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## Maximising water yield with indigenous tall grassland/rangeland on New Zealand uplands and trade-offs with alternative land uses

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**Key words :** Water yield, Indigenous grassland/rangeland, Land use, New Zealand

**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 ( $\delta^{18}\text{O}$  and  $\delta\text{D}$ ) 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.