent 1C, October 11, 2021, 11:00 AM - 12:45 PM

Seepage wetlands are naturally occurring zones along stream banks, or at the heads of streams, with shallow, saturated organic enriched soils and water tolerant plants (e.g., wetland grasses, rushes and sedges). We review New Zealand seepage wetland research to provide evidence of their ability to attenuate pollutants. Attenuation is the difference between the mass of nitrogen that flows into and out of a wetland, which may be the result denitrification, temporary storage in plant biomass and/or transformation to particulate N and/or dissolved organic N. Attenuation is best quantified as the difference between measured inflow and outflow loads. In many of the studies reviewed, outflow loads were measured, but inflow loads were poorly represented because of their subsurface origin and diffuse nature. Reported nitrate-N removal rates for seepage wetlands in New Zealand varied from 30-8100 mg N/m²/d. Removal rates varied with concentration and were highest where nitrate concentrations were high and where flows entered wetlands. Vertical mixing in the surface soils (5-10 cm) is important in seepage wetlands because it brings surface water containing nitrate into contact with anaerobic and microbially-active soils. Compaction and channelization of wetlands reduces mixing, reduces soil/water contact times, and hence reduces nitrogen attenuation. A strong case can be made to protect and enhance seepage wetlands as a way of managing nitrogen concentrations in streams. Further seepage wetland inflow/outflow studies in a range of environments are required to better quantify their role at attenuating pollutants.

Constructed wetlands at a landscape scale: Experience from Te Ahuriri

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Concurrent 1D, October 11, 2021, 11:00 AM - 12:45 PM

Whakaora Te Ahuriri wetland is an ambitious project to restore ecological, cultural and social values through the construction of a large wetland system on land previously drained to support agriculture. The site is located where the margins of Te Waihora/Lake Ellesmere once met the freshwater input of the Huritini/Halswell River within the large flat gradient catchment in the Canterbury Plains. With an intent to improve water quality from upstream agricultural inputs, support mahinga kai uses and reinstate 'lost' biodiversity values, the design and construction followed a collaborative process to reflect the vision of the Te Waihora Co-Governance Group to work closely as iwi, central and local government, industry and the wider community, to restore the mauri of Te Waihora/Lake Ellesmere.

The design and construction of a large-scale wetland on a flat gradient catchment presented a number of challenges which needed to be worked through. These included a careful balance of cut and fill to manage potential impacts on flooding, design of hydraulic controls and wetland bathymetry to pass a controlled flowrate through the system and a well-considered earthworks and construction strategy to avoid too much disturbance of the soil which was highly responsive of the river and groundwater levels and quickly became unworkable with too much vibration.

Long-term, Te Ahuriri wetland will support a study of the effectiveness of constructed wetlands in terms of both Matauranga Maori and 'western' science to contribute to the progressive improvement of New Zealand's freshwater lakes and estuaries.

The Whakaora Te Ahuriri Constructed Wetland: An Example of Collaboration and Consensus

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Concurrent 1D, October 11, 2021, 11:00 AM - 12:45 PM

Ahuriri Lagoon, which drains into Te Waihora/Lake Ellesmere, was once a significant mahinga kai resource to Ngāi Tahu. However, with European settlement, the Lagoon was completely drained and the mahinga kai values had been all but lost. To improve water quality, mahinga kai, and biodiversity values, the Whakaora Te Ahuriri project was initiated to develop a constructed wetland at the site. The project has been a model of collaboration and consensus, with: the constructed wetland co-designed by consultants, staff, and representatives of mana whenua and neighbouring farmers; the delivery of the project by a multi-disciplinary project team; and the project's governance by the Te Waihora Co-Governance Group. With the completion of engineering and earthworks over the four-hectare site, and the installation of 124,000 plants, the wetland is now operational. The outcomes of the project will be measured via the complementary approaches of a Mātauranga Māori monitoring programme and an applied research methodology. Time invested in project relationships resulted in a design that met the aspirations and expectations of all partners, and the ability to overcome challenges during the design and construction phases.

Whakamataara Ahuriri – the journey towards reinstating and restoring a once thriving cultural ecosystem and habitat

Miss Mapihi Martin-Paul

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Ahuriri Lagoon is a former open water wetland and significant mahinga kai located on the Huritini / Halswell River in the Te Waihora / Lake Ellesmere catchment. For Ngāi Tahu whanui, Ahuriri is associated with their longstanding settlement and occupation of the Port Hills, Te Waihora and the wider Canterbury Plains.

