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M R. Wells

K E. Hawley

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Shire of Manjimup: A brief assessment of the physical land resources with respect to horticultural land use

Compiled by:

M. Wells

Soil Conservation Research Officer

and K. Hawley

Officer in Charge, Manjimup District Office

Department of Agriculture

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Disclaimer

The contents of this report were based on the best available information at the time of publication. It is based in part on various assumptions and predictions. Conditions may change over time and conclusions should be interpreted in the light of the latest information available.

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1. Introduction

The Manjimup Shire is of importance to horticultural industries for two main reasons:

- a) It has a relatively high and reliable rainfall and a long growing season.
- b) Parts of the Shire have a combination of good quality water, suitable sites for large farm dams and suitable soils which favour irrigated horticulture.

At the request of G.R. Crimp and Associates, consultants to the Shire of Manjimup for the preparation of its District Town Planning Scheme, a brief study was initiated in order to define those areas within the Shire which have particular importance for horticulture. Due to the economic importance of horticultural industries to the Shire it is felt that some form of protection in the form of Shire planning controls is warranted to ensure the opportunities to use land for economic agricultural purposes are maintained.

In the limited time available it was decided the Department of Agriculture could best assist planning by an analysis of existing land resource survey information. The study aimed to delineate areas most capable of intensive agricultural use, ie. those with the least physical limitations to cultivation and irrigation, relying heavily on the experience of District staff to progressively refine the area assessment by consideration of existing land use and other relevant constraints.

The study area was rather arbitrarily defined as all rural land occurring within a rough 15 km radius of both Manjimup and Pemberton, but excluding salinity-prone lower rainfall areas. It was considered that the 15km radius would encompass the majority of the present horticultural areas and would include most areas subject to subdivision or alternative land use pressures resulting from future township expansion.

2. Land resources of the area

The most useful land resource survey data for the area was found in McArthur and Clifton (1975). Their publication contains a map of soil associations of the major part of the Shire at a scale of 1:250 000. Additional information on the nature of the landform—soil—vegetation associations was found in Johnston, McArthur and Peck (1980), Collins and Barrett (1980) and in Bradshaw and Lush (1981). The influence of land use on stream salinity in the area is discussed in Technical Bulletin NO. 27 of the Department of Agriculture (1974).

Landform/Geology:

In the broad physiographic setting most of the Shire forms part of the southern extremity of the Darling Plateau. The Plateau slopes gently southwards having an elevation of approximately 330 m AMSL in the northern part of the Shire) and approximately 40 m AMSL towards the coast where it appears to pass beneath sand dunes.

The Plateau has a basement of Precambrian gneissic rocks and is mantled by laterite. The laterite consists of massive ironstone or gravel underlain by mottled and pallid clays of the weathering zone. The Plateau is dissected to produce a landscape with laterite remnants of the original laterite surface on higher ground.

Soils:

Soil development has been largely determined by depth of dissection and exposed parent materials. On the upland laterite remnants the soils are predominantly massive ironstone or gravel with a matrix of light brown sand or sandy loam. These soils are extremely infertile and have very low water—holding capacities.

In dissected areas beneath the laterite mantle red and yellow podzolic soils have developed on acid to intermediate gneisses, and red earths occur on areas of basic gneisses. The red earth soils commonly have a brownish red loam or sandy loam surface changing gradually to a red clay subsoil. These soils have high water holding capacities but for most agricultural production require an annual top dressing of superphosphate fertiliser. The red podzolic soils are similar to the red earths but are duplex, showing a relatively sharp change in texture from the surface to the sub—surface. This change affects water penetration and for a time during winter such soils may have a perched water table. Yellow duplex podzolic soils are usually a little more poorly drained still, being commonly subject to waterlogging and generally infertility.

Two other broad soil associations occur in the Shire but are of little horticultural importance. These are the poorly drained yellow podzolics and solodics of the high level flats and swampy drainage areas north of Manjimup, and the calcareous sands, siliceous sands and podzols of the coastal dune areas. Soils of the former association have peaty sand surfaces and pale mottled clay subsoils, whilst the latter association is uniformly sandy.

Natural vegetation:

There is a broad association between landform, soils and natural vegetation in the Shire which is helpful in delineating areas of agricultural potential.

On the lateritic uplands where soils are commonly gravelly, Jarrah forest is dominant. Where the laterite has been eroded away, on moderately incised valleys with gentle slopes and dominantly podzolic soils, a Jarrah—Marri association is formed. On more deeply incised valleys with steeper slopes and red podzolics and red earth soils, a Karri—Marri association occurs. Within gully situations here, and in more dissected areas further to the south, a dominance of Karri on red earth soils is found. Elsewhere on the swampy high level flats north of Manjimup dense low scrub vegetation occurs.

