Before and after integrated catchment management: changes in instream ecology and water quality

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Few studies have comprehensively measured the effect of catchment rehabilitation measures in comparison with baseline conditions. Here, we present the changes in instream ecology and water quality for a 20 year period in a headwater catchment within the western Waikato Region, New Zealand. For the first six years, all of the land in the catchment was used for hill-country cattle and sheep grazing. An integrated catchment management plan was implemented whereby cattle was excluded from riparian areas, the most degraded land was planted in Pinus radiata, channel banks were planted with poplar trees. Stream reaches with riparian setbacks (with spaced poplars or native planting or natural regeneration) experienced decreased water temperature and periphyton biomass, and changes in macroinvertebrate community indices and composition indicating recovery towards reference native forest stream conditions. Reaches with active riparian tree planting had increased streambed cover by small wood and tree roots. In general, the macroinvertebrates recovered rapidly and now more closely resemble native forest stream macroinvertebrate metric values and faunal composition. Water temperature reduction and the close proximity of colonists in undisturbed native forest streams were identified as a key factors in this improvement.

The removal of cattle from riparian areas and had a positive and rapid effect on the water clarity of streams. In contrast, the water clarity decreased in those sub-catchments where cattle was excluded and riparian areas planted with trees and shrubs. Increases in concentrations of forms of P and N were recorded, and attributed to: i) the reduction of instream nutrient uptake by macrophytes and periphyton due to increased riparian shading; ii) temporary proliferation of nitrogen fixing weeds; and iii) reduced nutrient processing by seepage wetlands in response to afforestation. Our findings highlight the complex response of catchments to rehabilitation measures.