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Modelling Native Pasture Hydrology at the Catchment Scale

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Modelling native pasture hydrology at the catchment scale

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Key words: modelling, native pastures, CAT, Native Pasture Model

Introduction Australian native pastures, like many around the world have undergone botanical transition since the introduction of agriculture. This has resulted in a shift in the landscape water balance increasing recharge to groundwater systems, rising water tables and the salinisation of waterways and soils. The enhancement of native perennial grass species is the most likely method for improving the water balance in the high rainfall, topographically difficult grazing landscapes of south-eastern Australia. Studies into the hydrology of native species and their communities have shown that increased water use is possible though this varies with species attributes (Hughes *et al*. 2006). To examine the impact of native perennial species within a catchment landscape the 1-dimensional Native Pasture Model (NPM) was developed to be incorporated into the 3-dimensional catchment and groundwater model the Catchment Analysis Tool (CAT).

Material and methods The NPM was developed to simulate the growth and water use of two native species *Bothriochloa macra* (C_4) and *Austrodanthonia* spp. (C_3). The NPM was validated against treatments for an experiment conducted at Wagga Wagga NSW for green leaf area index (GLAI) and soil water deficit (SWD). The NPM was then incorporated into CAT and applied to the Bet Bet catchment (64,432 Ha), a high priority catchment in central Victoria. Water balance, stream flow and salt output data was then predicted over a 44 year period.

Results Modelled data simulated experimental data well showing a relative root mean square error (RRMSE) of 12.8% GLAI ($r^2 = 0.68$) and 24.1% SWD ($r^2 = 0.91$) for *Austrodanthonia* spp and a RRMSE of 15.8% GLAI ($r^2 = 0.82$) and 22.8% SWD ($r^2 = 0.91$) for *B.macra* (Figures 1 and 2). When modelled in CAT, water balance differences between species were evident with 3.6 mm more run-off and 12.8 mm less recharge to groundwater (Table 1) by *B.macra*. It also resulted in 391ML of additional stream flow and 6304t less salt out of the catchment for *B.macra*.

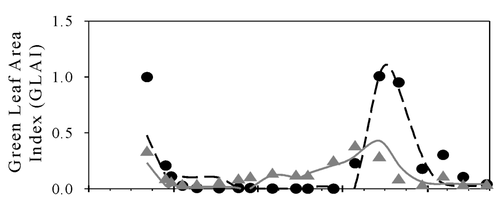

Figure 1 *Measured (scatter) and modelled (lines) GLAI for* Austrodanthonia *spp. (grey) and* B.macra *(black).*

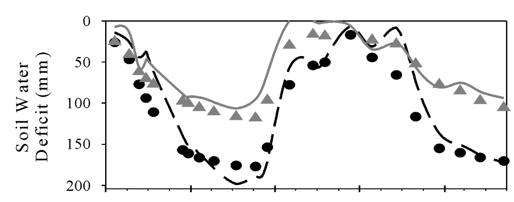

Figure 2 *Measured (scatter) and modelled (lines) SWD for* Austrodanthonia *spp. (grey) and* B.macra *(black).*

Table 1 *Water balance of* Bothriochloa macra *and* Austrodanthonia *spp. using the NPM in CAT when applied to the Bet Bet catchment (Area = 64,432 Ha).*

	Bothriochloa macra	*Austrodanthonia* spp.
Rainfall	557.2	557.2
Runoff	16.4	12.8
Soil evaporation	175.1	149.7
Transpiration	315.4	327.1
Evapotranspiration	490.5	476.8
Subsurface flow	12.1	16.2
Recharge	38.9	51.7
Stream flow (ML)	17902	18292
Salt output (t)	20677	26981

Conclusion Accurate prediction of the impact of botanical change on landscape hydrology is important for natural resource management. The NPM is unique in its ability to simulate Australian native species at both the plot and catchment scale. Further parameterisation of native species and the adoption of factors associated with botanical change within the model will enable modelling of dynamic temperate grassland landscapes.

References Hughes JD, Packer IJ, *et al*. (2006) Sustainable grazing systems for the Central Tablelands of New South Wales. 4. Soil water dynamics and runoff events for differently-managed pasture types. *Australian Journal of Experimental Agriculture* 46, 483-494.