

# Understanding pattern and function to inform wetland conservation

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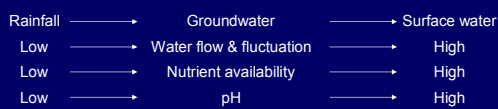


## Outline

- Aim – Summarise NZ wetlands/ main plants according to biotic and environmental characteristics
- Background – Wetland types, NZ wetland database
- Methods
- Results & Conclusions
  - Wetland type summaries
  - Species-environment models
  - Case study
  - Implications for management

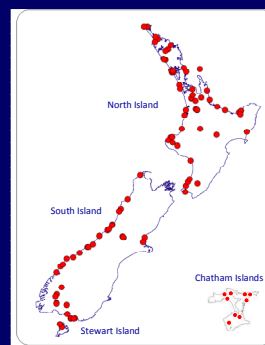


## Wetland functional types & environmental parameters



Johnson & Gerbeaux 2004, Zoltai & Vitt 1995

## NZ Wetland Database



- Lowland freshwater wetlands
- Bog, fen, swamp, marsh
- Representative plots
- Sample vegetation, soil, water
- 94 wetlands, 255 plots
- Methods in monitoring handbook
- <http://www.landcareresearch.co.nz/research/biocons/restoration/docs/handbook2004.pdf>



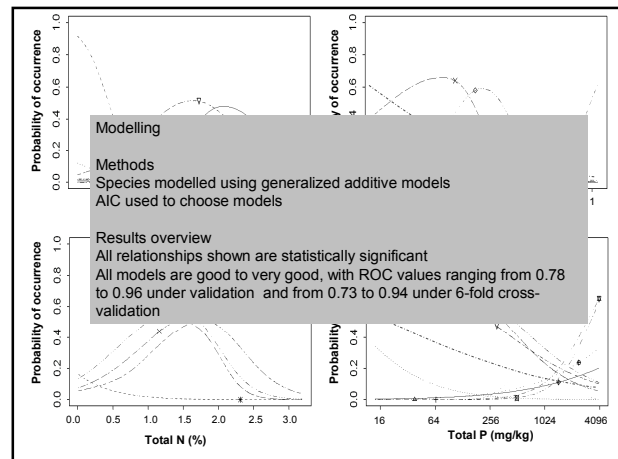
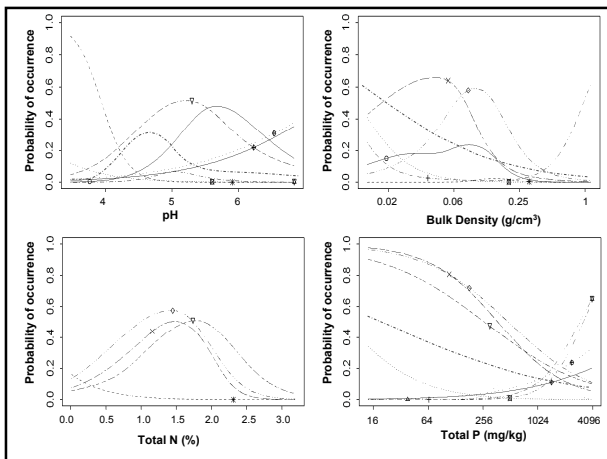
Chatham Island bog