It is important to understand the factors governing the occurrence of Karri because its associated red soils (Karri barns) are most sought after for intensive agricultural uses due to their good drainage and waterholding properties. The occurrence of Karri within a broad zone defined by rainfall, is not restricted by topography but more by the degree of landscape dissection, Karri is found most commonly in areas south of Manjimup, south of the laterite mantle remnants, in areas where erosion and dissection of that surface have been sufficient to expose underlying basic gneisses on which the red soils have developed.

3. Agricultural land use

The total area of Manjimup Shire is approximately 689 400 ha. Within this, the Australian Bureau of Statistics in 1980/81 reported a total area of 105 649 ha of “agricultural establishments”. This represents approximately 15% of the Shire area, and almost all of the remaining 85% consists of State Forest (See figure 1).

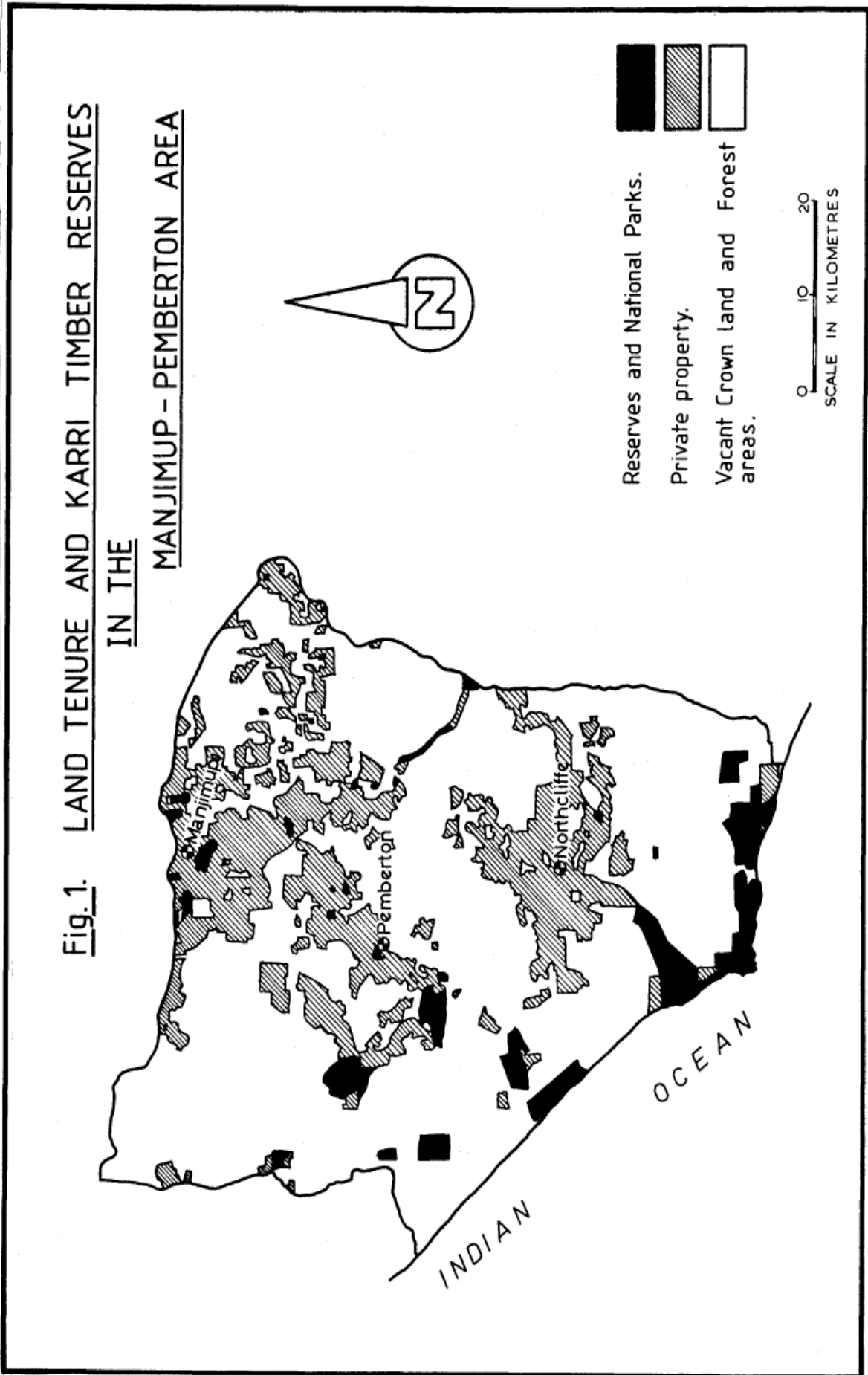
Despite the relatively small proportion of land devoted to agricultural uses Manjimup Shire is an important horticultural production area and its contribution to overall State production of horticultural crops is increasing. This trend has been apparent over the past 15 years or more and at present the Shire has about 40 percent of the State’s total area of potatoes and a high proportion of the State’s production of cauliflowers, beans, peas and onions.

