Geophysical Research Abstracts, Vol. 8, 10620, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10620

Hydrologic change reaping prosperity and pain

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An ecological adage stating “There is no such thing as a free lunch”, is particularly significant in dealing with land use hydrology across Australia. Water balance shifts have accompanied land alienation directed at greater productivity for food and fibre. Such shifts pose threats to the natural resource capital with several examples of severe land degradation that limits the viability of an enterprise offering initial improvement to productivity. Central to any hydrologic change is a modified pattern of water use by vegetation, detectable at a sub-diurnal and daily scale but may be masked at longer term scales of seasonal to annual. Over the past thirty years, grounds for water use response as the major determinant of hydrologic change have been reinforced in an era of evapotranspiration measurement, undertaken with the dual purpose for critical assessment of water outflow and for understanding benefit as plant productivity achieved through enhanced water use efficiency. ‘ Our view from the watershed focuses on elements in transition both upland and on arable land of low relief. The upland forest environment has undergone change to the detriment of water harvest following wildfire and also with the conversion of eucalypt communities to pine plantation. Lowland, agriculture has flourished with productivity exceeding that of natural grassland and woodland by as much as an order of magnitude but experiencing diminished water quality associated with outbreaks of soil salinity and acidity. On the first visit along this trajectory thirty years ago, we had been alerted to penalties that compromised the natural resource base through endeavours to increase plant productivity in both upland and lowland. The current view of benefit tarnished with a diminished resource base is forged on the basis of a contemporary data inventory of observed evapotranspiration that facilitates understanding for the interaction between outflow and plant productivity. Four case studies of ecological change, two dealing with the forest environment and two in arable country, are examined to explore this trade-off between streamflow and plant production. Intervention in eucalypt forest and cropland has increased plant

productivity in each case study through changed plant function that does not necessarily translate into changed outflow. Furthermore, changed plant function inducing reduced streamflow does not exercise an equivalent control on material transport in suspension and solution. Resolving these paradoxes has been accomplished in each case study through a better understanding of effective water use for growth. This understanding is central to an optimal ecology, productive in food, fibre and water and exercising enduring control on outflow that affords environmental protection.