Maximising Water Yield with Indigenous Tall Grassland/ Rangeland on New Zealand Uplands and Trade-offs with Alternative Land Uses

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Introduction Water is an essential ecosystem service that is under increasing pressure worldwide . Successful resource management requires accurate information on water yields from important source areas in relation to alternative land uses and vegetation types . Upper watersheds/catchments usually have the greatest potential for water production in New Zealand , regardless of where water is being extracted .

Methods Non-weighing lysimeters , containing indigenous tall tussock grassland or several types of alternative cover in a series of studies in SE New Zealand uplands (500-2000 m) have been supplemented with a range of other methods . These include two paired catchment studies , a weighing lysimeter and a stable isotope study (Mark and Dickinson 2008) .

Results and discussion Water yields from indigenous tall tussock grassland/rangeland have been consistently higher at upland (> 500 m) sites than from any of several alternate cover types tested , even bare soil . Such yields are mostly 60-65% of the 1300-1400 mm of annual precipitation , regardless of the methodology , but reached 80% in lysimeters on a highly fog-prone upland at 870 m . There is general agreement that the high yields from the indigenous tall bunch grassland/rangeland are associated with low evapo-transpiration from the dominant grass cover but the role of fog remains contentious . However , the stable isotope (δ^{18}O and δD) analyses of fog- , rain-and ground-water from three upland sites have indicated a subequal contribution from fog and rain . One long-term paired-catchment study has shown a steady reduction (up to 41% after 22 years) in water yield from an afforested (exotic *Pinus radiata*) catchment compared to that from an adjacent one of indigenous grassland . The second such study compared water yield following burning of the grassland/rangeland and revealed some reduction during the first three post-burn summers ; up to 32% in the second year , consistent with results from an earlier lysimeter study .

Conclusions The tall tussock grass life form and its leaf morphology/anatomy/physiology (fog deposition plus low transpiration) appears to be the differentiating factors . Maintaining dominance of such tussock grass cover is highly desirable for water production purposes , especially in upland supply catchments . Trade-offs between forestry for wood production/carbon sequestration versus water production should be carefully evaluated with fully integrated land use planning , particularly in such important catchments (Mark & Dickinson 2008) .

Reference

Mark , A . F . , Dickinson , K . J . M . 2008 . Maximizing water yield with indigenous non-forest vegetation : a New Zealand perspective . *Frontiers in Ecology and the Environment* 6(1) : in press .