
Biosecurity Management Overview

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Paul holds an MSc in biological sciences from the University of Waikato and has been a part of the aquatic plant management research team at NIWA since 1988, with over 25 years' experience in the field of plant ecology and biosecurity. He specialises in freshwater biosecurity, especially risk assessment and pest management. He previously worked with MAF, coordinating eradication programmes for nationally important noxious aquatic weeds. He also has experience in wetland ecology and management of nationally endangered wetland plants. He provides management advice to various government departments and regional authorities, and is a member of several Technical Advisory Groups with the Ministry for Primary Industries.

ABSTRACT

Today's symposium topic is the issue of water weeds in the Rotorua Lakes and their management. I will discuss how and where these weeds came from and how they got into New Zealand. The weeds discussed are only a small sample of potential weeds that could have additional or even greater impacts on Rotorua and New Zealand as a whole. I will discuss our legislation and how management at the border protects us from future weeds yet to enter this country. Unfortunately, it appears that our legislation has been too effective at keeping out new plants, with no new aquatic plants legally introduced since the mid 1990's but over 25% of aquatic plants in the aquarium/pond plant trade appear to have got here illegally. Several prosecutions have resulted from interception of smuggled plants.

Once inside our border, there are several biosecurity measures initiated that have kept a number of our worst weeds at bay. These include banning the propagation, sale and distribution of 30 aquatic weed species, national and regionally run eradication programmes for high-risk weeds, with the successful eradication of five species and great progress towards the eradication of around twelve other weeds. However, some of these plants, such as water hyacinth, are still illegally kept by some individuals and several new infestations have originated from such sources. Despite this, the programmes have successfully kept the volume of deliberate spread for a wide number of aquatic weeds to a trickle.

As previous speakers will have discussed, humans are the major cause of spread of aquatic weeds, with contaminated watercraft and trailers, fishing nets, diggers etc. all contributing to this spread. Bay of Plenty Regional Council have been proactively managing their lakes, identifying which lakes are threatened by which weeds, and then carrying out surveillance in order to detect and manage any new weed incursions. To assist with surveillance, they have designed and constructed weed cordons that effectively net off access points such as boat ramps (the main sites of new weed introduction) and have successfully detected and prevented establishment of new incursions of the weeds hornwort and egeria in Lake Rotoma. Each summer holidays an awareness programme run under the national 'Check, Clean, Dry' banner promotes inspection for weeds at boat ramps around the region. Additionally, surveillance of ornamental ponds near to high-value lakes has led to the detection of a number of potential weeds.

New Zealand is rightly heralded as a world leader in the field of biosecurity. We still have many iconic lakes close to their pristine state but these are under threat from a wide number of weeds. I have outlined a number of proactive management activities undertaken both nationally and regionally to prevent further weed incursions but it only takes one action or inaction to undo all of this.

TRANSCRIPT

I am going to take a step back from the Rotorua Lakes and give an overview of the biosecurity management system in New Zealand, talking about the origin of our weeds. I will talk about our worst weeds, protection at the border, stopping the spread, surveillance and incursion response using the approach of the Bay of Plenty Regional Council biosecurity team as an example and then a few thoughts on what might have been and what could be.

Where do our Weeds Come From?

Slide 1 is the world's worst aquatic weed (water hyacinth *Eichhornia crassipes*) and can be bought for 5 Euros a pot in Europe. **Slide 2** is an aquarium in Auckland; all of the plants in the aquarium were illegally smuggled into New Zealand. Most of our current aquatic weeds were deliberately introduced. 75% of the 100 odd naturalised species in New Zealand were imported through the trade and similar figures are found throughout the world. Only 3 of our 30 aquatic weeds managed under legislation in New Zealand were not imported that way.