Manjimup also contributes about 25% of State apple production and contains significant areas used for dairying, beef cattle and sheep production.

In general the red soils (Karri barns) are favoured for all types of agriculture but are commonly used for potato growing and apple and pear orchards under irrigation, and to a lesser extent for dairying.

The yellow podzolic soils are used mainly for extensive agriculture, for grazing of beef cattle and sheep. The very gravelly upland lateritic soils, the poorly drained upland flats, and the coastal dunes are generally used for low intensity grazing if at all.

Within the Manjimup-Pemberton region a combination of landform, climate and soil characteristics favour water storage in gully dams and hence favour irrigated horticultural land uses. It is significant to a consideration of landuse planning that these favourable conditions are relatively rare in Western Australia.



5. Factors limiting horticulture

The major factors considered to limit use of land for horticultural use within the Shire are:

(i) Salinity

Within south west Australia the removal of native forest and its replacement by annual crop and pasture plants has caused an increase in stream salinity and occurrence of saline seepages in dryland areas. Where rainfall is insufficient to adequately flush out salts that have accumulated within soils as a result of rising groundwater levels following clearing, the problem of increasing salinity occurs.

For the purposes of this study stream salinity has been the major consideration. In the Manjimup-Pemberton region increases in stream salinity since early settlement appears to be associated with clearing for agriculture in areas receiving less than 1000 mm (40 inches) annual rainfall (WA Dept. of Agric. 1974). It is generally considered that areas with rainfall in excess of 1100 mm per year are unlikely to be subject to salinity problems. However in this report the 1000 mm rainfall isohyet has been used to separate areas of considerable horticultural potential from those with relatively little potential. The reason for this is that the line shown on the attached map conveniently encompasses a number of existing horticultural properties which the Department of Agriculture feels should be included in any protection policies initiated by Shire planning.

The 1000 mm isohyet on the eastern side of the Shire, extends approximately along Muirs Highway to Peppermint Grove Road and then down the South West Highway. It is desirable that future horticultural land use be guided into the higher rainfall areas to the west of this line, and if possible west of the 1100 mm line.

(ii) Opportunity for on-site water storage

As large amounts of water are required for irrigation, a major limiting factor is whether or not areas of land to be used for horticulture have sufficient catchment area and suitable topography for dam construction. To the south and south west of Manjimup the dissected undulating terrain provides many suitable locations for gully dams. Given sufficient compaction the clay subsoils are also suitable.

(iii) Soil drainage and water holding capacity

The most desirable drainage and waterholding characteristics are found within the red earth soils (Karri barns). Sandier soils on the lateritic uplands and the southern coastal areas hold insufficient water for intensive cropping. The podzolic soils on the other hand often hold too much water and are commonly waterlogged in winter, particularly those soils with mottled yellow or grey coloured clay subsoils.

(iv) Erosion hazard

On loamy soil types, areas with slopes in excess of 25% are considered prone to erosion if cleared and cultivated. Soil losses from erosion can result in decreased productivity, sedimentation of streams, and decreased water quality. Intensive agriculture is therefore hazardous on some slopes and ridges of the more dissected land types.

(v) Soil depth and stone/gravel content

The shallowness and gravel content of many areas of upland lateritic soils is a factor limiting agricultural potential due to the impedence to cultivation and the inhibition of plant root and tuber growth.

5. Assessment Results

The land resources of the area were studied by stereoscopic examination of 1:50 000 scale aerial photographs and subsequent brief field checking against the 'background data' provided by McArthur and Clifton's report and other published data.

The study showed, not unexpectedly, that a large proportion of land within the study area was either currently being used for horticultural purposes or could be used in future. There are however some differences in potential or suitability based on the value of the physical land resources alone and these differences are shown on the map included with this report.

