Wetland vegetation – a lens on how our wetlands are changing

The following questions were asked during our live webinar with Olivia Burge but due to time restrictions, we were unable to answer these in the session.

Some LENZ environments may be expected to have more of their total area in wetlands than others, would you need higher samples in those environments?
Yes! We didn't have enough time to 'even out' sampling across the LENZ environments, so we just chose the LENZ environments that had the fewest plots per ha of wetlands within them. In a perfect world you are absolutely correct - you'd also 'top up' other LENZ environments that have plots but are relatively under-sampled. We are hoping to repeat the classification in perhaps 10-15 years, such that we can incorporate all the council data which is just beginning to be collected now in some cases.

Do you find a lot of variation between soil cores from the same wetland? We normally take 3 cores- would you have a recommended number?

This is a great question and will be affected by things like: (a) size and homogeneity of wetland (b) reasons for monitoring (this is really important! - monitoring with a view to enforcement action would need much more than samples aimed at detecting change in wetlands at the regional level). Within-wetland change (and this is just my general vibe) I would prefer to have more samples - but on the other hand you could take multiple samples from around the wetland and aggregate them (so you'll get an average across the whole wetland in one sample). This isn't covered by the Handbook, but might have been in the Tier 2 monitoring report HBRC contributed to? I think the problem is that replication for one purpose won' t always be sufficient for monitoring for a different purpose - but it's really expensive to be conservative and do heaps 'just in case' you need it!

Also a big gap on the NE corner of the SI from Marlborough down the Kaikoura Coast. Why wasn't that gap sampled as well?

So it's an internally funded project and we just don't have the money unfortunately to even out sampling across the country (see my answer to Q1 above). It would have been prioritised lower either because (a) the LENZ environment that sits in has plots elsewhere (it wasn't just a spatial exercise - LENZ splits up the country into similar abiotic environments or (b) it has fewer wetlands per ha of the LENZ area and so was a lower priority.

Questions & Answers

For constructed wetlands used in wastewater treatment, what would be the best plants to use for phosphate intake to reduce treated water P levels?

Check out some of NIWA's great work on constructed wetlands here https://niwa.co.nz/freshwater-and-estuaries/management-tools/restoration-tools/constructed-wetland-guidelines, and some of our work on integrated constructed wetlands that focus on including co-benefits for ecology, wellbeing, and cultural values: https://www.landcareresearch.co.nz/discover-our-research/biodiversity/species-and-ecosystem-conservation/restoring-wetland-ecosystem-functioning/protocols-condition-construction/.

Have you considered the potential of testing aquatic macrophytes to get a faster response to nutrient inputs to the system?

Nope - I agree that's a good avenue for wetlands that have a big aquatic component though! Thanks.

How could this approach be applied to coastal wetlands and estuaries influenced by brackish water?

Great question! We do sample in coastal marshes and *Apodasmia* (a classic coastal marsh species) from the top of my head was an interesting species but I would have to dig out the details. As an aside, because of the water flow fertilisation experiments typically use much higher loads of N and P to provoke a response (effectively dilution in water). We didn't incorporate *Apodasmia* because of insufficient replicates in the data.

Great presentation Olivia, just wondering if you would be able to give more details around the 'exciting avenues' you mentioned that could enable better understanding of the link between foliar and soil N&P?

Yes - that was the work around rarer species, and also the H' index that I discussed! Currently it's unfunded but we are actively pursuing options. Happy to discuss more sometime but to avoid disappointment I wanted to note it's not something we are currently working on. But would like to!

What are the key differences between the four?

I think you mean the 4 key wetland types? Check out Johnson and Gerbeaux, the book I showed on the slides. You can access it here: https://www.doc.govt.nz/documents/science-and-technical/WetlandsBW.pdf.

Has any data been collected on wetland areas in High Country - MacKenzie District?

Not to my knowledge.

What are the methods used in determining N and P for foliage and soil?

We use our lab: https://www.landcareresearch.co.nz/partner-with-us/laboratories-and-diagnostics/environmental-chemistry-laboratory/ and on that website there's some info on foliage and soil testing. There's more info in our report too https://www.envirolink.govt.nz/assets/2123-HBRC260-Wetland-plant-foliage-nutrients-as-indicators-of-soil-nutrients.pdf.

Do you think the N and P could be used more for root growth rather than transferred to the foliage? Could vary in different season or location.

Totally! In fact, if a plant puts on more biomass anywhere, it's effectively a dilution of the concentration too. So N:P in foliage will never be a 'perfect' indicator in that sense. It does have its uses though!

Might work better to estimate veg pools than concentrations for P?

Hi Norm - yeah that's another good avenue to consider too. Thank you!

Soil/foliar Ratio examples are from plants found in lower ph wetlands. Is the result as clear in marshes or swamps?

Leptospermum is actually sampled because it occurs across many wetland types! Something we noted in the report is that marshes were under-represented in our data (and can be hugely diverse too - you can get quite naturally low nutrient marshes).Theory predicts the relationship would be stronger in higher nutrient wetlands, but that's not something we specifically looked at. The report notes some of the representation by wetland type: https://www.envirolink.govt.nz/assets/2123-HBRC260-Wetland-plant-foliage-nutrients-as-indicators-of-soil-nutrients.pdf.

Was sampling taken from varying ecotones or just from main vegetation types (highest biomass)?

Dominant veg in the main veg types, as per the wetland monitoring handbook. Have a look here if interested: https://www.landcareresearch.co.nz/discover-our-research/biodiversity/species-and-ecosystem-conservation/restoring-wetland-ecosystem-functioning/protocols-condition-construction/ and the section "wetland condition monitoring".

While correlating soil N&P with foliage N&P, is the soil N&P total or plant available Soil N&P?

You could do either, but we used total N and P because that's what's typically collected (because of the cost/pragmatic reasons noted in my talk). Absolutely you might expect a stronger relationship with plant available, although depending on timing, plants and microbes might have sucked up all the N/P and so the plant available is lower than reflected in the foliage! Thus neither is 'perfect'. It's a great question though and informs how we consider the results.