Slide 1



Slide 2

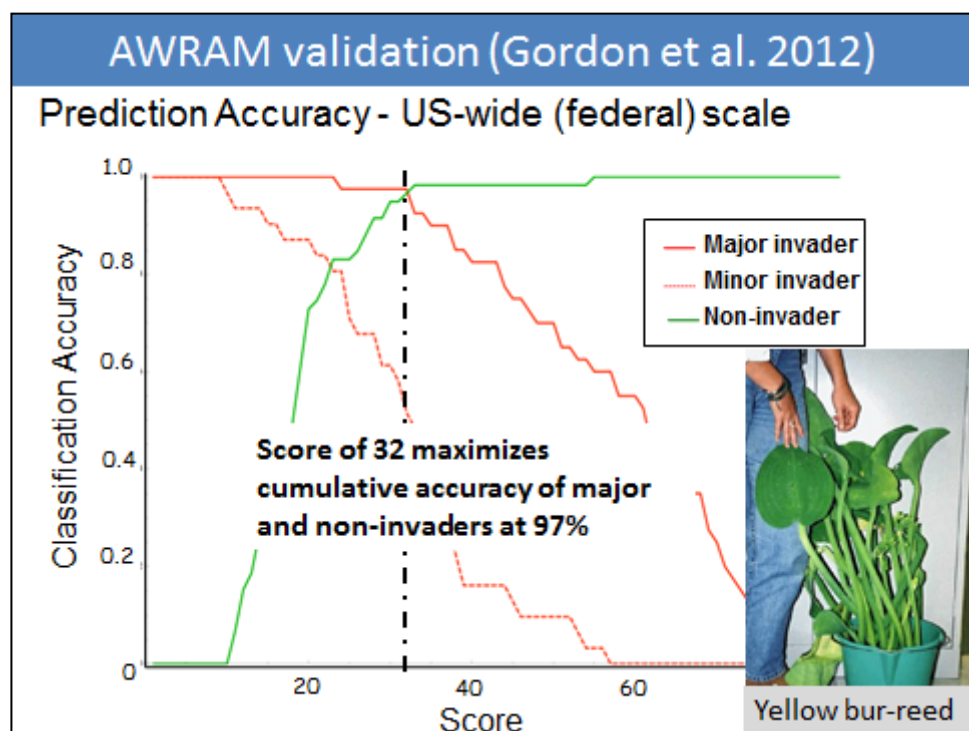
However we need a method to pick our worst weeds. There are over 180 species in New Zealand that have not naturalised, nor likely to. In the past weed history was the main way used to determine weed potential. If a plant was a problem weed in similar climates in Europe or North America we looked at managing it but of course the more times people introduce something the more likely it is to naturalise. Charles Darwin found this, Elton the father of invasion biology right up to recent papers shows that the more effort in introduction the more likely something is to naturalise.

John Clayton and I put together AWRAM (Aquatic Weed Risk Assessment Model) which is mentioned in several of the talks today (Champion and Clayton 2000). The model assesses:

- the invasiveness of the plant, its habitat versatility
- how competitive it is with other plants, both of the same life form and other life forms
- dispersal - propagule output, how it is spread, natural versus human, deliberate/accidental
- its impact, economic, environmental and recreational
- potential distribution - where it is now and where it could be – current versus uncolonised habitat
- resistance to management – scope of methods and effectiveness

The perfect aquatic weed would score 100. This model has been used in New Zealand, Australia, Micronesia and quite recently Doria Gordon has looked at its validation by applying it to a situation in the United States. **(Slide 3)** It is effective at distinguishing major weeds from non-invaders. A score of 32 maximizes 97% separation of non-weeds with major invaders. According to the Gordon et al. (2012) paper, the non-weed that was picked out as a potential major weed has already become a major weed in places like Queensland.

Slide 3



We need to protect New Zealand from aquatic weed invasions at the border and before the border because a lot of the potential problem weeds like Eurasian water-milfoil are not in New Zealand as far as we know. The weed risk model can evaluate potential weeds not present in a country by comparing them with existing weeds. The Biosecurity Act offers a couple of mechanisms to prevent the legal importation of species.

There are a number of notifiable organisms not yet in New Zealand, or were not when we did the work in the early 2000's. Two have since been detected in New Zealand and one has already been eradicated.

