Chapter 5

SEMI ARID WOODLANDS (CHARLEVILLE)

5.1. Nature of the region

5.1.1 Background

The 'Charleville area' discussed in this chapter, is defined by the boundaries of the Murweh Shire the location of which is shown on Figure 5.1.

In 1983-84 the Murweh Shire carried 821,000 sheep and 115,000 cattle. Properties commonly carry both sheep and cattle because;

(a) grazed together they appear to permit higher, sustained animal grazing pressure than can be achieved by sheep or cattle alone (Holmes, 1983). Mixed grazing also results in higher average woolcuts,
(b) together they allow a better utilization of family labour,
(c) diversification in production, and
(d) better management of the Acacia woodland vegetation.

Pastoral production across Australia has been under considerable economic pressure over the last fifteen years (Musgrave, 1983). Pastoral properties have responded to this pressure by shedding labour, reducing capital investment and, where possible, increasing property size.

At a regional level these responses have commonly led to a decline in the population and a reduction in the number of properties. The population of the Murweh Shire declined from 7,870 in 1963 to 5,5000 in 1983.

Table 5.1 shows, however, that there appears to have been little property level structural adjustment though some property build-up may have been disguised in holdings by individual family members. The total number of pastoral properties in the Murweh Shire has been about 230 for the past 40 years. Table 5.6 shows that for the whole of South West Queensland, the size distribution of sheep flocks has changed little over the last decade.

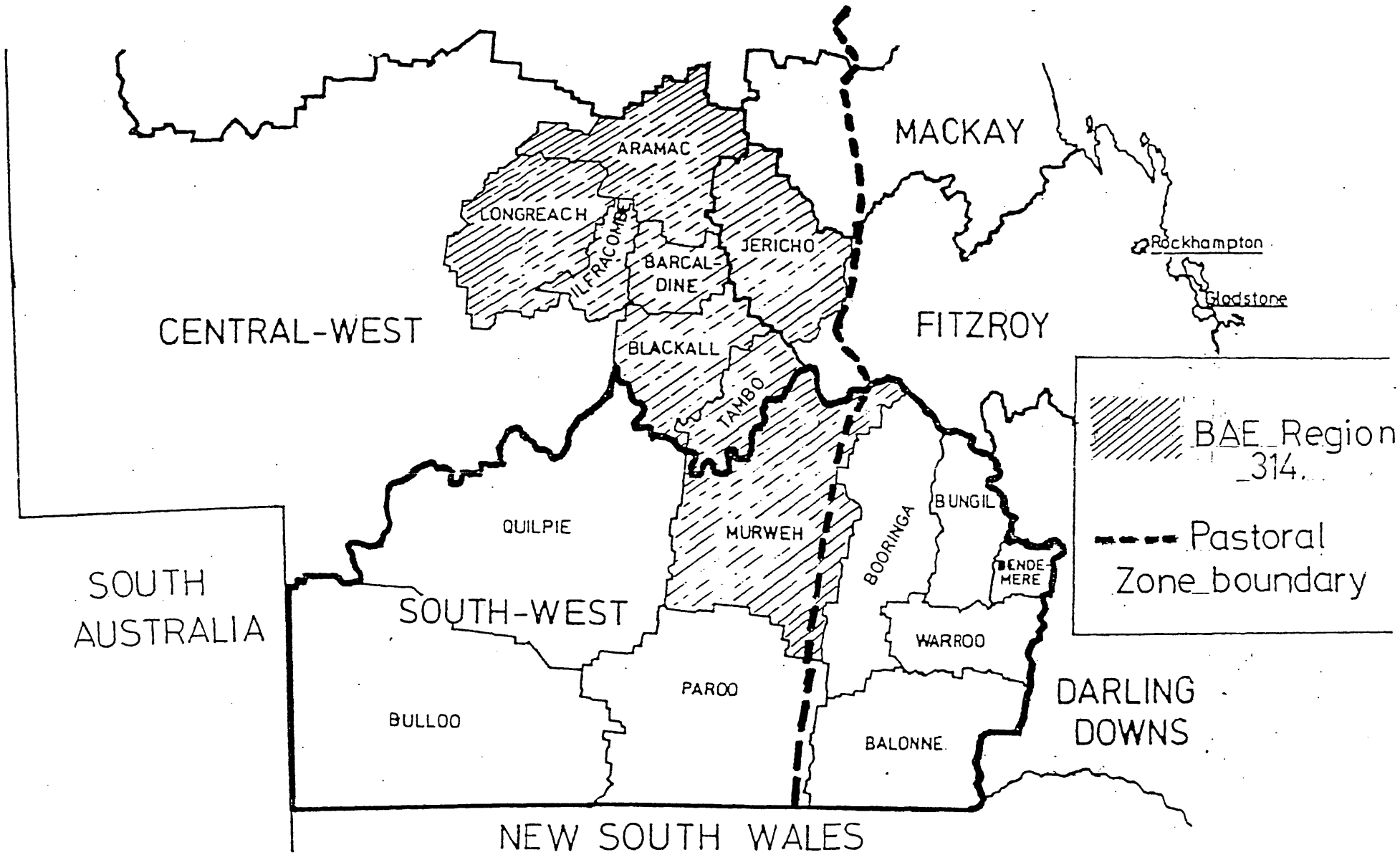


Figure 5.1 The Charleville area.

Structural adjustment would appear to be necessary. According to Mills (1982a) about half of the Murweh Shire sheep-beef graziers controlled less than the `living area' of 8,750 sheep, recommended by the Queensland Land Administration Commission (LAC). It is proposed that the very restrictive nature of pastoral land tenure in Queensland was the most significant cause of this lack of adjustment to property size.

Murweh Shire graziers have tried to respond to their changing economic circumstances. Figure 5.2 shows how emphasis shifted from wool production in the 1960's to beef in the 1970's and back to wool in the early 1980's. One of the unfortunate consequences of the move to beef production was very heavy grazing pressures from 1975-80.

Almost all properties in the Shire are now under a restricted leasehold title or perpetual lease, and run by family partnerships (Mills, 1982b).

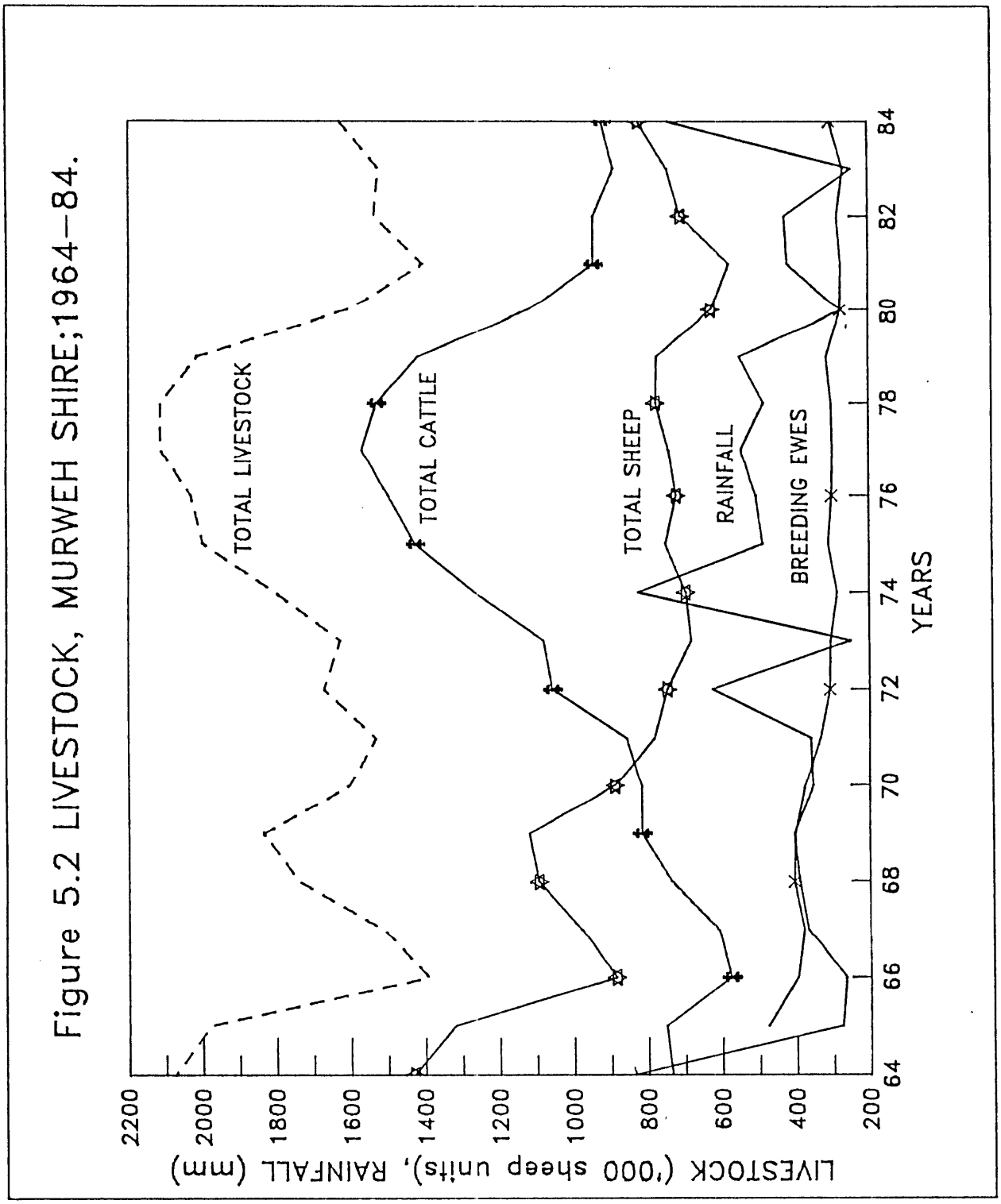


Figure 5.2 LIVESTOCK, MURWEH SHIRE;1964–84.

