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Improving the economic and environmental performance of a New Zealand hill country pastoral catchment

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Introduction Low-altitude steeplands managed for moderately intensive pastoralism cover some 4 million ha of the North Island of New Zealand . The relatively young geology of the lithosphere , combined with a moist-temperate climate and the relatively recent removal of the broadleaf-conifer forest for grassland development combine to present significant challenges for the physical sustainability of livestock farming . However , a combination of the benign climate , historically favourable policy and commodity systems , and the application of technological advances has contributed to overcoming these limitations . Since the mid 1980s , a number of forces have interacted to bring the sustainability of hill country pastoral farming under renewed scrutiny , including commodity price trends , government rationalisation and a strengthening environmental management paradigm in the social context of the sector .

Methods A multi-stakeholder group was established in 1996 to improve the economic and environmental performance of a typical hill country catchment-farm system . The group followed a three phase "action research" process of : 1 . building awareness of the current performance of the case study system , 2 . forecasting the outcomes of potential land use and management changes with decision-support models , and 3 . implementing a new land use plan to monitor the outcomes across a range of goals and indicators established by the group at the beginning of the project .

Results The new land use plan developed by the group involved conversion of approx . half of the 300 ha catchment farm to pine forestry , riparian management of the 20 km stream network to exclude livestock (including fencing and planting of native vegetation) , protection and enhancement of 5 ha of native forest fragments through fencing , pest control and supplementary planting , targeted erosion control through poplar pole planting and intensification of the remaining pastoral land (131 ha) through increasing stocking rate and a shift to bull finishing and high-fecundity sheep enterprises . This plan was implemented in 2001 for a net cost of NZ \$260 000 and the results were monitored over the subsequent 6 years in terms of livestock production , economic farm surplus , water quality and indigenous biodiversity recovery . In that time almost all the key performance indicators have shown improvements relative to previous levels and established benchmarks (Table 1) .

Table 1 *Selected quantitative biophysical indicators of performance in the Whatawhata case study catchment farm .*

<i>Indicator</i>	<i>Benchmark</i>	<i>Old system</i>	<i>New system</i>
Soil fertility (Olsen P)	25	17	23
Pasture production (kgDM/ha/y)	12100	9500	10000
Sediment export in water (kg/ha/y)	440	2861	687
P export in water (kg/ha/y)	0.8	3.0	1.2
Plant diversity in native forest (# spp/plot)	34	20	28
Lambing (% weaned per ewes mated)	120	109	124
Cattle gross margin (\$ per stock unit)	58	46	82
Annual Farm Surplus (\$ per ha of pastoral land)	253	181	285

Conclusions The existing land use (100% pastoral) and management of the case study catchment farm was failing to meet stakeholder goals from both economic and environmental perspectives . The diverse stakeholder group was able to reach a facilitated consensus on land use change using a goal-orientated approach , based on a combination of decision-support modelling , research results and stakeholder experience . Land use change was effective in moving the system toward stakeholder goals , though the rate of change in some indicators has not completely matched expectations , and the transition cost was high relative to subsequent annual farm surpluses .