Notifiable Organisms – not in New Zealand

Species	Status in New Zealand	AWRAM Ranking
<i>Ludwigia peruviana</i>	Notifiable Organism (not in NZ)	64
<i>Trapa natans</i>	Unwanted Organism (not in NZ)	63
<i>Panicum repens</i>	Not known in New Zealand	61
<i>Typha latifolia</i> *	Notifiable Organism	58
<i>Najas marina</i>	Notifiable Organism (not in NZ)	57
<i>Typha domingensis</i>	Notifiable Organism (not in NZ)	56
<i>Najas guadalupensis</i>	Notifiable Organism (not in NZ)	54
<i>Sagittaria sagittifolia</i> *	Notifiable Organism	52

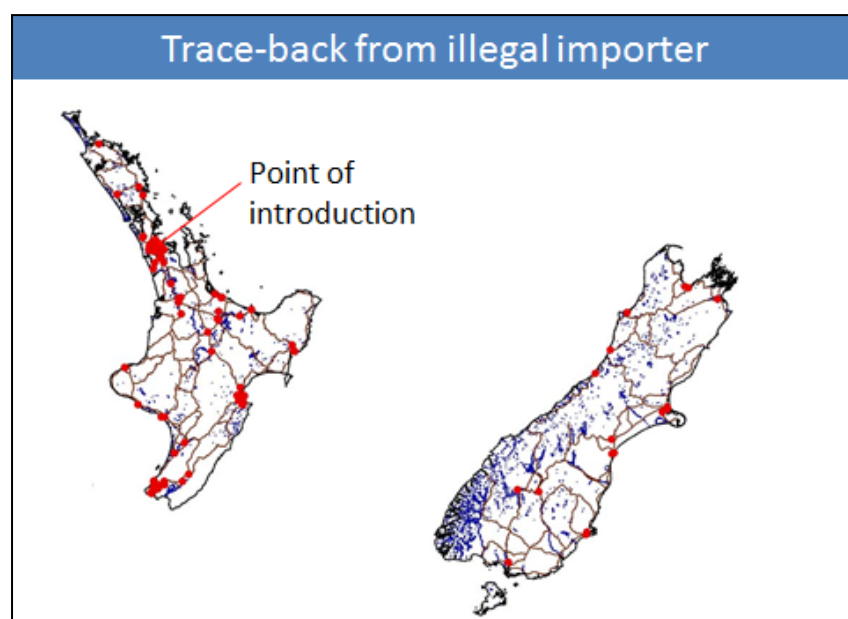
* Two of these species have since been detected in New Zealand and have been targeted for eradication

New Zealand management of biosecurity at the border is internationally renowned. At the border you think of beagles and people trying to find apples in your baggage. There are two pieces of legislation that guard us at the border, the Biosecurity Act, which is the border inspection, not only of passengers but also of mail in the international mail centre.

Then there is plant material brought into the country which has to be grown in quarantine for a growing season before it is released to check for regulated pests that might have been introduced with the plant. The Environmental Protection Authority (EPA, formerly ERMA) manage the importation of new organisms. You have to apply for the entry of these and pay for the privilege but no new aquatic plants have been introduced and very few other plants since the 1990s. The risk to New Zealand from legally imported aquatic plants has effectively been eliminated.

However, there is an issue with illegal imports. John Clayton and I (Champion and Clayton 2001) did a survey of the aquarium trade and surprisingly we found more than a quarter of the species in the trade were not in New Zealand in the 1970s when the last survey

Slide 4



happened. In 2006 the first successful prosecution of an illegal importer of aquarium plants was carried out and since then the world's worst submerged aquatic weed, *Hydrilla verticillata*, was intercepted at the border with some illegally introduced shrimps. It is probably one or two times a year interceptions like this happen.

Slide 4 (above) shows the impact of one importer in Auckland who sent material from Mangonui to Invercargill. This all came from copying his computer and noting what was sold on Trade Me. That one import action influenced the whole country.

So, some plants may have arrived in New Zealand illegally; the next step is managing the deliberate spread of them within the country. All of our top 15 weeds are traded internationally, all but one of them are exclusively human dispersed. 75% of naturalised aquatic species were imported in the aquarium/pond plant trade. Humans are the main agents of spread; both accidentally and deliberately, especially long-distance dispersal. Trade of aquatic plants is a highly effective dispersal mechanism and repeated introduction.

The National Pest Plan Accord started in 2002. It is a national programme with nursery industries, central and regional governments buy in. Thirty aquatic plants are banned from sale and distribution nationally in New Zealand and it is hugely effective.

Slide 5 shows the top 16 ranked weeds, the red are being the big 3 in the Rotorua Lakes. They rank very highly as weeds.

