THE HISTORY OF LAND MANAGEMENT AND ITS IMPACT ON WATER YIELD ON THE NORTHERN TABLELANDS OF NEW SOUTH WALES

P.A. Wright

Grazier, Armidale, N.S.W.

Australia's Rangelands include the Arid Zone, occupying 70 percent of the continent, and native, or natural pastures in the higher rainfall districts.

This paper is concerned with the latter portion of the Rangelands, and in particular with the pastures on the Northern Tablelands of New South Wales. It briefly examines the changes in Rangeland management which have occurred since early pastoral settlement, and some of the consequences of these changes, particularly upon our most basic rangeland resource - water.

The Northern Tablelands form the catchment area of the Namoi, Gwydir, Macintyre and Dumaresq river systems, all of which flow into the Barwon River, and are therefore of great significance to the Murray-Darling basin. The 3¼ million hectare area stretches from the Moonbi Range in the south to the Queensland border, and effectively across the border to Warwick and Stanthorpe in Southern Queensland. The average elevation approximates 900 metres, rising above 1500 metres on the Eastern scarp, and the average precipitation is 760 mm per annum. Winter temperatures are low, often with long periods of frost, and falls of snow on occasions. The principal soil parent materials are granite, ranging from fine, to coarse (Bull) granite, basalt, and Palaeozoic sediments (Harrington, 1977) but the vegetation has been considerably modified since the coming of European man.

Surveyor John Oxley (1820) records when he ascended to the Tablelands from the Liverpool Plains, and followed up the MacDonald River, a tributary of the Namoi, that "the country, although well clothed with grass, its less luxuriant growth (compared with the Liverpool Plains) showed the difference of soil not to be favourable" p. 289. On the following morning (September 9th) he records that "in the night we had a severe frost" p. 292. These are significant entries, for they indicate the conditions encountered by the pastoralists who were to follow with their flocks and herds, and which initiated, even from the earliest times, their persistent and ultimately successful endeavours to drastically alter the Tableland Rangeland scene.

The history of these endeavours, and the resultant changes in the pastures and stock numbers are documented by Wright (1964), McDonald (1966), Norton (1971) and Whalley et al. (1978). The most important features were ringbarking of trees and regular winter burning of pastures up until well after the turn of the century, and the rabbit plague of the 1920's. Superphosphate was recognised in the late 1920's, and became generally used in the 1930's but the development of aerial top-dressing and seeding in the 1950's led to the rapid increase in pasture improvement which took place from the 1960's onwards. (Table 1 and Figure 1). So fast and successful was this development, so eagerly was it pursued, and so radical were the consequent stocking policies and associated management strategies and decisions that there was little opportunity, even if such had been sought, to observe and monitor associated ecological changes, although a period of drought in the mid-1960's sounded a warning of what might come and created uneasiness in the minds of some.

Table 1: Land-use Changes in the Severn River Valley
(expressed as % of total land-use)(after Banens 1981)

Land Use	1950	1960	1970	1980
Crops	4	7	9	10
Improved Pasture	6	19	27	27
Topdressed Pasture	1	12	20	22
Native Pasture	77	51	29	26
Timbered Land	12	11	15	15

In association with the pasture revolution, and as a consequence of it, there were radical changes in animal husbandry practice and associated property development and management. Stock numbers, both sheep and cattle, rapidly increased (Table 2) and pastoral enterprises changed from a store stock operation, based on the importation of wethers for woolgrowing, and breeding of cattle for sale as store animals, to sheep-breeding for fat lamb and wool production, and the retention of store cattle for sale as fats. These changes brought a requirement for intensive sub-division of properties into smaller paddocks (Table 3), and in turn this precipitated a need for the provision of large numbers of dams for watering points (Table 3). Many such dams were subsequently found to be too small to cater for the greatly increased water consumption, and in the process of their enlargement the