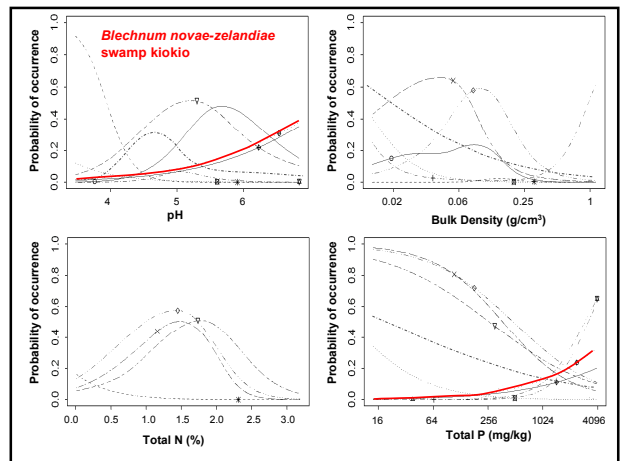
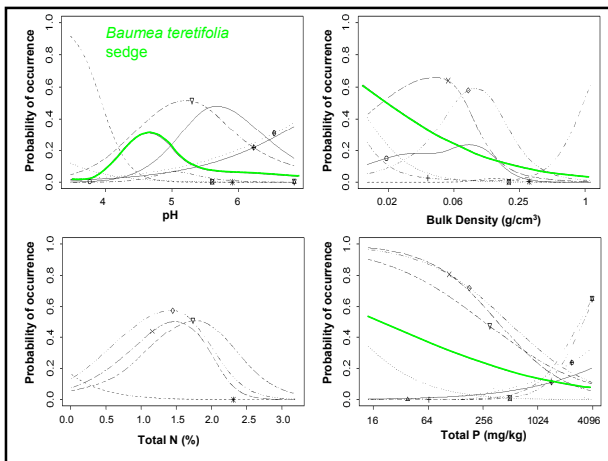
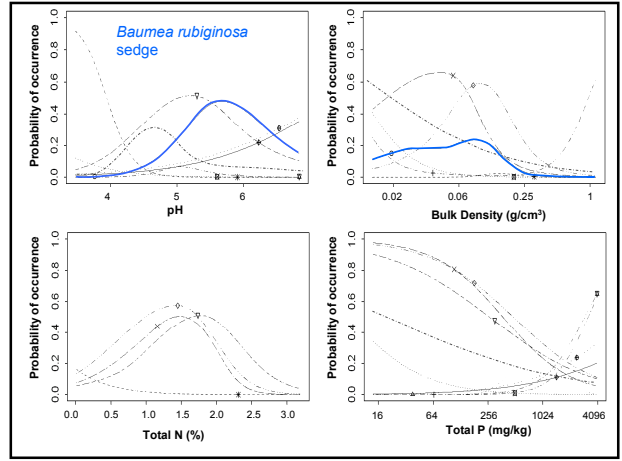
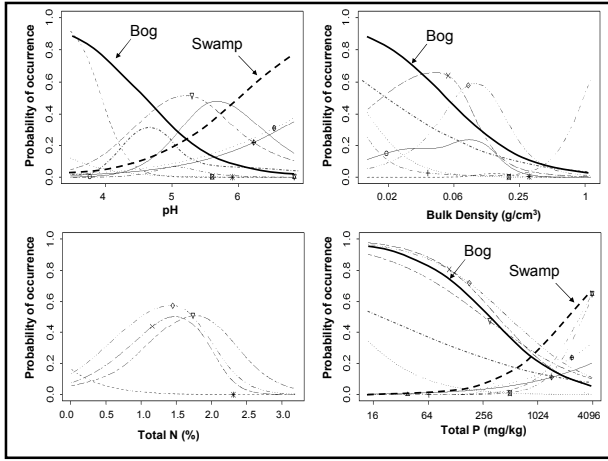
## Methods

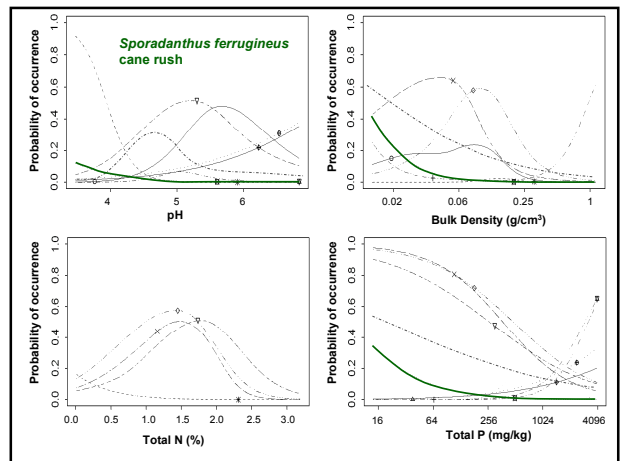
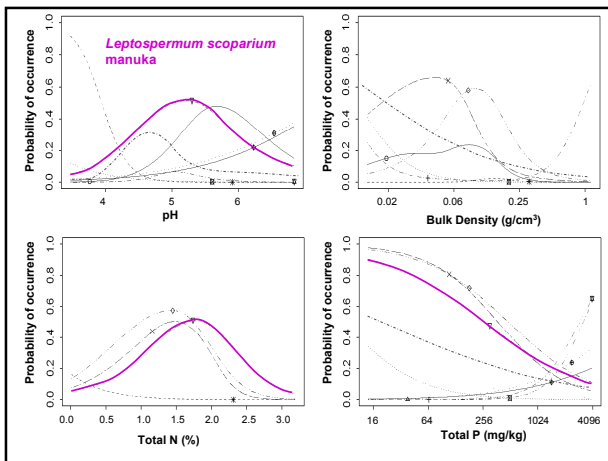
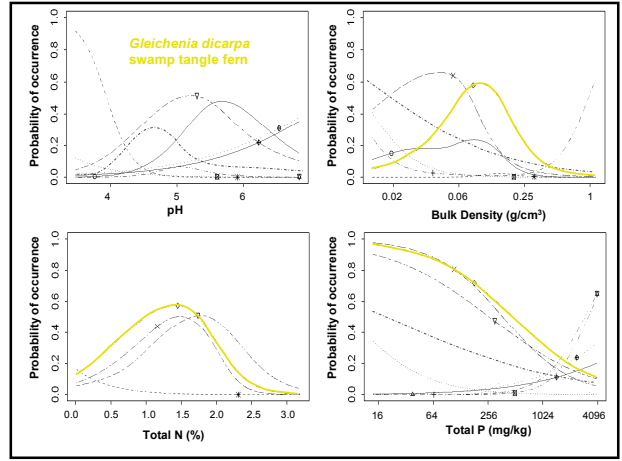
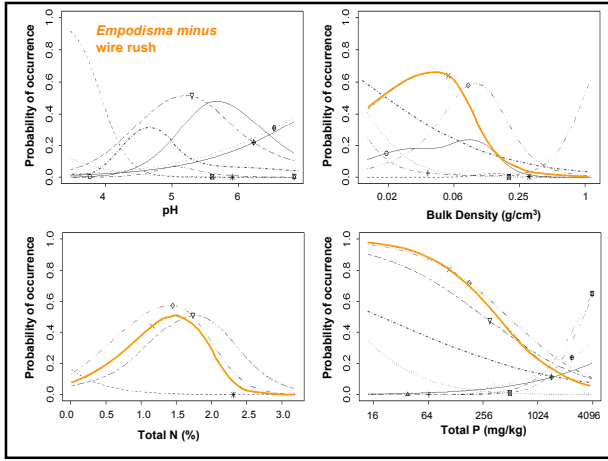
- Allocation of wetland type to each plot ( $n = 255$ ) based on vegetation composition (canopy layer) by ecologists
- Determined main environmental characteristics (soil) for each wetland type
- Modeled the responses of wetland type and the top-20 wetland species to environmental variables using GRASP (Generalised Regression Analysis and Spatial Predictor)