NPPA – Top 16 ranked weeds	
Species	AWRAM Ranking
<i>Phragmites australis</i>	75
<i>Hydrilla verticillata</i>	74
<i>Zizania latifolia</i>	68
<i>Ceratophyllum demersum</i>	67
<i>Eichhornia crassipes</i>	67
<i>Egeria densa</i>	64
<i>Alternanthera philoxeroides</i>	63
<i>Lagarosiphon major</i>	60
<i>Nymphoides peltata</i>	58
<i>Typha latifolia</i>	58
<i>Gymnocoronis spilanthoides</i>	57
<i>Salvinia molesta</i>	57
<i>Myriophyllum aquaticum</i>	56
<i>Lythrum salicaria</i>	54
<i>Utricularia gibba</i>	54
<i>Iris pseudacorus</i>	52

Slide 5

Slide 6 (over) shows the whole range including the water hyacinth that was eradicated from Lake Rotorua.

New Zealand is almost unique in the number of species under national or regional eradication programmes. **(Slide 7)** As well as the banning from sale and distribution we probably have the highest success rate of eradication internationally. It is akin to the work done on off-shore islands with mammals. Six species have been eradicated from New Zealand. There are also 6 programmes run by the Ministry for Primary Industries (MPI), National Interest Pest Responses including the hydrilla eradication programme. These are all national programmes, apart from Manchurian wild rice which is contained around Dargaville, and the other sites are targeted for eradication. Hornwort is widespread in the North island and is targeted for eradication in the South Island only.

Slide 8 shows plants detected in New Zealand last year that we thought had been eradicated nationally.

Slide 6



Eradication programmes

Species	Status in New Zealand	AWRAM Ranking
<i>Nymphoides peltata</i>	NPPA, eradicated by regional response	58
<i>Typha latifolia</i>	NO, eradicated by regional response	58
<i>Potamogeton perfoliatus</i>	NPPA, eradicated by regional response	55
<i>Zizania palustris</i>	Eradicated by national response	45
<i>Menyanthes trifoliata</i>	NO, eradicated by national response	45
<i>Pistia stratiotes</i>	NO, eradicated Class A Noxious Weed	42
<i>Phragmites australis</i>	NIPR	75
<i>Hydrilla verticillata</i>	NIPR	74
<i>Zizania latifolia</i>	NIPR (outside of Kaipara)	68
<i>Ceratophyllum demersum</i>	NIPR (SI only)	67
<i>Eichhornia crassipes</i>	NIPR	67
<i>Salvinia molesta</i>	NIPR	57

Slide 7

Slide 8



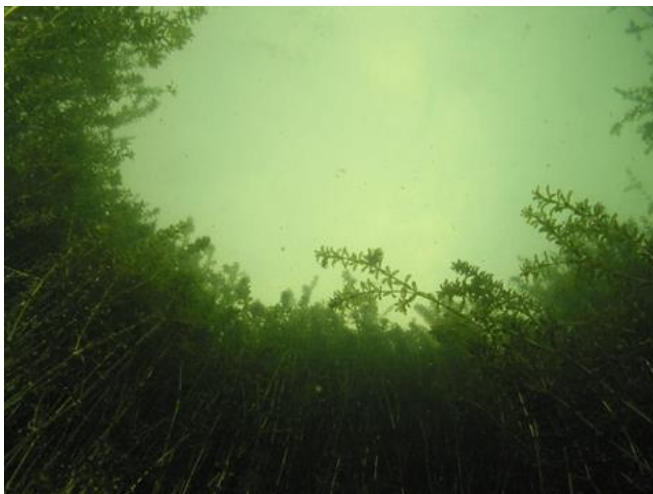


MPI found that Amazonian sponge plant (*Limnobiium laevigatum*) (**Slide 9**) was being sold on Trade Me and we did not know it was in the country. We would have done something if we did. I acquired plants, grew them on and found them to be water lettuce (*Pistia stratiotes*) not sponge plant, and these plants may be held in cultivation even though all of the field sites have been eradicated.