Boffa Miskell consultants were tasked with designing and delivering a Mātauranga Māori Monitoring Programme as part of the wider Whakaora Te Ahuriri project. The objectives of the Mātauranga Māori Monitoring Programme were to demonstrate how to measure the cultural outcomes of the Whakaora Te Ahuriri project and determine whether the reinstated Ahuriri Lagoon has improved cultural outcomes for Ngāi Tahu Papatipu Rūnanga.

The Mātauranga Māori Monitoring Programme sought to integrate cultural values and aspirations into the design and construction of the wetland, with a particular focus on improving mahinga kai, by providing a catalytic wetland system that tests both its probability and value in restoring the lagoon, its habitats, and some of its original functions for Ngāi Tahu.

The design and implementation of the monitoring programme involved working in collaboration with Papatipu Rūnanga representatives to monitor six sites across the Ahuriri area, in the Huritini / Halswell River and within the reconstructed Ahuriri Lagoon, using various cultural monitoring tools such as the Takiwā tool, the Cultural Health Index and monitoring of the fish communities. Throughout the Whakaora Te Ahuriri project, mātauranga Māori has been identified as critical to successful design and reconstruction of the traditional wetland, and an essential tool to monitor the wetland's progress and performance.

“Wetlands don’t work”: wetlands, water quality and confronting barriers to change

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Concurrent 1E, October 11, 2021, 11:00 AM - 12:45 PM

All over the world, wetlands are used to address point or diffuse pollution. The history of creating or constructing wetlands goes back almost seventy years, so the concept of utilising wetlands to tackle water quality issues is not new. However, with increasing concern regarding the quality of surface waters, the loss of aquatic biodiversity, the risks to human health, the unsustainable costs (in terms of both capital and operational costs) and inherent, high levels of embedded carbon, there should be unmitigated enthusiasm to embrace wetlands as low-cost, multi-benefit natural infrastructure solutions for water quality challenges. Alas, drawing on examples of the implementation of integrated constructed wetlands from North West Europe, but with relevance at global scale, it is clear that there are major evidential, institutional and psychological barriers that impede widespread adoption of wetlands in future water quality management. This presentation will discuss some of the challenges to, and propose possible solutions for, enhancing future uptake of wetlands in water management in order to ensure that well-designed wetlands, which integrate across social, economic and environmental landscapes, proliferate.

CONSTRUCTED URBAN WETLANDS - THE OPPORTUNITIES THAT LIE BEYOND TRADITIONAL STORMWATER MANAGEMENT

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Concurrent 1E, October 11, 2021, 11:00 AM - 12:45 PM

Land use changes from human activities have altered natural drainage patterns and water regimes resulting in degradation and decline of surface and groundwater dependant ecosystems. While sensitive areas of land are set aside for conservation, unfortunately these natural habitats can be completely cut off from water sources. Implementation of Constructed Urban Wetlands offers an opportunity to restore environmental function and facilitate ecosystem services.

Traditional Constructed Urban Wetlands are designed to provide treatment and visual aesthetics in an urban setting. Indeed, wetlands can provide functions beyond the traditional realm. They can restore natural environmental functions to existing isolated remnant conservation areas. This approach challenges the traditional role beyond current practice. One such example was the new wetland constructed as part of 170 Hectare developing urban area located south of Adelaide, Australia. It lies directly adjacent to a Conservation Park that lies on natural sand lenses and a shallow perched aquifer system, which supports a coastal woodland system and its marshes. Historical development has seen its freshwater marshes dry up, resulting in declining plant diversity and vegetation health.

A urban growth area adjacent to this Park presented an opportunity to re-think traditional stormwater management approaches. The shallow aquifer was recharged through the planned urban wetland to reinstate controlled stormwater flow back towards the Park with a passive recharge scheme. After 12 months of the scheme's establishment, the Park has seen the activation of its freshwater marshes and re-germination of historical plant species. This project provides a blueprint for other planned development areas.

