

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**The dynamics of temporary wetlands in dune slacks at  
Tāngimoana, Manawatu, New Zealand, with special  
reference to the endangered sand spiked sedge,  
*Eleocharis neozelandica* Kirk (Cyperaceae).**

**Nicholas J.D.Singers**

**1997**

**A thesis submitted in partial fulfillment of the requirements for the  
degree of Masters in Science in Ecology at Massey University,  
Palmerston North.**

## Acknowledgements

This research was funded by Department of Conservation and Massey University Graduate Research Fund, and permission to work in the area was granted by the Manawatu District Council.

I would firstly like to thank the lovely Christine Bayler, who was my constant and faithful helper whenever I needed help, putting up with my grumpiness and general irritability. A huge thanks goes to Jill Rapšón, for her valuable supervision and sacrificing her own valuable time to help with field work. Without her encouragement and patience this would never have been finished. Colin Ogle proposed the Masterate in the first place, and encouraged me, and sacrificed his scarce time. Thanks Mum, for everything really, but particularly for helping with my statistics; my brother Robert, "flick the little fire engine" who put out the fire lit by the Tangimoana fire-bug, when helping with field work; and all family; Alaster Robertson, for his useful ideas, contributions and supervision; the Department of Ecology, Massey University; especially Jens Jorgensen, the "village blacksmith", for making experimental materials functional and for his valuable field assistance; and Barbara Just; Penny Aspin who enthusiastically jumped, rolled and fell down dunes while getting sunburnt for continuous days on end; Kim McBreen, my fellow sufferer through our extended Masters experience, and fieldwork assistant. Halema Flannagan, Graeme Franklyn, Grant Blackwell, Adele Plummer, for their fieldwork assistance; Robert Burgess, for discussions on dune formation and dune ecology during his visit to the study site; Patrick Hesp, for encouragement and discussions on dune morphology; Mike Shepherd, for discussing the Manawatu dune formation; John Barkla, Don Ravine, Tom Rouse, Wayne Beggs and Shannel Courtney, all good DoC people for their help; Max Barry, for access to the study site and for "pulling me out of sand"; Sam Atkinson, for his rainfall data from Flock House after being bribed with Black Mac; Ewan Cameron

and Euan Nicol for their *Eleocharis neozelandica* herbarium records.  
And all my flatmates for putting up with Masters stress!

P.S. No thanks to the persons who stole one exclosure plot, damaged others, pulled out or shot off water pipes and all other general vandalism.

<b>Contents</b>	<b>Page</b>
<b>Thesis abstract</b>	8
<b>Chapter One</b>	
<b>Introduction</b>	10
<i>History of the Manawatu dunes</i>	10
<i>The study site</i>	14
References	19
<b>Chapter Two</b>	
<b>The vegetation of the proposed DoC reserve in a coastal dune system at Tangimoana, Manawatu New Zealand.</b>	
Abstract	21
Introduction	21
Methods	23
Results	26
<i>Vegetation analysis</i>	26
<i>Geomorphological variables</i>	32
<i>Disturbance factors</i>	33
<i>Soil environmental variables</i>	35
Discussion	37
References	42
<b>Chapter Three</b>	
<b><i>Eleocharis neozelandica</i> (Cyperaceae) Kirk, an endangered sedge: habitat and cultivation.</b>	
Abstract	45
Introduction	45
<i>Recorded history of Eleocharis neozelandica</i>	46
Methods	49
<i>Seed germination and propagation</i>	49
<i>Comparisons of Eleocharis neozelandica populations</i>	51

	Page
Results	52
Discussion	55
References	59

## **Chapter Four**

### **The planting of a unnamed, rare native daphne, *Pimelea* “Turakina” at Tangimoana, Manawatu.**

Abstract	60
Introduction	60
Methods	62
<i>Planting</i>	62
Results	65
Discussion	66
References	69

## **Chapter Five**

### **The water table dynamics of temporary dune slack wetlands at Tangimoana, Manawatu, New Zealand, with reference to vegetation change in exclosure and control permanent plots.**

Abstract	70
Introduction	70
Methods	74
<i>Water table monitoring</i>	74
<i>Rainfall data</i>	75
<i>Vegetation monitoring of the rabbit exclosures</i>	76
Results	77
<i>Wetland water table shapes</i>	77
<i>Water table response to rainfall</i>	81
<i>Vegetation responses to water table and inside rabbit exclosures</i>	87
Discussion	91
<i>Water table fluctuations</i>	91
<i>Water table impacts on vegetation</i>	92