Hydrilla grew down to 10 metres in Lake Tutira, Hawke's Bay. **Slide 10** is a hole in the weed bed but shows how dense the growth is. The weed

Slide 9

beds here are up to 6 metres tall. In 2008 an eradication programme began, led by MPI and taking in 20 years of research by NIWA using endothall and grass carp. The herbicide was used in November; grass carp were released a month later. The carp were around 25 cm long and less than a kilo when released. Last year the largest fish we caught was over 9 kilos and greater than 80 cm. (**Slide 11**) After 2 years there were no hydrilla beds remaining within the lake. More than 99% of hydrilla has been removed and we still have native vegetation growing under the browsing pressure of grass carp. Effectively the risk of spread of the worst submerged weed in the world has been averted. (**Slide 12**)



Slide 10



Slide 11



Slide 12

How do weeds spread?

- Natural spread – seed production and adaption for spread
- Recreational craft, trailers, anchor wells, jet motors
- Fishing nets – especially fyke nets, mullet nets
- Contaminated diggers and harvesters
- Coarse fishermen
- Aquarium liberation
- Deliberate planting

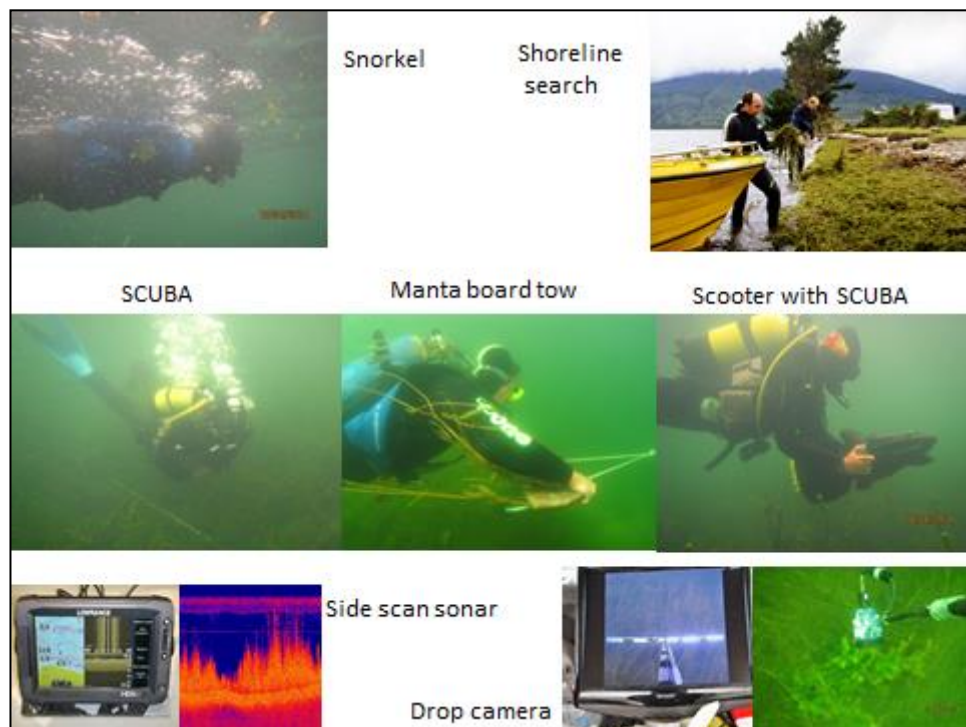
There are some high risk weeds like the fringed water lily (*Nymphoides peltata*) which have flattened seeds with little spikes on their margins and they are adapted for spread by ducks. We have had only one field site and two other sites in the country. Fortunately they were removed before ducks could spread them around. In this case the eradication technique was called filling in the water body. The risk was so high that it was probably worth that approach.



Surveillance is carried out by the Bay of Plenty Regional Council who identify the high risk lakes; which lakes have which weeds, which lakes do not have the weeds. They detect new weed incursions, and weed cordons are an important tool developed right here in the Bay of Plenty. There is an awareness programme carried out around these activities.

A research programme in the Bay of Plenty over the last year looked at the best way of detecting new weed incursions. NIWA used totara branches as a surrogate for submerged weeds and had teams of divers either being towed behind a boat or with underwater scooters. It seemed to be the best or optimal method to detect these weed incursions. (Slide 13)

Slide 13



The weed cordon at Lake Okataina separates off the main body of the lake from the area where most of the weeds are likely to be deposited either from trailers or other boat parts. **(Slide 14)** In Lake Rotoma the two worst weeds, hornwort and egeria, have been detected within the weed cordon but have not established outside it. **(Slide 15)**

Slide 14



Slide 15



What if you find something? Find out how far it has spread. If there is any opportunity to hold it where it is, and eradication is deemed feasible, undertake a control programme

with hand weeding, suction dredging, bottom lining with opaque material, or in some cases herbicide application could be used to achieve this goal.