Table 5.1

Agricultural Establishments in the Murweh Shire (1945-84)

Year	Sheep Estab. (a)	Sheep Hold. (b)	Meat Cattle Estab. (c)	Meat Cattle Hold. (d)	Sheep/ Beef Estab.	Total Estab.	Total Hold.
1945		195		221			230
1953		201		201			229
1955		223		213			243
1958		214		210			245
1964		205		208			241
1974		185		222			244
1975		187		222			-
1976	70	185	57	224	81	215	-
1977	78	178	60	219	75	222	-
1978	77	177	55	216	76	221	231
1979	63	168	64	222	89	230	234
1980	55	163	73	211	92	229	235
1981	58	166	68	208	87	224	231
1982	80	169	59	196	73	224	-
1983	85	177	59	188	74	225	-
1984	88	170	56	186	72	227	-

(a) Sheep Establishment: sheep gross income at least four times greater than cattle gross income.

(b) Sheep Holding: property where sheep are present.

(c) Cattle Establishment: cattle gross income at least four times greater than sheep gross income.

(d) Cattle Holding: property where cattle are present.

Note: Establishments were first measured by the ABS in 1976.

Sources: ABS (Qld) `Livestock and Livestock Products' (1974-1984).
ABS Statistics of Queensland (1945-1974).

5.1.2 Climate

The climate of the Murweh Shire is hot and semi-arid with a predominantly summer rainfall. Charleville has a median rainfall of 320 mm in 'summer' (October to March), and 140 mm in 'winter' (April to September). 'Average' annual rainfall is 513 mm, (Queensland Year Book, 1984). The fact that average annual rainfall is higher than the sum of median summer and winter rainfall is due to the highly variable and episodic nature of the climate.

Summer rains depend on the random paths taken by rain bearing depressions, Winter rainfall comes from anticyclonic fronts developed over southern Australia. These weather patterns rarely have the strength to deliver significant quantities of rain to inland Queensland.

Figure 5.3 shows the annual rainfall frequency for Oakwood Station, about 80 km north of Charleville, for the period 1883 to 1976. Like Charleville, about two-thirds of the years receive below average rainfall. The most frequent annual rainfall experienced falls in the range 300-350 mm, well below the average.

Drought is a common event and often widespread in the Charleville area (Pressland, 1984). Holmes (1985 pers. comm.) estimates that drought occurs three years in every ten. Once started droughts are also insidious, being statistically more likely to persist then to be broken.

Table 5.2, suggests, however, that rainfall was not the only factor considered in official drought declarations. An element in the apparent persistence of drought may have been the financial assistance provided to drought declared areas, especially since the early 1970's. Drought assistance includes subsidies on transport for fodder and stock and carry-on loans at concessional rates of interest. The issue of official drought declaration and land condition is addressed later in this chapter.

Areas that have been overstocked will respond to below average rainfall seasons as though they were droughts. DPI (1973, p.6-12) notes how overstocking leads to "...a man made component aggravating drought situations", with respect to land condition.

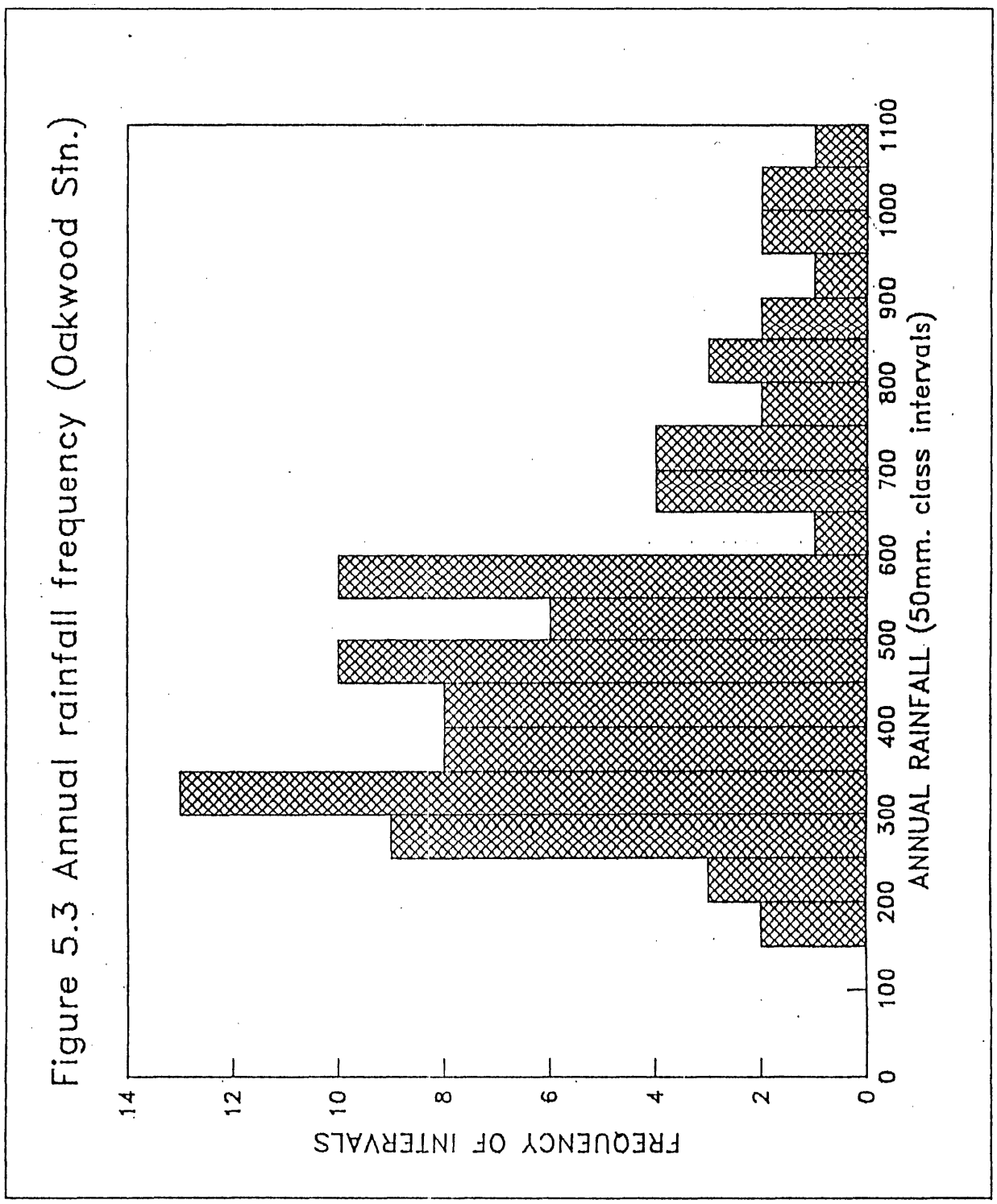


Figure 5.3 Annual rainfall frequency (Oakwood Stn.)

Extremes of temperature also characterise southwest Queensland. In summer the average daily maximum temperature is 34.4°C, with heatwaves, or continuous periods of daily maxima above 38°C being frequent. In winter frosts are common (Pressland, 1984) while relative humidity is low throughout the year. Annual evaporation is 2,100 mm at Charleville.