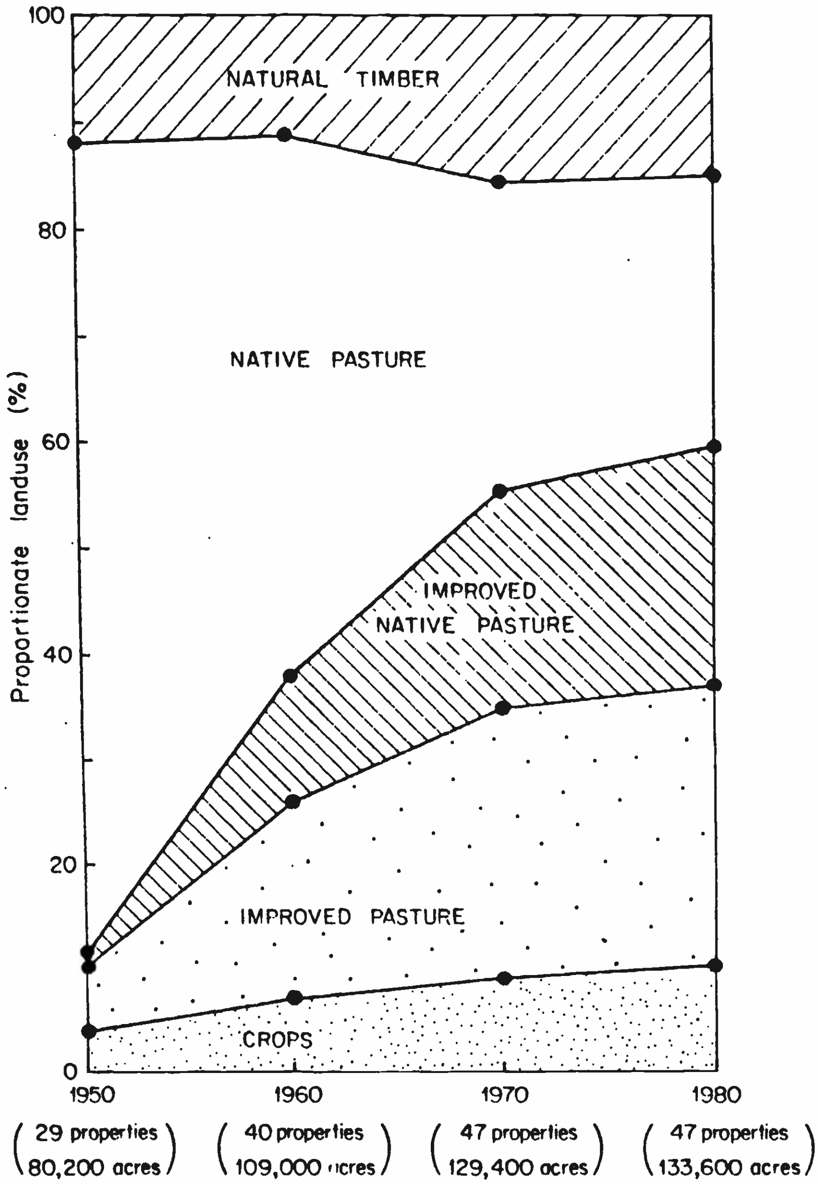

Figure 1: Land-use Changes in the Severn River Valley
(after Banens 1981)

mistake was frequently made of increasing surface area rather than depth, leading to considerable water loss through evaporation. Problems of verge puddling through trampling, siltation and poor water quality soon emerged.

It was also found that many of the hiterto permanent spring-fed creeks containing deep water holes, which were greatly relied upon, became silted from bank erosion caused by stock trampling, particularly cattle, and the free-flow of water was further hindered by the appearance of Cumbungi and other aquatic growths which took root in the silt beds. The most significant change noted however, was an apparent reduction in the amount and intensity