Check, clean, dry is a great message, it was developed under the didymo programme. There is also *Stop the Spread* which was the catch cry in the Rotorua Lakes. Essentially it is the same message from the didymo programme and equally applies to invasive weeds, pest fish and pests we do not have in New Zealand like zebra mussels. The message is out there but it needs to be reinforced. Every year the Council employs students to carry around promotional material, talk to people at boat ramps around the region and raise awareness. BOPRC are also carrying out inspections of ornamental ponds around the high risk lakes. They had detected one of the weeds, water poppy (*Hydrocleys nymphoides*), which had been eradicated from Lake Rotoehu back in the 1980s. We have to look at all avenues where weeds may come from.

There is a real conundrum with effective biosecurity. If it is successful then nothing changes which is **not** a great thing to sell politically. If you invest a lot of money to prevent a new incursion establishing you will end up where you started. But for me the way to look at it is to think what could have happened if this work was not undertaken? **Slide 16** illustrates what might have been when US\$25 million a year was spent managing hydrilla in Florida. The risk of this is now negligible in New Zealand thanks to the programme outlined earlier in the talk.

Slide 16



Slide 17

Slide 17 is water soldier (*Stratiotes aloides*), a prickly horrible space invader plant that is a notifiable organism, hopefully never coming into New Zealand. We stop things even before they come in. It is also a very popular plant in the trade in Europe.



Water hyacinth (**Slide 18**) is a tropical weed but this is in Paeroa, not exactly tropical, and of course it was growing in Lake Rotorua in the 1950s.

Slide 18

Slide 19 is marshwort (*Nymphoides montana*) in Lake Okareka before it was eradicated by covering the whole area with black polythene. About a kilometre of lake shore was absolutely smothered by this plant.



Slide 19



Other weeds like alligator weed which is not known in the Rotorua Lakes but Bay of Plenty and Waikato are trying to stop this completely dominating marginal areas of water bodies and wetlands. (**Slide 20**)

Slide 20



Phragmites

Slide 21

The worst ranked aquatic weed in New Zealand phragmites (*Phragmites australis*), (Slide 21)

Manchurian wild rice (*Zizania latifolia*) (Slide 22) and North America's worst wetland weed, purple loosestrife (*Lythrum salicaria*), (Slide 23) which could all completely modify the lake shores of the Rotorua Lakes and elsewhere in the country.



Manchurian wild rice

Slide 22



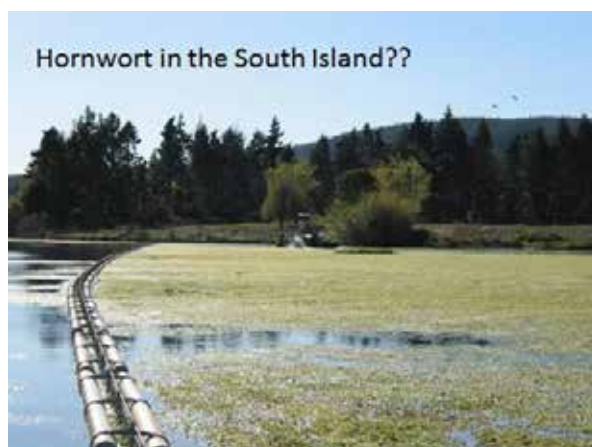
Purple loosestrife

This in fact is a photo of Lake Horowhenua before the work started on the management of it there.

Slide 23

Slide 24 is hornwort in Lake Whakamaru and what Mighty River Power have to put up with on the Waikato River hydro dams. Hopefully none of the South Island hydro dams ever have to deal with this thanks to successful eradication work carried out by DOC and MPI.

Slide 24



Hornwort in the South Island??