The map delineates different mapping units with relatively uniform and characteristic, soil and landform properties. For each map unit a number of factors considered relevant to the horticultural potential of the land, have been assessed in terms of the degree of limitation their presence or absence is likely to impose on that land use. Table 1 lists the factors and shows how each is considered to affect the suitability of land for irrigated horticulture.

Table 2 gives a brief description of each of the map units, the severity of limiting factors, and subsequently a horticultural suitability ranking. The ranking can be simply related to the number of crosses within the 'limiting factors' portion the table. In terms of horticultural potential there are differences between different landform positions (upper slopes against lower slopes) within the same soil association eg. areas A, B, C. However, delineation of these separate areas is not warranted at this mapping scale. The number of limiting 'crosses' should therefore be averaged among the different landform positions to enable comparisons with other more homogeneous areas.

The favoured 'Karri soils' occur most commonly in the Pemberton and Nyamup associations (areas A and B within detailed study area), although often on the steeper more erosion—prone slopes.

Table 1 Factors limiting suitability for irrigated horticulture

Factor	Degree of limitation		
	None to slight (-)	Moderate (x)	Severe (xx)
Stream salinity	Not affected, > 1000mm rainfall	-	Affected, < 1000mm rainfall
Dam sites	Suitable, undulating-hilly topography; clay sub-soils; large catchment area.	Marginal, slightly undulating or upper slopes with small catchments.	Unsuitable, flat topography; poor sandy subsoils.
Soil drainage	Well drained but with good water-holding capacity for plant growth.	Excessively well drained with very 1cM waterholding capacity.	Poorly drained, subject to waterlogging.
Erosion hazard	Gentle to moderate slopes, either loamy or sandy soils.	Steeper slopes with loamy soils.	Steeper slopes with sandy soils.
Soil Depth/ Stone, gravel.	Deep soils, gravel and stone free.	Moderately deep Soils with gravel.	Shallow soils with much gravel and massive rock outcrop.

6. Conclusion

By considering both the existing and the potential use of the land resources, the horticultural importance of the Shire's rural land may be ranked in descending order as follows:

1. Those areas of undulating mainly non—lateritic and non-saline country with predominantly gentle slopes and better drained red soils occurring in reasonable proximity to the townships of Manjimup and Pemberton. These include areas south of Ralston Road and to the south west of Muirs Highway near Manjimup, and the Eastbrook and Pimelia areas near Pemberton.
2. Those areas of similar dissected country with somewhat steeper slopes occurring west of the 1000 mm isohyet and generally to the south of Manjimup township.
3. Those remaining areas west of the 1000mm isohyet that have some significant limitations with respect to either farm dam suitability, soil drainage or soil depth.
4. Those remaining areas of the Shire that may have generally favourable terrain and soil type but are east of the 1000mm isohyet and hence may be prone to stream salinity problems.
5. Coastal areas of the Shire with either poor sandy soils that hold little water for plant growths or else swampy low lying terrain providing little opportunity for gully dams for water storage.

Table 2

Area	Description		Limiting Factors					Horticultural Ranking
			Salinity	Dam sites	Soil Drainage	Erosion hazard	Soil Depth/ gravels	
Within Study Area	Landform	Soils (Refer McArthur & Clifton-1975)						
A	Dissected country with predominantly gentle slopes	Nyamup: Upper slopes- gravelly podzolics	-	X	X	-	X	1
B	Dissected country with predominantly steeper slopes.	Pemberton: Upper slopes-Podzolics Lower slopes — red earths	-	X	X	-	-	2
C	Upland remnants of lateritic plateau.	Balbarrup: Rises – block laterite Slopes – gravelly sands						
D	Drainage areas & broad upland flats	Perup: Podzolics & solodics with some gravel pavement	-	XX	XX	-	X	3
E	Flatter, weakly dissected lateritic country	? : Podzolics, commonly gravelly	-	XX	X	-	X	3
Elsewhere in Shire								
Areas east of 1000mm Isohyet	Dissected lateritic country with gentle slopes on areas of block laterite on plateau remnants	Nyamup): As for A, C Balbarrup)	XX	X	X	-	X	4
Coastal Regions	Most commonly, coastal sand plains, dunes & low hills. Less commonly lowlying swampy areas	Mainly Chudalup, Cary, Meerup Quagering & Blackwater) - Uniform sandy soils with some areas of gravelly podzolics & gravelly red earths. Some peaty sands.	-	XX	X	X	-	5
			*Nil to slight		X Moderate		.XX Severe	

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