Table 2: Stock Figures
Armidale Pastures Protection Board District

Rated for Year	Cattle	Sheep	Rated for Year	Cattle	Sheep
1957	107,245	2,211,432	1969	195,269	3,710,233
1958	110,556	2,308,317	1970	204,211	3,404,659
1959	108,774	2,389,131	1971	233,230	3,145,463
1960	117,539	2,561,946	1972	279,024	2,863,940
1961	141,615	2,612,532	1973	350,600	2,678,455
1962	156,792	2,552,403	1974	391,434	2,517,236
1963	168,687	2,857,470	1975	429,573	2,638,602
1964	204,901	3,124,700	1976	454,968	2,771,351
1965	220,388	3,612,827	1977	457,039	2,754,391
1966	172,932	3,165,152	1978	458,153	2,868,732
1967	139,620	3,167,374	1979	420,114	2,879,230
1968	179,658	3,842,333	1980	402,654	2,976,445

Table 3: Changes in the Pastoral
Industry in the Severn River Valley Study (after Banens 1981)

	1950		1960		1970		1980	
	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
Changes in Livestock Densities (animals per shared 10 hectares)	1.0	17	1.2	22	2.2	27	3.2	26
Changes in average Paddock Size (hectares)	84		60		48		43	
Changes in Dam Densities (dams per 1000 hectares)	4		7		10		13	

of water runoff into streams and dams from storm rains, and a reduction in the flow rate and permanency of the numerous fresh water springs for which the tableland country was noted. These conditions led to the construction of more dams in an effort to store more water when runoff did occur.

However, it was the onset of a two-year drought at the close of 1964 which brought the first real warning of the consequences of the rapid and

and radical changes. The clover dominant pastures blew away in dust; and many of the exotic introduced grass species failed. But more importantly, and significantly, a serious and limiting shortage of water developed. Dams became empty, and springs and streams not known to have failed in the driest of times, dried up. Nevertheless, with the breaking of the drought and ensuing floods, confidence soon returned. The pasture and associated property development programmes were resumed with a vigour which increased with a demand for increased production per acre to offset the impact of a growing cost/price squeeze. The warning of water limitation made many pastoralists uneasy, but an ensuing period of high rainfall dispelled their fears. Stock numbers continued to rise, and there was a significant emphasis on cattle numbers (see Tables 2 and 3).

The bonanza was short-lived. The year 1979 saw the onset of what was to become a far more devastating drought. In contrast to 1965, it was preceded by a period of rainfall sufficient to maintain pasture growth, but insufficient to precipitate runoff from the improved pastures. Consequently, water storages were depleted prior to the onset of the drought and by mid-1980 a water crisis had developed. Water, rather than pasture, had become the limiting factor, and the crisis now was extended to the urban communities, which, over the period under discussion had also increased their demands on available water. Almost every urban supply reservoir reached a stage where remaining supply was calculated in days, not months or years.

Co-incidental with the pattern of changed land-use and management on the Tablelands since the 1950's, there had been a similar change on the Western plains. A traditional pastoral economy was supplanted by intensive agriculture, and the Western rivers, largely fed from the Tablelands source, held vast irrigation potential. This developed on an unforseen and quite unplanned basis, aided by the construction, largely as the result of political pressures and reactions, of large storage dams below the Tableland catchment areas. When drought set in, the consequent drain on these reservoirs reduced them to 20%, and less, of their capacities. Although outflow was curtailed by regulation, and irrigation quotas reduced, the newly-imposed pressure on the rivers reverberated through to the Murray-Darling system. This had obvious, though unforseen repercussions upon their already established irrigation economies, where there is now deep concern not only over the shortage of water, but over resultant problems of salting, and deterioration of water quality. This whole development is now the just cause of extreme concern to South Australia for whom the Murray is the staff of life. However, in looking for solutions to cause and effect, attention must go beyond the new irrigation complex on the upper rivers. It must go also to the Tablelands, which are the staff of life to the Western rivers (see Figures 2 and 3, Severn Valley Rainfall and Runoff Duration Curves). Moreover, it would be dangerous in the extreme to seek simple solutions such as the provision of more water from other sources, as envisaged in the concept of the diversion of Eastern-flowing rivers to the West. In the light of repercussions now being experienced as a result of interference with the natural state of things, such may well exacerbate and extend the problems, rather than cure them.

