TE PAIAKA – NATIVE ROOT PROJECT: QUANTIFYIHNG THE BENEFIT OF NATIVE, RIPARIAN VEGETATION TO REDUCE BANK EROSION AND SEDIMENT LOADS

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In the Hōteo River catchment, it has been highlighted that streambank erosion contributes between 72% - 93% of fine-grained sediment being transported to the Kaipara Moana (Simon *et al*, 2016; Hughes, *et al*, 2022), as opposed to land-based erosion, as previously assumed. Improving methods to stabilise streambanks and reduce erosion is one of the key actions required to reduce sediment loads and restore the health and wellbeing of Te Taiao. With Te Mana o te Wai ensuring that the health and well-being of wai is the first obligation, there is a responsibility for industry to provide more certainty that enhanced environmental outcomes are being achieved.

Riparian plants can play an important role in reducing erosion through the effects of their above-ground biomass, which reduces the effective stress applied to bank surfaces. Roots of riparian plants provide reinforcement to the bank mass, increase shear strength, and reduce the likelihood of bank collapse. Although plants have traditionally been seen as the 'silver bullet' and an easy fix for stabilising stream banks, little quantitative information is known about how effective New Zealand native species are at reducing erosion. One notable exception is the Manaaki Whenua – Landcare NZ study (Watson and Marden, 2004) and subsequent publications. In many cases, however, plants alone are not sufficient to solve bank erosion issues.

METHODS

Through Te Paiaka – Native Root Project, quantitative data on root-reinforcement characteristics (tensile strength and architecture) of 11 select native species, each spanning a range of age classes were collected and analysed. These data were combined with additional data provided by A. Benson (written comm., 2002) to establish species-specific relations between four age classes and diameter at breast height (DBH). Resulting root characteristics by age class were coded into RipRoot, the root-reinforcement sub-model (Pollen and Simon 2005) contained within the Bank-Stability and Toe-Erosion Model (BSTEM) (Simon et al., 2000; 2011).

In operation, BSTEM is initially run without vegetation to determine the potential failure-plane angle and the Factor of Safety (F_s) without vegetation. A user then engages RipRoot, enters a maximum rooting depth, and species and age classes to generate bank top and bank face plant assemblages. RipRoot then calculates the added apparent cohesion due to root-reinforcement in each layer. Running BSTEM again provides the F_s for the same bank geometry but accounting for the additional reinforcement provided by the roots. Comparison of the F_s with and without the selected species assemblages gives the benefit of the specified vegetation. Various combinations of plants on the bank top and bank face can then be applied to test for the greatest effectiveness.

FINDINGS

Results showed that out of the 11 species, Cabbage tree (*Cordyline australis*) was by far the most effective plant at providing increased bank strength through root reinforcement, increasing the F_s from ~1.24 to ~1.3 for juvenile, early mature, and mature trees. This was due to increases in the average, apparent cohesion over the top 1.5 m of 10-13 kPa. The next most effective species was Lacebark (*Hoheria populnea*), increasing the F_s to just 1.05, with additional apparent cohesion of ~2.4 kPa over the upper 1.5 m. The absolute values of these results and their relative effectiveness will vary for banks of different geometries and composition. These preliminary experiments represent vegetation located only on the bank top. Effectiveness would of course increase if additional vegetation on the bank face was also considered. Additional tests that reflect the

increased hydraulic roughness provided by established herbaceous species shows large potential reductions in hydraulic erosion as well.

SIGNIFICANCE

The preliminary results show that native vegetation can be effective in protecting streambanks and reducing erosion from this important source, which has regional and national significance under operational programmes and Te Mana o te Wai. Real data from native NZ species has been applied in a quantitative modeling framework to aid in testing of the effectiveness and benefit of this stream management tool.

KEYWORDS

Streambank erosion, Te Mana o te Wai, Riparian management, Riparian modelling