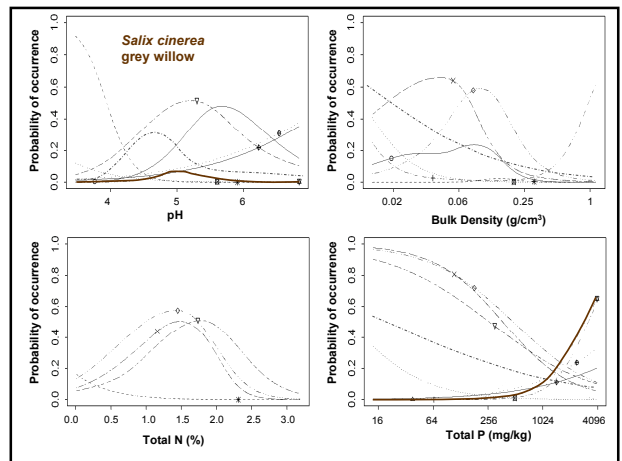
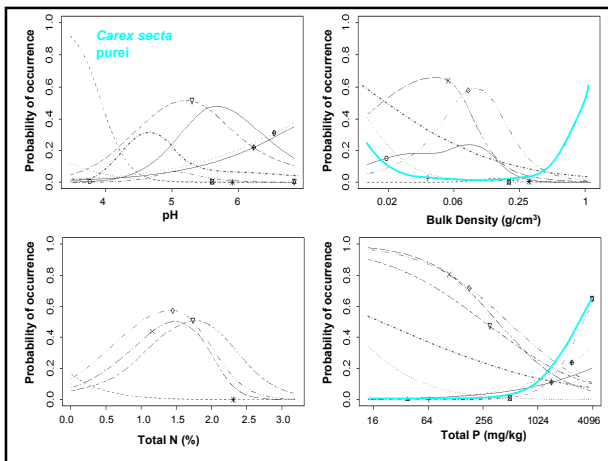
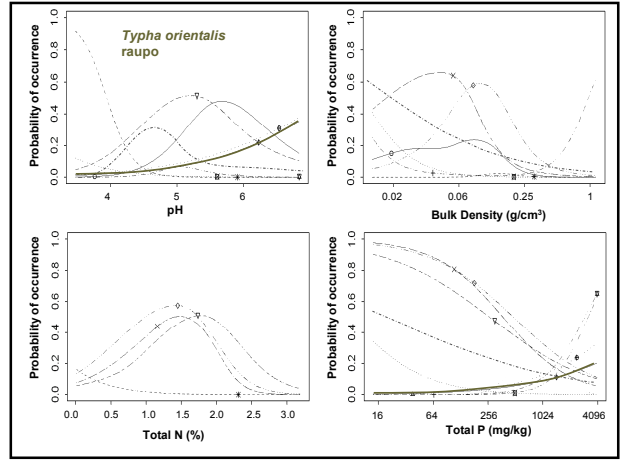
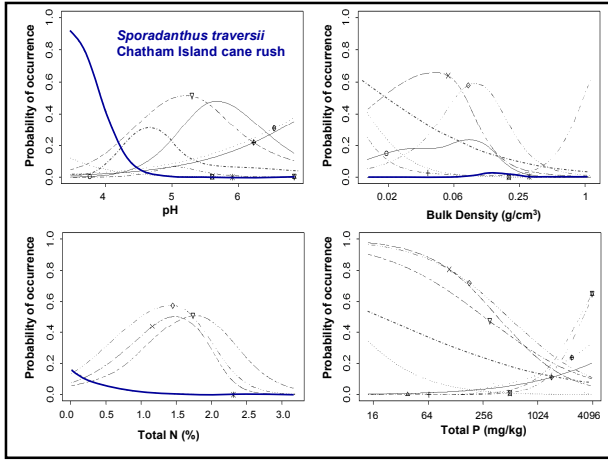
## Wetland type environmental means from soil analyses (90 percentile range)