Flood control and water quality benefits accruing from wetlands in urban environments

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Concurrent 1E, October 11, 2021, 11:00 AM - 12:45 PM

Ingenuity in the design of cities is a prerequisite for meeting the current and future aspirations of urban populations. It is also essential to ensure sustainability and resilience in the face of climate change and other disruptors to the normal evolution of cities. Wetlands in urban and peri-urban settings can, in the right circumstances and in combination with built infrastructure, mitigate floods, act as buffers against storms and improve water quality. Evidence is mounting that integrated systems, combining built and natural infrastructure (i.e. both natural and constructed wetlands) are not only more resilient but also, in some cases, require less operational effort and reduce the costs of water resources development. However, care is needed to understand dynamic wetland functions and limitations. For example, to ensure that chemical loadings do not exceed the physiological tolerances of wetland microbes, plant and animal species. Drawing on experience from both the developed and developing world, this presentation will demonstrate the value of integrating wetlands with traditional built infrastructure to enhance the livability of cities and build the resilience of urban communities. The need for strong political will to protect urban wetlands and support green growth is emphasized as is the importance of systems monitoring.

Investing in flood management: lessons on making the case for natural processes

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Concurrent 1E, October 11, 2021, 11:00 AM - 12:45 PM

Climate change is likely to mean more frequent and intense fluvial and coastal flooding for many countries across the globe, often affecting the poorest communities. In the UK, governmental and non-governmental organisations have been working together to develop a more sustainable and efficient way to manage flooding using natural processes at the coast and in river catchments.

Hard flood defences have been used to manage flooding but it is now widely recognised that these defences alone are not enough. In recent years, there has been increased attention given to softer approaches that offer more sustainable ways of managing flood risk. Natural Flood Management (NFM) is an approach in fluvial systems that uses opportunities in the landscape to hold back and slow down the flow of water before it reaches homes and businesses.

In this presentation, we discuss the policy platform and financing mechanism that have underpinned NFM in the UK to date and present evidence on the effectiveness of this technique in two freshwater catchments in southwest England. We also explain the multiple additional benefits this approach provides for people and wildlife and identify how more much-needed action could be facilitated through more innovative financing mechanisms.

Technical and stakeholder solutions to enhance the functions of natural infrastructure

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Concurrent 1E, October 11, 2021, 11:00 AM - 12:45 PM

To effectively deliver sustainable water resource investments they need to be resilient to emerging challenges such as climate change whilst realising multiple benefits for the environment and local communities. In practice this is often hard to achieve, particularly if local communities are not fully engaged in the design, construction and management process. To examine issues related to delivering successful wetland natural infrastructure projects two case studies in the UK (River Swilgate) and Sri Lanka (Metro Colombo Catchment) will be discussed. Severe flooding of the River Swilgate has impacted residents and raised the profile of river management among stakeholders. Government agencies have identified the flood mechanisms responsible and that the river is in poor ecological status due to physical river alterations and diffuse pollution. Extensive community consultation led to the establishment of a partnership project which brought together government agencies, local community and civil society groups to consider wetland natural infrastructure options for the river and floodplain. Colombo's wetlands are fundamental natural infrastructure supporting the well-being of residents. The wetlands provide a range of benefits, such as flood mitigation, climate cooling and water treatment. Despite recognition of the importance of these urban wetlands, extensive loss and degradation has occurred with 60% being lost since the 1980s. To halt this loss it is essential that the value of the wetlands is fully recognised and natural infrastructure is incorporated into urban planning. This paper will present the technical and stakeholder engagement challenges, successes and solutions in recognising and delivering effective wetland natural infrastructure.

Wetlands and flow regulation

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Concurrent 1E, October 11, 2021, 11:00 AM - 12:45 PM

By affecting evapotranspiration and influencing how water is routed and stored in a basin, wetlands make a significant contribution to the hydrological cycle. Although widely attributed a major role in regulating flows (i.e. both attenuating floods and maintaining flow during dry periods) these services are rarely factored into the planning and management of water resources. One reason for the failure to include them is lack of understanding of the hydrological functions occurring, their dynamic nature, and the interaction of these functions with the catchments in which wetlands are located. Both the lack of quantitative information and a recognized method to incorporate them into decision-making processes, make it very difficult to integrate natural hydrological functions into the planning and management of water resources. This presentation summarizes the findings of a study conducted to quantify the flow regulating functions of wetlands in the Zambezi basin. A simple pragmatic approach, utilizing readily available flow data, was developed and applied at different locations within the basin. The results demonstrate the difficulty of generalizing impacts; simple correlations between extent of wetlands within a catchment and impacts on flow were not found. The strength of the method is that it enables the impacts of wetlands on flow to be made explicit without the need to resort to complex computer models. As such, it provides a way for water resource planners and engineers to deduce the impacts of wetlands on flows and assess the implications (positive or negative) for communities living downstream.