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# Cost Benefit Analysis of Riparian Planting Options for Freshwater Coastal Streams in Horowhenua

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Ngā utu kia piki te Mauri o ngā wai a Parawhenuamea

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## Abstract

Freshwater ecosystem health is an important policy priority in New Zealand, recently highlighted by the government's launch of the 'Freshwater Reform 2013'. One practical way of improving freshwater ecosystem health is riparian planting. In this context, the aim was to develop and apply a cost benefit analysis (CBA) methodology to evaluate riparian planting options for restoring five freshwater coastal streams of importance to iwi/hapū in the Horowhenua, drawing on two distinct disciplines – freshwater ecology and economics.

Essential to this CBA methodology was an explicit evaluation of a desired policy outcome. Accordingly, attention was given to assessing what constitutes the desired policy outcome that is 'freshwater ecosystem health of coastal streams'. This assessment was based on developing a detailed understanding of the attributes that must be managed to achieve 'freshwater ecosystem health' including: in-stream temperature, periphyton, sediment, water flows, ecological connectivity, nitrate and ammonia, key fish species and stream invertebrates. The CBA methodology then focused on developing a new systems framework (interrelated ecosystem 'biophysical structures', 'processes' and 'functions') for assessing the ecological role of riparian vegetation in improving freshwater ecosystem health.

Non-market economic values required for CBA calculations were then derived using a benefit transfer method. Data from three study sites (Karapiro South Waikato, Hurunui Canterbury, and Canterbury) based on 'choice experiment' values were evaluated for their suitability for use in the policy site (Horowhenua). The suitability of data from study sites for use in the policy site applied the Welch T test and Wilcoxon rank sum, using 'personal income' as the assessment criterion. Over 100 hundred planting scenarios were then tested by CBA, with almost all having positive net present values for both 5m and 10m width planting options.

The study concludes with a discussion of the practical and policy implications of these findings, and highlights the limitations of this study and how these can be overcome in future research.

Keywords: Indigenous, ecosystem health, freshwater coastal streams, riparian, environmental cost benefit analysis, benefit transfer



## Dedication

I dedicate this thesis to my children

Hemi, Reggae and Ramaroa,

their children and their children's children



Figure 1: Carved pātaka (food store) 'Te Takinga' at Lake Waiwiri taken by George Leslie Adkin 1906 (Source: Alexander Turnbull Library, New Zealand)



## **Te koi a ngā Tīpuna, a vigilant observation of Ancestors**

*Maringi noa ngā roimata a Ranginui ki te umu a Papatuanuku*

*Tae atu ki Te-Wao-nui-a-Tāne rāua ko Hine-Pari-Maunga*

*Ara ko ngā mātua o Parawhenuamea te Atua o ngā manga me ngā awa*

*The tears of Ranginui fall to the chest of Papatuanuku*

*to the great forest of Tane and the Mountain Maiden*

*the parents of Parawhenuamea the Deity of streams and rivers*

*Heke ngā ua tae atu ki ngā rau a te maru a Tāne*

*Katahi ka whakaeto ki te kōhauhau*

*I te korenga a Tāne, he ua kei te whenua*

*hei ngaru kawea ngā kino ki ngā wai a Parawhenuamea*

*The rain stops at the leaves of the canopy of Tāne*

*then evaporates to the atmosphere*

*In the absence of Tāne much rain arrives at the land*

*a wave taking contaminants to the waters of Parawhenuamea*



## Ngā Mihi, Acknowledgements

Tuatahi, he whakaaro mo te koi a ngā Tipuna, nā ngā kōrero a neherā whakamarama ai ngā Atua me tō rātou ake rohe he tātai ki te taiao pērā ki Te-Wao-Nui-a-Tāne, a Hine-Pari-Maunga, ka puta ko Parawhenuamea.

*First a thought for the vigilance of the Ancestors, reflected in the oratory for Atua and their domains a system within the natural environment like that of Te-Wao-Nui-a-Tāne, Hine-Pari-Maunga, produced is Parawhenuamea.*

Nō hea tēnei Kaitito? Whānau mai ki te motu ko Mangaia ki Kuki Airani a Pāpā, he uri hoki no Scotland. He Māori a Māmā ko ētahi Iwi Te Ngare a Huia, a Tamatera, me Tūhoe. Ēngari hokihoki au ki a Kikopiri a Te Ngare a Huia; ki te raki o Kikopiri he roto ko Waiwiri, ki te tonga a Kikopiri he awa ko Ohau rere mai I ngā pae maunga ko Tararua tae atu ki te Moana-tāpokopoko-a-Tāwhaki.

*From where is this Scribe? Father born in Mangaia one of the Cook Islands, he also a descendant from Scotland. Mother is Māori, Tribes include Te Ngare a Huia, Tamatera and Tūhoe. Yet I frequently return to Kikopiri of Te Ngare a Huia; to the north of Kikopiri is the lake called Waiwiri, to the south of Kikopiri is the river called Ohau running from the ranges of Tararua to the Tasman Sea.*

I would like to acknowledge the MBIE-funded Manaaki Taha Moana (MTM) research team. Professor Murray Patterson and Derrylea Hardy at Massey University, I would like to thank for your guidance in organising my ideas in order for me to complete this milestone. I am particularly grateful Murray for the instruction to first understand the ecological processes of riparian vegetation at the interface of terrestrial and aquatic ecosystems, which led me (an accountancy and finance double major) to an acquaintance with freshwater ecology, tōku maioha. I would also like to thank Dr. Huhana Smith, Aroha Sphinks and Moira Poutama from Taiao Raukawa, for your counsel and tautoko during this journey.

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*Also to colleagues there are many benefits of our collaboration generating ideas and exchanging ideas, toward this issue to restore the life force of freshwater. Karawhiua!*

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