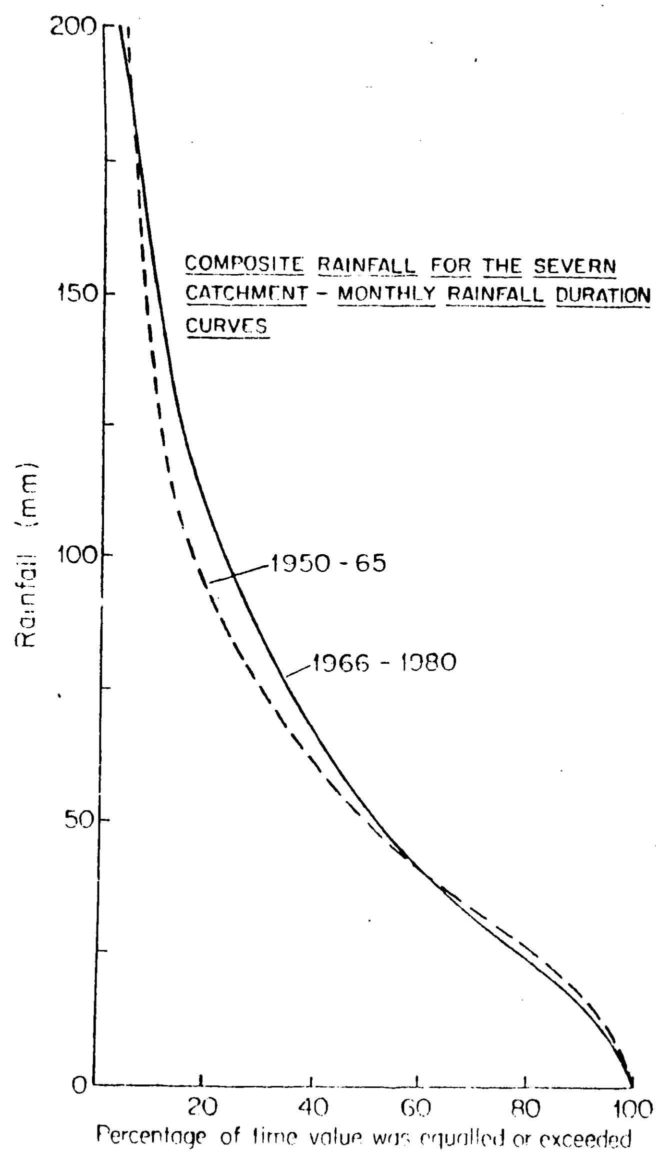

Figure 2: Severn Valley Rainfall Duration Curves

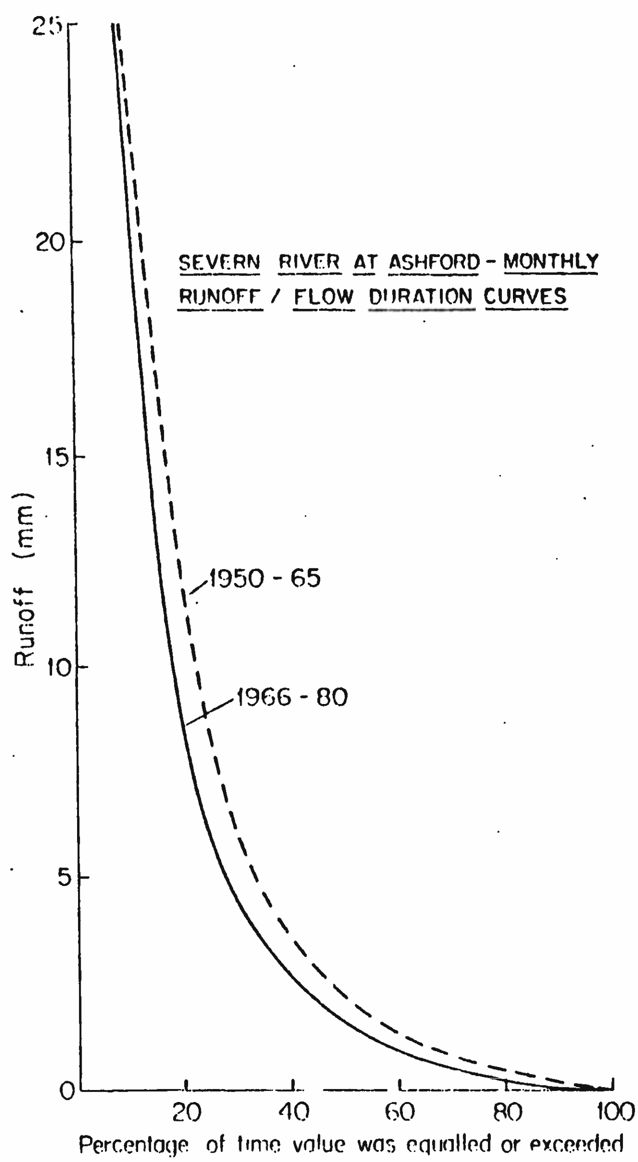

Figure 2: Severn Valley Runoff Duration Curves

The manifestations of this time-fractional chapter in Rangeland mismanagement have now engendered deep concern.

Accordingly, the Resource Engineering Department of the Faculty of Resource Management at the University of New England, in co-operation with a group of graziers, farmers, Local Government representatives and citizens, and with the support of the Conservation Society of New South Wales, has embarked on a Water Management Research programme, with the goal of "Water For the Future". The first phase of this programme, now completed, constituted a study of the Hydrology of the 3500 sq. km. catchment area of the

Severn River, which forms the headwaters of the Macintyre River. This region typifies the pasture development history of the Tablelands.

In summary this study (Banens 1981), which was largely conducted on a personal interview/questionnaire basis revealed the following (see Tables 1 and 2 and Figures 1, 2 and 3):

1. A decrease in native pasture from 77% of total land-use in 1950 to 26% in 1980.
2. An increase in sheep numbers of 55%, and cattle numbers 225% in the same period.
3. An increase in dam density of 230%.
4. A reduction by 50% in paddock size.
5. Despite increased precipitation in the last 15 years as compared with the preceding 15 years, there was a reduction in runoff over the latter period.

These findings substantiate the uneasiness engendered in the 1960's, and confirmed by the drought of the 'eighties', the lesson is that water is a finite resource. We simply cannot continue to take it for granted that there is plenty more where it comes from. Perhaps there is another lesson. The use and management of our Rangeland resources