Table 5.2

Drought declarations in the Murweh Shire (1964-82)

YEAR	Months of drought declaration in year	Annual rainfall (mm) at Charleville	
1964	2	227	D(a)
1965	10	266	D
1966	4	368	
1967	8	391	
1968	1	406	
1969	10	353	D
1970	12	359	D
1971	12	625	
1972	11	251	D
1973	3	824	
1974	0	488	
1975	0	506	
1976	0	546	
1977	0	484	
1978	0	550	
1979	0	273	D
1980	12	419	
1981	12	427	
1982	12	245	D
1983	10	740	

(a) D = drought years, defined as those years when annual rainfall is within the lower three deciles of all historical annual rainfalls.

Sources: Pressland (1984, p. 29)

5.1.3 Soils and Vegetation

About two thirds of the Murweh Shire is composed of Mulga country, with 25 per cent being open eucalyptus woodlands, and 10 per cent Mitchell grass plains (Mills and Ahern, 1980).

The two major soil types of the Charleville area are the relatively fertile, grey brown and red cracking clays which most often occur on alluvial plains; and the more common infertile red earths found away from streamlines. The poorer productivity of the mulga country is due to the lower fertility and water holding capacity of its red earths.

The cracking clays support mainly grasslands, particularly Mitchell grass (Astrebla sp.). Mitchell grass plants may survive up to twenty five years, are quite drought tolerant, and recover well after firing. Orr and Holmes (1984, p. 249) suggest the optimum stocking rate for Mitchell grasslands is 1.2 hectares per sheep. Although able to sustain high levels of animal production in normal and good years, the Mitchell grass plains have no tree or shrub component and once the pasture has been eaten off graziers have to rely on mulga to feed livestock.

Adapted to living on infertile soils, but "...where there is some possibility of (moisture) recharge at all seasons" (Johnson and Burrows, 1981), the mulga woodlands are found between the 170-450 mm ishoyets.

Economically, the primary value of the mulga tree is as a source of fodder in droughts and the winter dry seasons, when it provides a maintenance diet for sheep. Graziers facilitate sheep browsing by `pushing' mulga trees over with bulldozers, or cutting them down with chainsaws.

Successful mulga management depends on both the maintenance of high levels of organic matter in the topsoil (Pressland, 1985) and "...shrub control and the maintenance of a rigorous perennial pasture..." (Harrington et al, 1984 p. 205). Grazing experiments at Charleville suggest that a 20% utilisation of the standing pasture biomass is an optimum grazing strategy (ibid).

Holmes claims that mulga country is suitable only for wool production from dry sheep and the breeding of store cattle; while Mitchell grass associations are best suited to breeding sheep and fattening cattle. Indeed, Orr and Holmes (1984, p. 248) maintain that "...mulga shrublands cannot maintain self-replacing flocks", and depend on Mitchell grass associations for adequate replacements.

Because of the comparative advantages of mulga and Mitchell grass associations across the range of seasons experienced in the Charleville area, most graziers seek to have properties with both types of vegetation.

5.1.4 Economic parameters

The BAE Region 314, which includes the Murweh Shire, is shown in Figure 5.1. Table 5.3 indicates that the average enterprise size in the Region in 1982/83 was 10,600 sheep equivalents, made up of 5,000 sheep and 700 cattle. The total capital value of this 'average' property was nearly $600,000, or about $56 per sheep equivalent. Livestock made up 44 per cent of the capital value of the property and fencing and waters about 40 per cent. Relatively small amounts of capital are invested in plant and machinery.

About two thirds of the annual labour input to the average property was supplied by the family.

The average farm business debt was $69,000 and farm business equity ratio 87 per cent. Full equity was found on 22% of properties while 37% had less than 80 per cent equity. This indicates that about one third of graziers may be suffering financial stress.

In monitoring the profitability of mixed sheep/cattle grazing enterprises in the Charleville area from 1972 to 1978, Holmes (1983) noted that the gross margin per sheep equivalent carried was much higher than that for cattle, in the absence of dingo predation. Gross margin per sheep varied from $4.90 to $6.50 and for cattle from $16.40 to $36.00 per head (or $2.05 and $4.50 per sheep equivalent at a conversion rate of 8 sheep per 1 cattle). Despite the higher gross margin for the sheep enterprise, Holmes found that in the mulga country east of Charleville, those properties with the highest return on capital per hectare ran greater numbers of cattle (in terms of sheep equivalents) than they ran sheep. This data suggest that, at the margin of substitution of sheep for cattle, there is an optimum level of forage utilisation and profitability not attainable by either sheep or cattle grazed alone.

Table 5.3

Average Property Financial Performance Region 314, Queensland (1982)

(all sheep and cattle properties)

	1982/83	1981/82
Farm Size (ha.)	18,000	15,000
Type of tenure		
Freehold (ha.)	1,430	900
Leasehold (ha.)	16,450	14,400
Average capital structure ($)		
Livestock	265,634	199,275
Other trading stocks	3,590	4,406
Total plant, machinery	43,774	36,671
Buildings (excl. homestead)	35,913	33,715
Land and fixed improvements (excl. buildings)	243,395	203,913
TOTAL CAPITAL ($)	592,306	478,000
Average sheep numbers	5,000	4,700
Average cattle numbers	700	630
Average enterprise size (sheep equivalents)	10,600	9,740
Farm labour input (weeks/year)		
Total family labour	100	86
Hired (permanent)	30	27
Hired (casual)	16	8
TOTAL LABOUR INPUT	147	126
Total cash receipts (average per farm) ($)		
Sheep sales	12,681	18,276
Total livestock sales	72,655	68,449
Wool	63,146	55,345
Government income assistance	2,142	18
Total sundry receipts	3,992	2,204
TOTAL CASH RECEIPTS	143,000	126,179
Total cash costs (average per farm) ($)		
Hired labour costs	23,426	17,000
Materials	29,208	17,000
Services and contracts	36,237	28,821
Livestock purchases, other costs	13,356	25,519
TOTAL CASH COSTS (excl. family labour)	101,619	87,863
Farm cash operating surplus (average per farm) ($)		
Depreciation and family labour (average per farm ($)		
Net depreciation	16,439	12,970
Total imputed family labour	18,275	15,000
Farm business debt ($)	68,772	61,098
Equity (farm business equity ratio, %)	87	87
Total off farm income of operator and spouse	4,400	3,848

5.2 Administrative Framework

From the establishment of the state of Queensland in 1860 pastoral lands were leased as 'runs'. Each run was more than 25 but less than 100 square miles in area (6,500 - 26,000 ha.). There were, initially, no restrictions on the number of runs an individual, or corporation could hold. Leases were issued for 14 years.

The Crown Land Act of 1884 laid down a legal framework for pastoral land tenure that was to persist for a century. The Act laid down the policy of closer settlement, or the breaking down of large properties into small family owned and operated units. It also established most of the land tenures existing today in the Charleville area. These range from the relatively short term 30 year pastoral leases, through perpetual lease to various (freehold) selection tenures.

Queensland land legislation does not recognise an explicit pastoral zone. All rural land was originally occupied under pastoral lease tenure and even today some high rainfall zone coastal land is still held under pastoral lease. Like other Australian colonial land tenures the Queensland pastoral leases were seen as a temporary form of tenure. It was envisaged that all pastoral leases would eventually be closely settled by families and alienated from the Crown. Colonial era pastoral leases were to prove inappropriate for livestock production in the arid zone, having short tenures, high rentals and uncertain rights of renewal.

The Land Acts of 1910 and 1962 were essentially Acts of consolidation, in that closer settlement policy remained the central thrust of legislation. The 1962 Act, however, reintroduced the freeholding of land in Queensland which had been banned in 1920. While the promotion of freeholding pastoral land was aimed at satisfying grazier desires to security of tenure, the strict limits on property size accompanying alienation, tended to consolidate the problem of small property size. It is relatively easy for governments to allocate extra land to properties held under leasehold tenure. Alienated land can only be expanded at private cost, and government options for assisting structural adjustment are limited.

Most of the pastoral properties in the Charleville area were developed as 30 year pastoral leases. Lease conditions encouraged capital investment and land clearance. After 15 years the Crown had the right to resume up to one half of the property. The lessee was compensated for any development work undertaken on the resumed portion. At the end of the 30 years a new 30 year pastoral lease was issued for the portion of the original lease still held by the lessee. Again the Crown had the right to resume up to one half of the property after fifteen years. This process of lease issue and partial resumption continued till the lease was reduced to a `living area', (QLA, Section 5) and the lessee was then entitled to exchange his pastoral lease for a selection tenure.

The portions of pastoral leases resumed by the Crown were subdivided into selection tenures. Available only for family occupation, they placed many constraints on property management, and until 1985 restricted property size to 24,000 hectares. A comparison of pastoral lease and selection tenures is shown in Table 5.4.