Type	pH	TN %	BD g/cm <sup>3</sup>	TP mg/kg	$n$
Bog	<b>4.49</b> (3.78-5.5)	<b>1.26</b> (0.7-2.0)	<b>0.08</b> (0.03-0.15)	<b>474</b> (73-1071)	115
Fen	<b>4.87</b> (3.9-5.78)	<b>1.52</b> (0.23-2.21)	<b>0.12</b> (0.05-0.23)	<b>767</b> (65-1700)	64
Swamp	<b>5.55</b> (4.4-6.41)	<b>1.56</b> (0.17-2.94)	<b>0.17</b> (0.04-0.46)	<b>1378</b> (184-3337)	73
Marsh	<b>5.63</b> (4.98-6.81)	<b>0.43</b> (0.24-0.60)	<b>0.46</b> (0.33-0.56)	<b>360</b> (249-542)	3







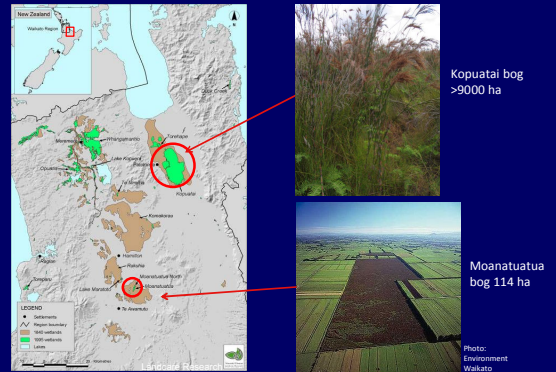


## Alien species in wetland types

Wetland type	<i>n</i>	Alien species %
Marsh	3	70.1
Swamp	24	46.3
Fen	25	19.7
Bog	45	23.4

Clarkson et al. 2008

## Case study: impact of drainage and other modifications



## Moanatuatua

- Decline in wetland biodiversity from 1974 to 1997 (25 yr)
  - Vascular species: 17 to 11
  - Mean water table: -21.1 cm to -45 cm
  - Wetland condition index: 20/25 to 15.5/25
  - In 1997 still dominated by peat formers
  - 2009?????

### Comparison of peat properties

	Moanatuatua (remnant)	Kopuatai (intact)
pH	4.4 a	4.7 a
Von Post	1.8 a	1.4 a
Bulk density g cm <sup>-3</sup>	0.07 a	0.03 b
Total N mg cm <sup>-3</sup>	0.6 a	0.36 a
Total P ug cm <sup>-3</sup>	108 a	3.89 b

Clarkson et al. 1998



*Empodisma minus* peat-forming cluster roots

## Conclusion

- Species have distinct nutrient profiles across the range of wetlands in NZ
- Nutrient profiles could be used for identifying indicator species for wetland types
- Nutrient profiles allow matching species with nutrient levels of modified habitats for increased restoration success
- Some wetland types are less resilient than others to environmental disturbances
- e.g., weed invasion greater threat in swamps & marshes

## Acknowledgements

- NZ Foundation for Research, Science & Technology
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- Regional Councils
- District Councils
- Iwi
- Community groups
- Other landowners and landholders

## Moanatuatua: effects of deepening of marginal drain

Photo: Dave Campbell