must become less the province of chance and opportunity, to be exploited unthinkingly by land-users, agricultural advisers, economists, politicians, public servants and even scientists. All have their part to play in determining patterns of land-use, but those parts must in future be played with knowledge afore-thought, not knowledge afterthought.

References

Armidale Pastures Protection Board. Analysis of Stock Figures 1957-1980.

Banens, R.J. (1981). Hydrology and Land-Use Study of the Severn Valley. Draft Report, Resource Engineering Department, Faculty of Resource Management, University of New England, Armidale.

Harrington, H.J. (1977). An Atlas of New England (Vol. I), ed. D.H. Lea, J.J. Pigram and L. Greenwood, Department of Geography, University of New England, Armidale.

McDonald, G.T. (1968). Recent Pasture Development on the Northern Tablelands of N.S.W. Aust. Geog. 10: 382-91.

Norton, B.E. (1971). The Grasslands of the New England Tablelands in the Nineteenth Century. Armidale & District Historical Society Journal and Proceedings. No. 15: 1-13

Oxley, John. (1820). Journals of Two Expeditions into the Interior of N.S.W. Undertaken by Order of the British Government in the Years 1817-1818. John Murray. London.

Whalley, R.D.B., Robinson, G.G. and Taylor, J.A. (1978). General effects of management and grazing by domestic livestock on the Rangelands of the Northern Tablelands of N.S.W. Aust. Rangeland Journal. I: 174-90.

Wright, P.A. (1964). Pasture Improvement in New England. Armidale Historical Society Journal and Proceedings. No. 7: 15-23

Acknowledgements

Assistance and advice, Dr. R.D.B. Whalley, Department of Botany, University of New England and Mr. R.J. Banens, Resource Engineering Department, University of New England and for typing, Lorraine Blight, Resource Engineering Department, University of New England.