Few restrictions were imposed on the management of pastoral leases. No limits were placed on size and virtually no control exercised over factors such as agistment and stocking levels which may have lead to degradation. The most serious restrictions on pastoral lessees were that the usual lease term was only thirty years and that the Crown reserved the right to resume up to half of the property after fifteen years. These latter conditions would have provided few incentives to conservative management.

Present land policy is aimed at a build up of property size and the conversion of pastoral lease tenures to Grazing Homestead Freeholding lease (GHFL), which terminates in a restricted freehold title after 40 years.

Tables 5.1 and 5.6 show that the build up of property size is very slow, particularly among those properties with less than the 12-14,000 sheep equivalents considered to be a minimum for survival on mulga country (Mills 1982a). Table 5.5 shows that the average area of pastoral leases has hardly changed since the process of freeholding began.

While property size build up has been very slow, the process of alienation has been rapid, particularly after 1970. Figures 5.4 and 5.5 illustrate the rate of alienation of land in Queensland between 1970 and 1980.

Table 5.4

Pastoral land tenures in Queensland

Ownership	Size	Term	Personal Occupation (Residence)	Agistment	Stocking of land	Sub-leasing
Pastoral Leases						
company or family	no limits	30-70 years	no condi-tions	no condi-tions	no condi-tions	no condi-tions
Selection tenures						
family only	strict limits (d)	per-petual	personal occupation for whole term	permission required over 6 months	may be subject to con-ditions	not per-mitted

(a) Selection tenures (a) Perpetual Lease Grazing Homestead Perpetual Leases (GHPL).
(b) Freehold (i) Grazing Homestead Freehold Lease (GHFL). This is a derivative lease, only being available after the surrender of a GHPL.
(ii) Agricultural Farm (AF). This lease is obtained through ballot.

Both GHFL and AF have terms of 40 years. GHFL terminate in restricted freehold title, while AF leads to a grant of fee simple title.

(b) At 31/12/85 no individual may hold a GHPL which is substantially in excess of two living areas, (QLA, Section 86). The Queensland Land Administration equated a living area with a carrying capacity of 8,750 sheep (Mills, J.R., 1982). It is suggested that a GHPL in the Murweh Shire would be limited to a maximum size of about 20,000 sheep.

In the Murweh Shire most of the properties have been converted to selection tenure. Holmes (1980) found that the average property size in 1979 was 21,000 hectares and carrying about 10,600 sheep in most years. This data would appear to confirm the property size adjustment problem identified by Mills (1982a). What is more the policy of encouraging freeholding is attenuating government options for facilitating structural adjustment, as public intervention to alter the size of alienated land parcels is difficult and expensive.

Table 5.5

Average area of Queensland Pastoral Leases (1875-1984)(a)

Year	Number of Leases	Area of Leases (million ha.)	Average area per Lease ('000 ha.)
1875	4,292	73	17
1884	9,542	128	13
1890	5,540	116	21
1895	3,339	107	32
1900	2,272	91	40
1905(b)	1,113	72	65
1915	1,973	90	46
1920(c)	1,975	84	43
1925	1,897	74	39
1938	3,400	124	36
1955	2,413	103	43
1958(d)	2,275	99	44
1960	2,155	99	46
1963	2,059	98	48
1971	1,939	97	50
1973	1,917	97	51
1979	1,855	94	51
1982(b)	1,844	95	52
1983(b)	1,805	95	53
1984	1,778	85	48

Notes: (a) Includes Pastoral Holdings, Preferential Pastoral Holdings, Pastoral Development Holdings and Stud Holdings.

(b) Period of severe drought.

(c) Prohibition of freeholding of land in Queensland.

(d) Freeholding reintroduced.

Source: Statistics of Queensland, 1929/30, 1952-74.

Table 5.6

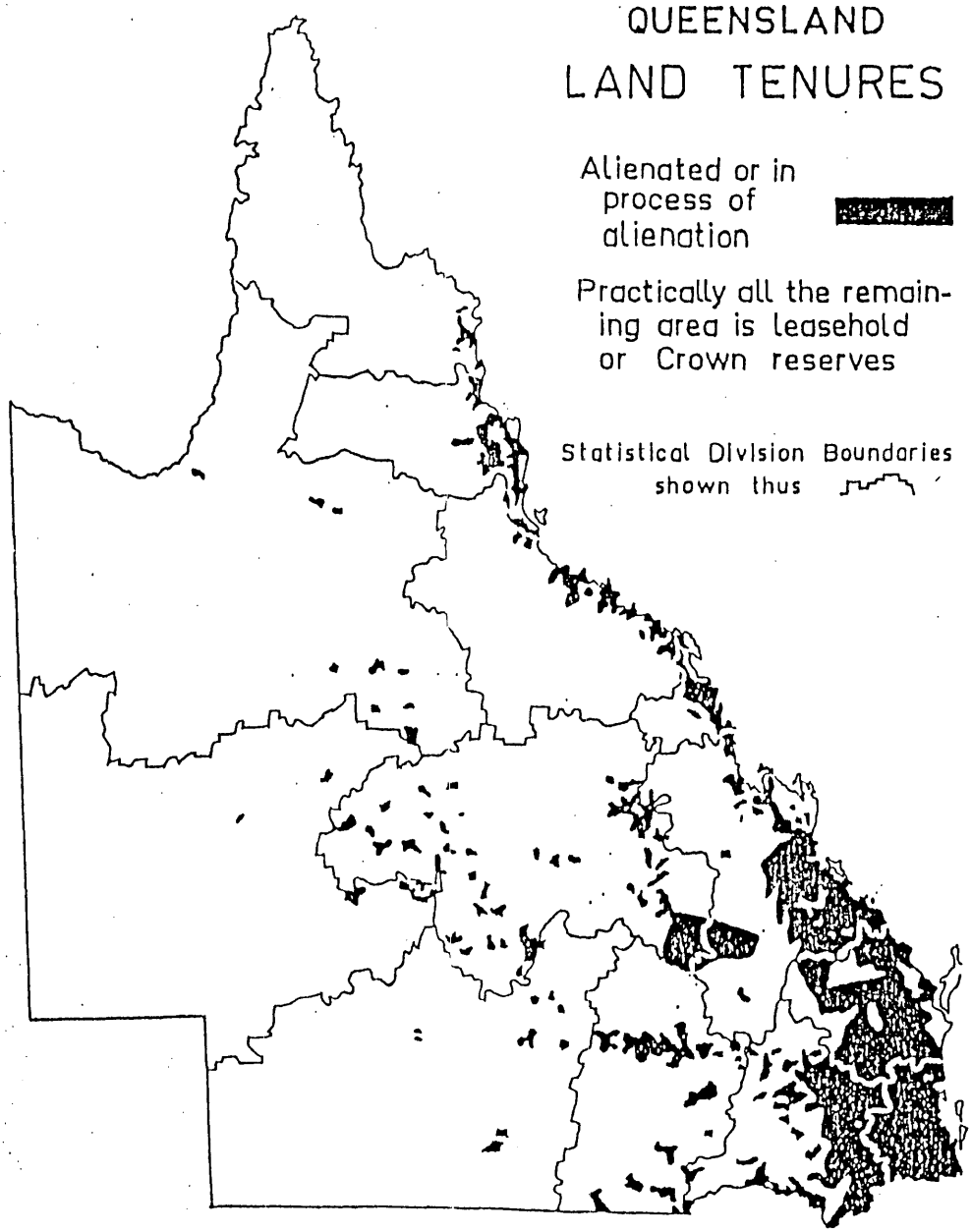
Size of sheep flocks in south west Queensland (1975-84)

Year	Total properties		Size of flock ('000 sheep)												
	with sheep	no sheep	0-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-15	15-20	20-25	50+
1975	1,300	741	443	136	183	138	113	79	63	44	28	51	13	7	2
1976	1,282	763	424	156	180	127	120	81	64	35	25	42	17	9	2
1977	1,241	720	411	130	153	146	109	69	78	39	28	52	13	11	2
1978	1,220	744	407	119	153	135	106	82	68	39	28	58	13	10	2
1979	1,177	785	384	107	136	127	115	83	77	38	23	58	14	13	2
1980	1,141	802	387	145	166	129	102	69	42	19	24	38	11	9	0
1981	1,118	820	441	185	157	128	63	51	32	20	9	21	5	6	0
1982	1,115	811	375	156	151	110	98	68	53	26	24	33	11	10	0
1983	1,172	737	374	177	159	132	100	77	40	34	13	43	13	9	1
1984	1,153	753	345	118	146	142	102	81	61	37	27	63	14	15	2

Note: Drought conditions from 1979-80 and 1982-83.