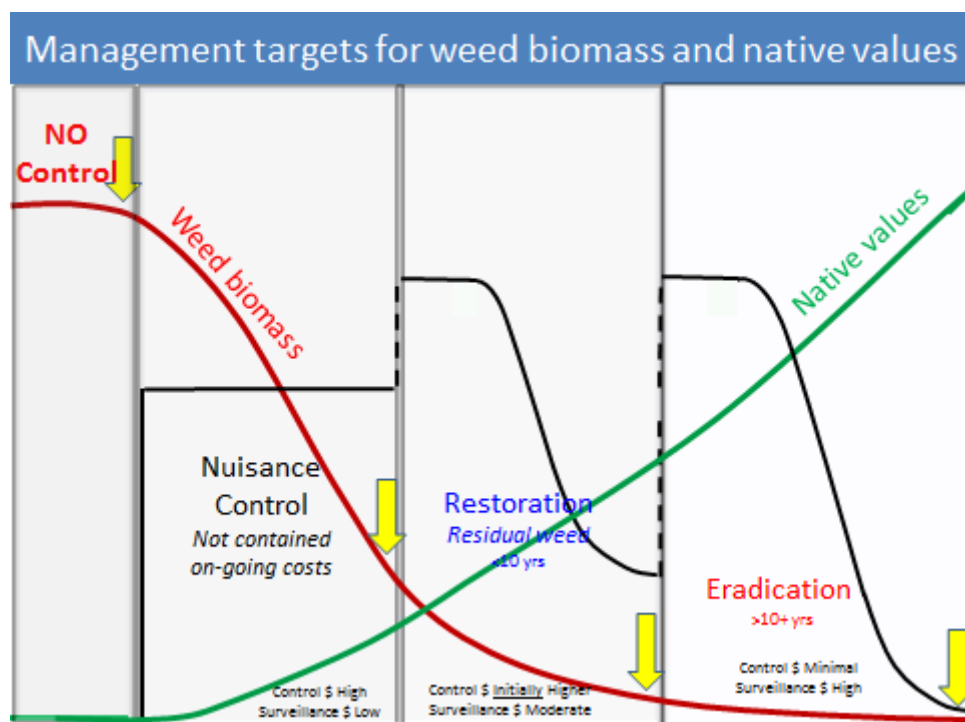
The key points of my talk are:

- Banning the importation of potential aquatic weeds helps keep the risk offshore, but when there is a will there is a way. If someone wants to get something through the border they probably can.
- Banning from sale is a highly effective management tool by restricting the dispersal of potential aquatic weeds. Even with plants kept illegally, the volume is incredibly reduced by the ban of sale, so the risk is reduced.
- Proactive management has been highly effective to date. Maybe we have not advertised it well enough, but funds are limited and memories are short.
- The gains made only require one action or inaction to undo all the good work.

We have worked with the Northland Regional Council to produce a lakes strategy that prioritises their highest value waterbodies as they have a large number of iconic pristine lakes. It is about protecting rather than restoring in this case, to stop weeds and other water quality issues. It integrates all management activities including catchment management and protecting endangered species all under the same umbrella, a holistic management. If you manage water quality there will still be weed problems, it needs to be looked at as a whole.

Current levels of aquatic weed management in the Rotorua Lakes are mostly reactive nuisance control because the funding for that is very low compared to the water quality budget. But scaled up to allow for restoration of native vegetation should be the desired outcome. Deb Hofstra talked about the scaling up of this reactive nuisance weed control using the graph in **Slide 25** and with just a little bit more money invested in herbicidal control we could end up with native plant restoration while still keeping the weeds at a low level. It is achievable but there is a cost involved. It is up to the community to decide their desired outcome.

Slide 25



Finally I would like to acknowledge all my colleagues at NIWA and the Aquatic Plant Group, the Bay of Plenty Regional Council and especially one person in the Ministry for Primary Industries, Victoria Lamb, who unfortunately for the country is no longer working in that organisation. She spearheaded all of those programmes that started in 2008.



Acknowledgements

NIWA aquatic plants group:
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Ministry for Primary Industries:
Victoria Lamb, Rose Bird and John Sanson

Freshwater and Estuaries centre



are starting to happen. Council is going out to the communities asking what they want and bringing in experts to say what our best approach is and what tools we need in the toolbox. It is starting to happen collectively across New Zealand and has been a long time coming. As the Minister said, it has been sitting on central government's agenda for a couple of decades, but I think progress will be made. The aquatic weed situation has been at the bottom of the agenda so it is just a matter of getting it up there in high lights. Hopefully forums like this will do that.