	Page
<i>Vegetation change over time</i>	94
Conclusion	96
References	97

## **Chapter Six**

### **Dune slack wetland plant growth in response to sand burial, waterlogging and submergence.**

Abstract	98
Introduction	98
<i>Anoxia</i>	98
<i>Sand burial</i>	99
Methods	102
<i>Waterlogging</i>	102
<i>Sand burial</i>	103
<i>Analysis</i>	104
Results	106
<i>Waterlogging</i>	106
<i>Sand burial</i>	109
Discussion	112
<i>Waterlogging</i>	112
<i>Sand burial</i>	115
<i>Waterlogging in relation to the distribution     of the four dune slack plants in situ.</i>	116
References	119

## **Chapter Seven**

### **The construction of a temporary wetland in dune hollows, for habitat creation for the endangered sand spiked sedge, *Eleocharis neozelandica***

Abstract	121
Introduction	121
Methods	124
Results	129

	Page
<i>Eleocharis neozelandica</i> and <i>Isolepis cernua</i> survival	130
Demographics of <i>Eleocharis neozelandica</i>	131
Rabbit browse of <i>Eleocharis neozelandica</i>	132
The colonization of the constructed temporary wetlands	134
Discussion	137
<i>Wetland creation</i>	137
<i>Plant survival and colonization</i>	138
<i>Elevation requirements and consequences</i>	139
<i>Rabbit browse</i>	140
Conclusion	141
References	142
<b>Chapter Eight</b>	
Discussion	143
<i>The dunes and their temporary wetlands</i>	143
<i>Rare species</i>	144
<i>Conservation management</i>	146
References	152
<b>Appendix</b>	
<b>The Tangimoana dump dunes species list</b>	153
<b>Bibliography</b>	158



## Thesis Abstract

Parabolic dunes are a feature of the Manawatu, New Zealand coastline. Moving inland, the dunes form temporary wetlands in deflation hollows (dune slacks) on their seaward side. One of the few remaining natural dune systems left in the Manawatu is located south of the Rangitikei River mouth at Tangimoana, the "Tangimoana dump dunes", a proposed DoC reserve. The area contains excellent examples of temporary wetlands in dune slacks, with early successional vegetation well represented. This vegetation is being eliminated by larger wetland plants and is unable to colonize new habitat, as dune stabilization prevents its formation.

The vegetation of the proposed reserve was sampled and vegetation patterns were related to environmental factors. Foredune, dune plain, slack, marram dune, shrub dune and grassland communities were identified. A low species diversity was found, which included a high proportion of exotic species in the grassland, shrub and marram dune communities. The low number of communities and species richness may be related to the area's youth and the dune's dynamic nature.

Water table fluctuations were monitored in two temporary wetlands, which contained the endangered sand spiked sedge, *Eleocharis neozelandica*, an early successional species. The water table fluctuations were directly related to rainfall and season. A high winter and spring water table in 1995 resulted in dramatic changes in the distributions of some dune slack plants. Control and exclosure plots were used to assess the effects of rabbit browse on the dune slack vegetation. These plots also provided valuable information of the vegetation change to water table heights. Species more suited to permanently wet locations increased greatly, while species suited to more temporary wet areas moved higher in elevation, to around the winter high water line.

Two endangered plants of the Manawatu dunelands, *Eleocharis neozelandica* and *Pimelea* "Turakina" were cultivated and then established at the Tangimoana dump dunes. *Pimelea* "Turakina" appears to be well adapted to the Manawatu dune lands and produced abundant seedlings at Tangimoana. Creation of deflation hollows for *E. neozelandica* habitat was undertaken. *E. neozelandica* was planted in the constructed hollows at three separate elevations, and survived winter submergence at the medium and high elevation sites, of at least seven months at the medium site, and appears to be a valuable and effective management tool for the conservation of dune slack species. The tolerance and growth of *E. neozelandica* and other dune slack species in relation to sand burial, waterlogging and submergence was studied in controlled experiments. They appear to be generally intolerant of sand burial, but all survived submergence and thrived in waterlogged conditions.

Temporary wetlands in dune slacks at the Tangimoana are incredibly dynamic in relation to the water table fluctuations, and changes in species distributions resulting from them. Management solutions need to be active and address these results in order to maintain the indigenous flora of the area.