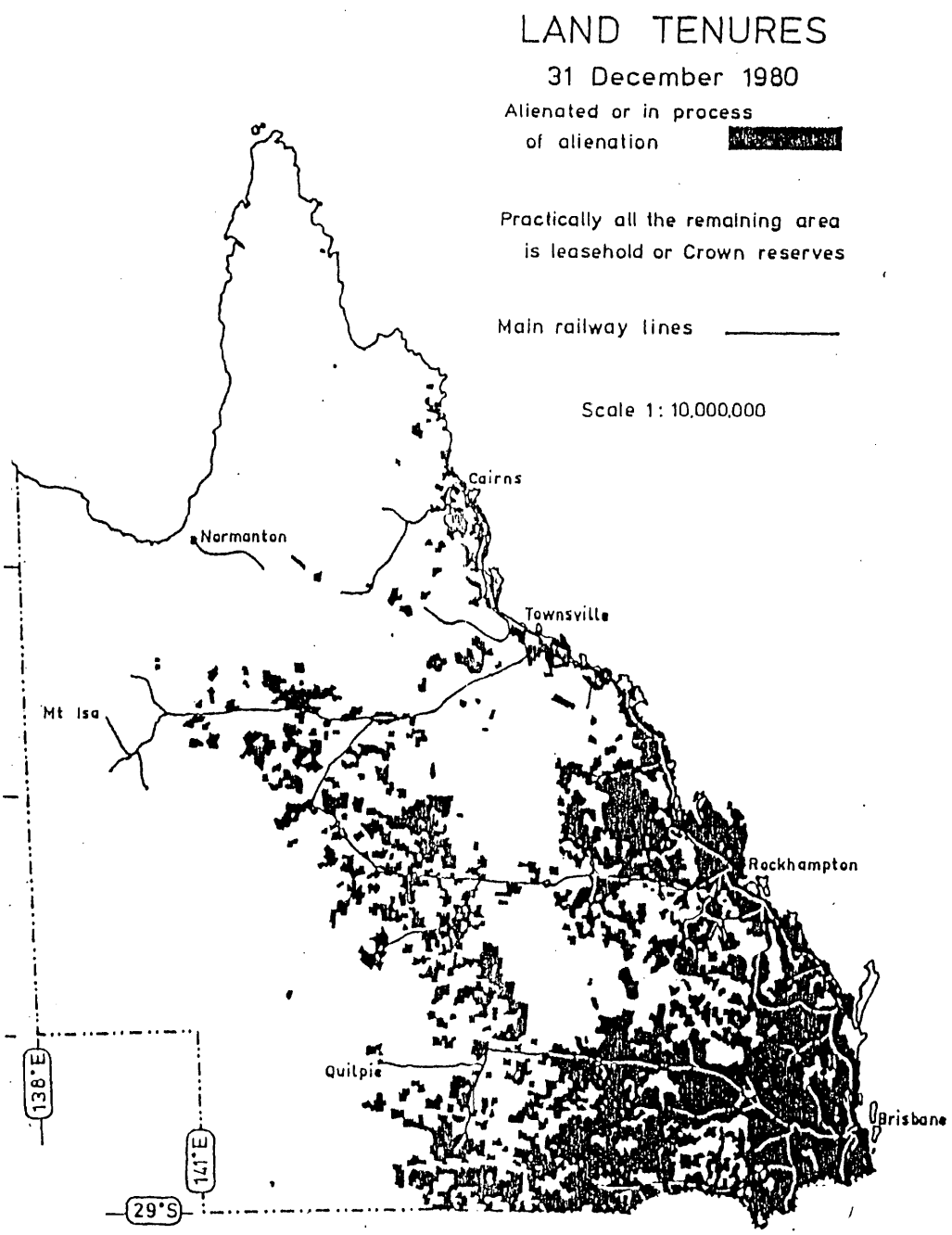
Source: ABS (QLD) `Livestock and Livestock Products', 1975-84.

Figure 5.4 Land alienation in Queensland, 1970.



Source: Queensland Yearbook 1970

Figure 5.5 Land alienation in Queensland, 1980.



Source: Queensland Yearbook 1983

5.3 Land Status and Management Problems

To Mills (1982a) land degradation is "...changes to land which have occurred on a shorter timescale than geological processes, and which adversely affect the productivity and management of land for pastoral use".

In a survey of land systems susceptible to degradation in the Charleville area, Mills estimated that 16 per cent was badly degraded in 1981. Further, woody weed populations in mulga country were significant and increasing.

Harrington et al (1984, p. 197) claim that the exclusion of fire and overgrazing have reduced the carrying capacity of mulga associations. Perennial grasses have been eliminated and over most of these woodlands. Sheep and cattle "...subsist on low quality browse with only unpredictable flushes of ephermeral growth". (ibid)

Mills has also suggested that properties located on mulga country need to be able to carry 12-14,000 sheep equivalents to enable the implementation of conservative management strategies and provide a positive cash flow in nine years out of ten. Holmes estimates that three quarters of the present Murweh Shire graziers have less than this number of stock. That is a majority of Shire graziers have small businesses that are at risk.

Mills (1982b) estimated that one third of the grazier population south west of Charleville was in the `establishment phase' of the family development cycle. Education and other family costs are high and rather inflexible in this phase. Most graziers attach the highest priority to the education of their children. The suggestion is that, during the `establishment phase', graziers on smaller holdings may not be prepared to maintain conservative stocking rates if there had to be a choice between educational aspirations and short term land condition.

There has been a general recognition of a linkage between pastoral property viability and land degradation. The DPI (1973) lamented that high incomes from wool production in the 1950's were the basis on which the Queensland government carried out closer settlement schemes in pastoral areas. The Department claimed that the smaller (4-5,000 sheep) properties created by government led to "flogging country out" when the terms of trade for pastoral production declined in the 1960's and 1970's.

If small property size encourages exploitative management, then the Charleville area may face continued land degradation for many years to come.

5.4 The Various forms of Land Management

Before describing various categories of land management practised in the Charleville area it is important to be aware of the considerable variations in managerial ability displayed by graziers. Data supplied by Holmes for the period 1974-84, shows average gross margins per head of cattle carried of between $-4 and $+2.3 in the Charleville area. There was no correlation between gross margins and property size or seasonal conditions in the data. The considerable diversity in managerial skill is an important factor in both business viability and land condition.

The three hypothetical categories of land management to be investigated in this chapter represent 'average', the 'most exploitative' (PITS) and the best (DPI) possible levels of land management in the Charleville area. Present knowledge about the relationships between pastoral property management and land condition precludes the creation of more comprehensive categories of management. The extent to which grazing pressures are reduced during drought (drought grazing capacity) is the most significant factor separating the three categories of management.

AVERAGE mananagement reduces stock numbers by 20% in drought, results in only fair range condition and represents the most common property management found in the Charleville area. PITS represents the particularly exploitative management found among a minority of graziers whom reduce stock numbers by only 10% in drought. DPI management in that which the DPI considers to be the best attainable in the Charleville area. DPI managers reduce stock numbers by 25% in the first year of a drought.

The values assigned to key performance variables of the properties being studied are shown in Table 5.7. They were derived from secondry data provided by the ABS and BAE and verified by DPI staff at Charleville.

All properties are assumed to be run by a resident family and the business structure is a partnership of at least two family members.

Table 5.7

Key Variables Assigned to Charleville Area Properties[1]

Land Management Category	PITS			AVERAGE			DPI		
Property size ('000 sheep) in normal years	5	10	15	5	10	15	5	10	15
Average Total Costs per sheep carried ($)	11.2	10.0	9.5	10.9	9.0	8.2	10.1	8.4	8.0
Variable cost ($ per sheep)	4.0	4.3	4.5	4.0	4.3	4.5	4.0	4.3	4.5
Drought variable costs (% of variable costs)	200	200	180	200	180	150	180	150	130
Fixed costs per property ($'000)	20	25	30	20	25	30	20	25	30
Total capital value ($/sheep)	50	50	50	60	60	60	70	70	70
Initial capital (excluding stock and land ($'000))	115	230	345	200	400	600	215	430	645
Maximum Loan ($'000)	125	251	375	150	300	525	175	350	525
Drought grazing capacity ('000 sheep)	4.5	9	13.5	4	8	12	3.6	7.5	11
Maximum sheep purchases (per year)	400	1000	1500	400	1000	1500	500	1000	5000

[1] Properties are located on mulga country and wool production is the dominant form of income. Off-farm income comes solely from interest on (cash) investment. Property size and livestock mix is assumed to remain constant over the period of study.

Table 5.8

Property size, management and survival

Property type	P5	P10	P15	A5	D5,D10,D15 A10,A15
Probability of surviving;					
30 years	0.1	0.5	0.7	0.9	1.0
60 years	0.0	0.2	0.4	0.9	1.0
90 years	0.0	0.02	0.2	0.7	1.0
100 years	0.00	0.02	0.15	0.71	1.0

P = PITS management

A = AVERAGE management

D = DPI management

5 = 5,000 sheep property size

10 = 10,000 sheep property size

15 = 15,000 sheep property size

5.5.2 Viability

The measures of viability for the nine properties are shown in Table 5.9.

All indicators of viabilty improved with increased property size and more conservative management. Income and net worth increased while stress and debt declined. (The rise in peak loan from $20,000 for property DPI to $50,000 for DPI is associated with the higher income of the latter through droughts, attracting high taxes and larger loans to finance the tax levied.)

Exploitative management seriously reduces the discounted net worth of the property. Holmes (1986, pers. comm.) suggests that asset accumulation is an important grazier objective. Further, increased net worth may improve borrowing ability. Therefore the relatively small gains in net worth associated with the change from AVERAGE to DPI management should still provide incentive to graziers. The asset decline associated with PITS management would be an anathema to almost all graziers.

5.5 Property size and management

It has been proposed by Mills (1982a) that properties located on mulga country need to be able to carry 12-14,000 sheep equivalent to enable the implementation of conservative management strategies and provide a positive cash flow in nine years out of ten.

To test this hypothesis the PITS, AVERAGE, and DPI management was applied to the three property sizes of 5,000, 10,000 and 15,000 sheep. These nine different management/size scenarios were then simulated through a century of property operations during which there were 30 droughts, 50 average and 20 good seasons. In order to provide probability estimates for survival, 100 randomly generated centuries of seasons (each with 30 droughts, 50 average and 20 good seasons) were then simulated.

5.5.1 Survival

The rate of survival for each property type is given in Table 5.8.

The results indicate that it is possible for properties carrying as few as 5,000 sheep to practice conservative DPI management and survive over the long term. Indeed properties carrying 10,000 sheep can survive under both AVERAGE and DPI management. Therefore the hypothesis that properties needed to carry 12-14,000 sheep to practice conservative management is rejected, on the criteria of survival.

It is important to note, however, that exploitative PITS management was incompatible with survival over all property sizes.

While DPI management might enable small properties to survive it may only be attainable by a few of graziers, due to the wide range of managerial ability outlined earlier. For less able managers the practice of conservative management may require a property size such as 12-14,000 sheep. The results indicate that under the most common prevailing management 10,000 sheep are required for survival, although properties of 5,000 sheep have a 90% chance of surviving for 60 years.

An important element of this trial, not demonstrated on Table 5.9, is that as property management improves and size increases, the variability of income declines. That is income flows become more predictable, a particularly important factor in assessing the potential to repay debt.

Minimum flock sizes occur in periods of severe drought and are a function of the rate of destocking practiced during drought and stock mortality. For AVERAGE properties the rate of destocking is slower and mortality higher than under DPI management. For a given flock size, as management improves the minimum flock size declines. This suggests that the more conservative the management the less manual work is required in drought, because fewer sheep have to be managed. Less manual work also reduces physical stress during these particularly difficult periods.

When equity in the property falls below 80%, graziers are likely to become anxious and suffer from 'equity stress'. Mills (1982b) suggested the level of 80%. Everett and Edwards (1985) suggested that the 'stress signal' equated to a debt of $20 per head of sheep carried, which at the time of their research, equated to an equity level of 80%.

Table 5.9 shows that equity stress declined with improved management and increased property size. Everett and Edwards also suggested that equity stress was directly transmitted to the land resource. The elimination of equity stress should reduce the risk of land degradations.

Peak loans, or the largest loan taken out in the century of operations declines rapidly with improved management. The peak loans associated with PITS management equalled the loan limit for the property, and bankruptcy.

Loan size also has a critical impact on property survival. During simulations for this, and other trials in the study, it was noted that if loans exceeded about 30% of equity, then properties often became bankrupt very quickly, unless they encountered a long run of favourable seasons. Such a result seems to reinforce the validity of grazier concerns about maintaining at least 80% equity.

The minimum family income in this trial was a living allowance of $4,000. More conservative management is rewarded with higher family and business incomes in the long term, an important incentive to those graziers who may have to accept some short term declines in income associated with the change to a more conservative property management.

Negative cash flow in the property business means that the family allowance is reduced to only $4,000, a state of poverty. Only the AVERAGE 15 property, and all the DPI property sizes had positive cash flows in nine years out of ten.

The Mills hypothesis is again rejected as positive cash flow in nine years out of ten was found in DPI 5,000 and DPI 10,000 properties.

It is noteworthy that the AVERAGE 10,000 property, one with which Mills would be most familiar, was able to survive for a century, but did not provide a positive cash flow in nine years out of ten. This result tends to vindicate Mills' judgement about property size and cash flow for most of the existing properties in the Murweh Shire. Further, until it can be proven that DPI management can be achieved by a majority of graziers, the Mills hypothesis has to be accepted under current conditions.

Table 5.9

Property Size, Management and Viability

Average levels of various parameters

Management type	PITS			AVERAGE			DPI		
Size ('000 sheep)	P5	P10	P15	A5	A10	A15	D5	D10	D15
Average family income ($'000)	4	7	11	10	23	35	20	36	50
Average net farm income ($'000)	-9	-5	4	10	40	71	28	71	116
Minimum sheep (units)	(a)	(a)	(a)	(a)	5600	8400	2625	5250	7857
Equity stress (years)	9	14	17	10	1	0	0	0	0
Years of negative cash flow	-	-	-	40	14	8	8	3	7
Peak loan ($'000)	125	250	348	100	80	50	23	20	50
Discounted net worth ($'000)	47	180	396	280	580	920	330	670	1000

(a) Minimum sheep units not calculated unless properly achieved survival.

5.5.3 Discussion

The key variables assigned to the nine property management/size scenarios, and shown in Table 5.7, were obtained from experts. The results of the model simulations were verified by the same experts as being representative of real property operations. The input data and simulation results for the AVERAGE x 10 sheep property were similar to those obtained by BAE survey, as shown in Table 5.3.

The actual figures presented in Table 5.9 may accurately represent only a small number of real properties. The general validation of the simulation results, however, suggests that the important trend identified in the trial, namely that property survival and viability increases with more conservative management and larger property size, should be accepted.

The Mills' hypothesis of a minimum property size of 12-14,000 sheep to enable the implementation of conservative management strategies and positive cash flow were rejected. It must be said, however, that Mills may not have seen DPI management in practice. Mills is familiar with PITS and AVERAGE management and his hypothesis, as it relates to these property types is accepted.

5.5.4 The incentives to adopting conservative management

Tables 5.10, 5.11 and 5.12 show the various parameters of survival and viability that may offer incentives for graziers with properties located on mulga country to improve land management and condition.

Survival

Assuming a grazier first wants to secure the future of the property business then the four types of property currently having less than certain survival have the following options to attain survival;

PITS 5,000 adopts DPI management

PITS 10,000 adopts AVERAGE management, or
destocks the property to 5,000 and adopts DPI management

Table 5.10

5,000 sheep; survival and viability

Type of management	PITS	AVERAGE	DPI
Probability of SURVIVAL (100 years)	0	0.7	1.0
Average years survived	17	8.7	100
Average family income ($)	4,000	10,000	20,000
Average net farm income ($)	-9,000	10,000	28,000
Peak loan ($)	125,000	100,000	23,000
Equity at peak loan (%)	50	67	93
Percentage of years of operation with equity stress	53	11	0
Discounted net worth ($)	47,000	280,000	330,000

Table 5.11

10,000 sheep; survival and viability

Type of management	PITS	AVERAGE	DPI
Probability of SURVIVAL (100 years)	0.02	1.0	1.0
Average years survived	37	100	100
Average family income ($)	7,000	23,000	36,000
Average net farm income ($)	-5,000	40,000	71,000
Minimum sheep (units)	-	5,600	5,250
Peak loan ($)	250,000	80,000	20,000
Equity at peak loan (%)	50	87	97
Percentage of years of operation with equity stress	37	0	0
Discounted net worth ($)	180,000	580,000	670,000

Table 5.12

15,000 sheep; survival and viability

Type of management	PITS	AVERAGE	DPI
Probability of SURVIVAL (100 years)	0.15	1.0	1.0
Average years survived	57	100	100
Average family income ($)	11,000	35,000	50,000
Average net farm income ($)	4,000	71,000	116,000
Minimum sheep (units)	3,100	8,400	7,857
Peak loan ($)	348,000	50,000	50,000
Equity at peak loan (%)	46	95	95
Percentage of years of operation with equity stress	30	0	0
Discounted net worth ($)	396,000	920,000	1,000,000

PITS 15,000 adopts AVERAGE management, or
destocks the property to 10,000 and adopts DPI management, or

AVERAGE 5,000 adopts DPI management.

The adoption of a more conservative land management strategy does not by itself guarantee survival. The increased viability of more conservatively managed properties comes mainly from the improved wool cuts and survival rates of stock, which are in turn directly related to good land condition. Hence the grazier adopting a more conservative management strategy would have to destock the property to some extent to initiate regeneration. DPI Charleville staff estimate it would take at least three good seasons, or about 12 years to take PITS land condition to DPI standards with very low stocking rates. The grazier would thus have to persist for many years on a small flock before the full rewards of conservative management were apparent.

The larger the property size the greater are the number of choices available for attaining survival and improved viability. The smaller the property the greater is the extent to which management has to change. For instance the only option for survival of the PITS 5,000 property is the adoption of DPI management. The extent of destocking necessary for this transition and the slow rate of recovery of PITS to DPI land condition would probably bankrupt the business very quickly. Even the AVERAGE 5,000 property may have difficulty attaining DPI land condition.

Viability

The property PITS 5,000 has no option other than to adopt DPI management. Table 5.10 indicates that with AVERAGE management the minimum equity can be as low as 67%, and there is only a 0.67 probability of survival. Under DPI management family income is double that of AVERAGE 5,000 properties and considerable resources are left for reinvestment on or off the property.

The property PITS 10,000 is in a better position. Immediate destocking to 5,000 sheep and adoption of DPI management would leave the grazier family in every respect better off after a few good seasons. Non-family labour being employed could be dismissed and the sale of 5,000 sheep would provide a

considerable reduction of current loans. The regeneration of land condition could be expected to be rapid, possibly allowing a future return to a 10,000 sheep flock.

Moving to AVERAGE 10,000 is also desirable by every measure of financial viability. Although this move would also involve an initial reduction of stock numbers, the sales would be relatively few.

The choice of a move to either option might depend on a grazier preference for slightly lower average family and farm income but a higher minimum equity (DPI 5,000), or higher short term income levels and the possibility of lower equity (AVERAGE 10,000).

The property PITS 15,000 has several alternative strategies, all of which leave the family in a better financial position. A move to AVERAGE management would require some initial destocking, but while the PITS 5,000 property had an average of 17 years to adopt better management, before bankruptcy, the PITS 15,000 property has an average of 57 years to do the same. Further, almost every financial reward at AVERAGE 15,000 is better than those at AVERAGE 10,000 and DPI 5,000.

The property AVERAGE 5,000, like PITS 5,000 has no choice but to improve management in any quest for a better rate of survival. Neither property is likely to have the ability to service a loan to expand property size.

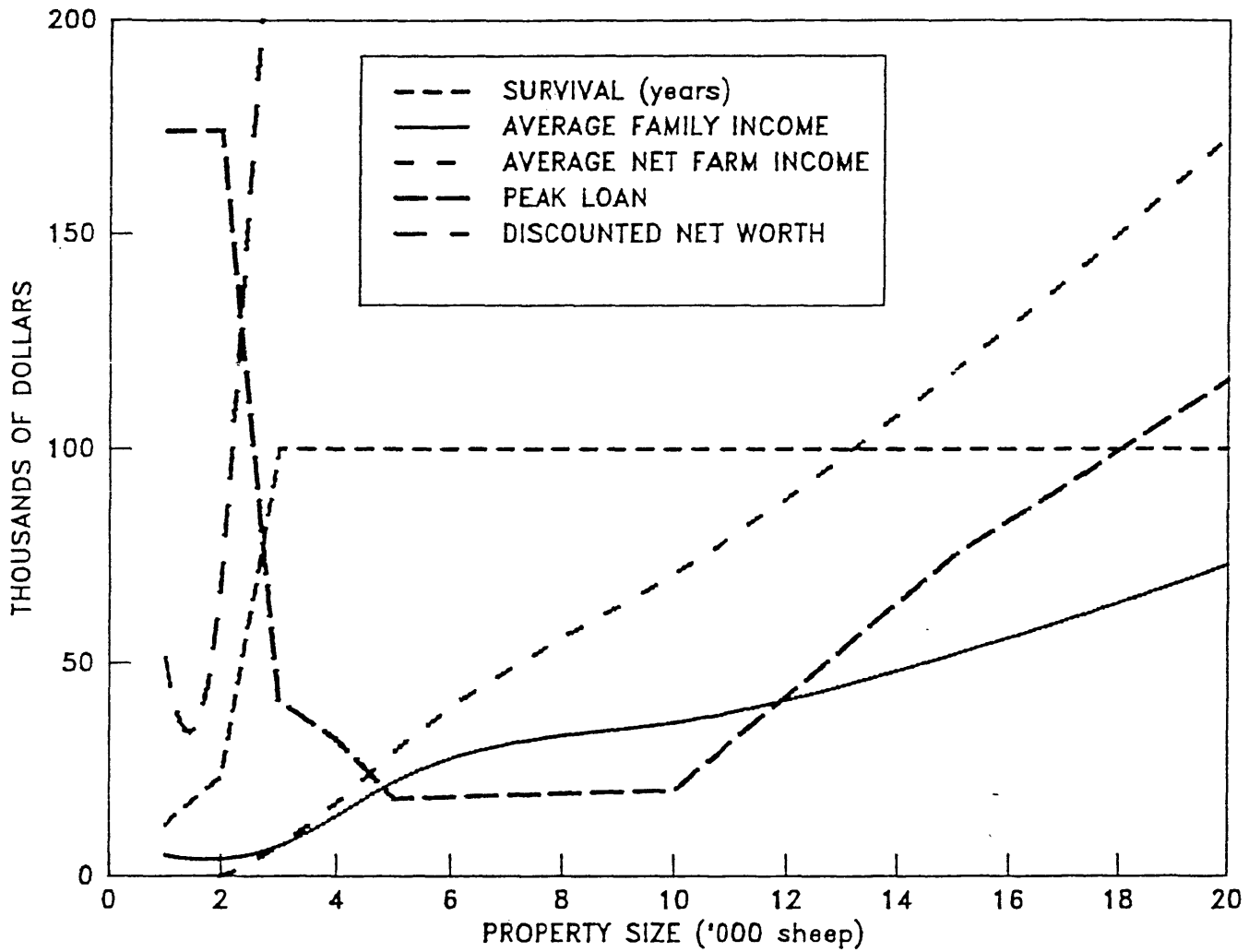
Financial incentives to adopt more conservative management are also evident for AVERAGE 10,000 and AVERAGE 15,000 properties which can survive without adopting DPI management. Flexibility increases with conservative management. For instance properties are able to survive with smaller flocks indicating an enhanced capacity to survive severe droughts and allowing for more flexible labour management.

5.5.5. Minimum size of flock and survival

A trial to determine the lower limits of property survival under DPI management gave results which are illustrated in Figure 5.6.

The lower limit to survival under DPI mangement is a flock size in normal years, of 3,000 sheep.

Figure 5.6 Economies of scale and DPI management.



A trial to determine the size of property which would allow PITS management a century of survival indicated that PITS type management can be successful if the property size is above 18,000 sheep. The legal maximum property size an individual may hold in the form of Grazing Homestead Perpetual Leases (QLA Section 86), is about 20,000 sheep. Policies which are aimed at property build up may be offering graziers the flexibility with which to reduce degradation. The same policies also offer the PITS type manager with a least 18,000 sheep the opportunity to remain viable. It would appear that an essential component of property build up policy would be regular monitoring of land condition to eliminate PITS type management and the degradation of large land areas.

The policy of increasing property size through allocation of "additionals" may risk expanding exploitative management.

Additionals, (or small lease parcels made available after the expiry or resumption of a nearby lease) are only available to the smallest properties, which are the most likely to be under heavy grazing pressure. Further, additionals do not give the grazier an area on which to secure future viability as the additionals are only allowed to expand the property from non-viable to marginally viable. For instance the QLA (Section 269(9)) states that an additional must not raise the aggregate area to in excess of a living area. Holmes (1986, pers. comm.) notes that Queensland additionals also tend not to adjoin the property being built up, making management difficult.

Additionals are not allocated as an incentive, for instance, to better management.

5.6 Conservative and Exploitative Management

5.6.1 Introduction

Conservative management of rangelands involves frequent adjustments of stock numbers in response to changing weather conditions and the availability of feed. Once a drought has been diagnosed it is assumed that the conservative manager will immediately move to reduce stock numbers. Exploitative management attempts to retain stock.

In this Section it is proposed that the performance of the nine hypothetical grazing properties identified in Section 5.5 be examined in relation to two levels of drought grazing capacity, as measures of the most conservative and exploitative management.

The simulation model used in this study requires the specification for the property of the maximum number of sheep that can be grazed in normal years (NGC), and the first year of drought (DGC). Should a drought extend into a second year the maximum number of sheep carried is further reduced to those levels shown in Table 5.13. The table indicates that PITS management reduces stock numbers at a much slower rate than DPI management.

Of the 30 drought years experienced every century in the Charleville area, 19 are single year events, four last two years and there is only one three year drought. The rate of destocking in the first (or only) year of drought is thus a critical determinant of conservative or exploitative management.

Exploitative management, while avoiding most of the costs associated with restocking after a one year drought, incurs other penalties. Firstly mortality increases among the stock held and (drought) variable costs rise considerably as, in the Charleville area, it is expensive to cut down or 'push' mulga with tractors or otherwise provide supplementary feed in an attempt to keep sheep alive in times of drought. The extent of these extra costs are also detailed in Table 5.13.

To simulate the extreme range of drought management strategies, the DGC was equated with the NGC to represent the most exploitative strategy and the DGC was reduced to half the NGC, for the most conservative strategy.

The results of the trial are shown in Table 5.14.

5.6.2 Survival

The most exploitative strategy (3), did not enable the survival of PITS type management, at any level of property size and in reality would ensure the failure of all the other AVERAGE and DPI properties. The most conservative management did not affect the survival of AVERAGE or DPI properties, though it caused the failure of the AVERAGE property carrying 5000 sheep. This failure is due to the too drastic a cut in sheep numbers in a drought and highlights the need for conservative management to be reasonable, and not to result in needless bankruptcy.

Table 5.13

Exploitative and Conservative Management

Management type	PITS			AVERAGE			DPI		
Size ('000 sheep)	5	10	15	5	10	15	5	10	15
Normal Grazing Capacity (NGC) ('000 sheep)	5	10	15	5	10	15	5	10	15
Drought Grazing Capacity (DGC) ('000 sheep)	4.5	9.0	13.5	4.0	8.0	12.0	3.7	7.5	11.2
Grazing capacity in second drought year ('000 sheep)	4.1	8.2	12.3	3.2	6.4	9.6	3.0	6.0	9.0
Drought variable costs ($/sheep)	8.00	8.60	8.10	8.04	7.74	6.75	7.20	6.45	5.85
Average mortality in adult ewes (%)	16	16	16	10	10	10	6	6	6
Lamb marking in drought (%)	20	20	20	35	35	35	45	45	45

5.6.3 Viability

Making PITS management even more exploitative further depressed the property performances predicted in Table 5.9. Application of the most conservative management considerably depressed the already low viability of PITS properties and does not appear to be a reasonable option for improving their land condition, or business performance.

The most exploitative strategy increased the value of Average Family, and Net Farm Incomes above those found in Table 5.9. This result could only be practically achieved in the short term because of the debilitating effect of such extremely exploitative management.

The larger and better managed the property the less impact the most conservative strategy had on viability. For AVERAGE properties carrying 5000 and 10,000 sheep the most conservative strategy caused significant declines in viability and increase in equity stress. Clearly, optimum land management lies between the two extreme tested here. The resilience of larger properties to the imposition of extremely conservative management indicates how important it is that structural adjustment be achieved before more conservative land management demands are made on pastoral property manager.

The apparently high returns to the most exploitative management would, in practice, be only possible over the short term. Nevertheless they highlight the need for land agencies to constantly monitor land condition, and for graziers to resist the temptations of short term gain through exploitative management.

The impact of varying levels of DGC on the performance of an AVERAGE property carrying 10,000 sheep is shown in Table 5.15. It is noticeable that, over the long term, DGC could be reduced to as low as 4,000 sheep before survival is compromised, while the DGC of less than 6,000 sheep is required before viability is seriously reduced. If DGC was 9,000 or 10,000 sheep the property would be in effect under PITS management, and would not survive. This trial demonstrates that, while conservative managers have a wide margin for error in optimizing DGC, exploitative managers run considerable risks of bankruptcy in small margins of departure from a DGC of 8000 sheep.

Table 5.14

The Relative Benefits of Exploitative and Conservative Management

Management type	PITS						AVERAGE						DP1					
Size ('000 sheep)	5		10		15		5		10		15		5		10		15	
Drought grazing policy	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
Average Family Income ($'000)	4	4	4	4	8	4	13	4	26	15	38	24	24	15	41	30	60	41
Average Net Farm Income ($'000)	-19	-19	-19	-21	3	-22	16	1	46	26	81	49	33	20	82	57	131	94
Minimum Flock Size ('000 sheep)	0	0	0	0	0	0	4	0	5	3	14	5	4	1	9	3	14	5
Equity Stress (years)	7	6	16	16	34	19	1	27	1	5	0	0	0	1	0	0	0	0
Peak Loan ($'000)	125	125	250	250	375	375	53	150	96	137	75	73	12	45	11	40	33	63
Discounted Net Worth ($'000)	11	13	49	23	407	97	302	171	604	525	945	850	348	300	696	635	1044	950
Survival (years)	9	9	23	18	69	28	100	59	100	100	100	100	100	100	100	100	100	100

Notes: E = most exploitative management, DGC = NGC
C = MOST CONSERVATIVE MANAGEMENT, DGC = (0.5) NGC

Table 5.15

Conservative Management and A10 Property Performance

DGC ('000 sheep)	2	3	4	5	6	7	8
Average Family Income ($'000)	4	4	10	15	19	21	24
Average Net Farm Income ($'000)	-22	-3	18	26	3	36	41
Minimum Sheep	0	0	2800	3500	4200	4900	5000
Equity stress (years)	16	32	13	5	2	2	1
Peak Loan ($'000)	299	299	137	137	110	107	93
Discounted Net Worth ($'000)	95	280	476	525	549	567	581
Years Survived	20	60	100	100	100	100	100

A10 AVERAGE management for Charleville area, carrying 10,000 sheep.

DGC Drought grazing capacity, the number of sheep held on the property in the first year of a drought.

5.6.4 Discussion

To this point no mention has been made of the impact of conservative and exploitative management on land condition. No absolute measure is available, but in practice the most exploitative management would severely reduce the productive potential and viability of a property in the long term.

This trial demonstrates that there are few long term incentives for current Charleville area management to become more exploitative. The small benefits indicated would be most unlikely to compensate the grazier for losses in productivity, land condition and the increased risk of bankruptcy.

Secondly for AVERAGE properties even more conservative management than that presently suggested by experts as necessary to achieve DPI standards could be employed without affecting long term survival. The extremely conservative strategy tested may indeed represent a considerable underutilisation of available forage resources, and an unnecessary loss of income to family and farm business.

For PITS properties the extent to which survival and viability can be improved under the most conservative destocking policy is not certain. It would appear that for PITS properties carrying 5000 sheep land regeneration would have to take place inside nine years to enable the property to survive through a century. Since the excellent seasonal conditions likely to support such a rate of regeneration are likely to occur only every century, it would appear that the best solution, for the State, would be resumption of the lease.

Finally the most exploitative strategies retain large numbers of sheep in droughts. Such flock sizes not only mean greater numbers of stock dying but place considerable additional work burdens on the property workforce as reflected in the higher drought variable costs in Table 5.13. Drought is a time of considerable psychological stress to graziers. The extra workloads associated with supplementary feeding in droughts only exascerbate these stresses.

5.7 Constant and Variable Operator Income Flows

The ability of graziers to be flexible in their approach to property management is a primary determinant of business survival and viability. This flexibility is commonly exhibited by acceptance of large fluctuations in family income.

In this section the performance of the nine hypothetical Charleville area properties defined in Section 5.5 are compared under two strategies of family income payment. In the first strategy the family is paid $4,000 every year, plus 50% of any positive cash pool. (Positive cash pools only occur when the property business is free of all debt.)

In the second strategy the family is paid a constant annuity equal to the average family income of the first strategy. No additional payments are made from any cash pool. The first strategy requires the family to accept a fluctuating income, the second a constant, certain income.

The results of the trial are presented in Table 5.16.

5.7.2 Survival

Constant family incomes tend to increase the survival of properties under PITS management and decrease the survival of better managed properties, especially AVERAGE properties.

Those simulations which increased the survival of PITS properties and retarded the survival of AVERAGE properties, under constant annuity payments, all provided for an excellent run of seasons in the first twenty years of property operation. A run of good seasons boosts the probability of survival of smaller and more exploitatively managed properties while an initial run of droughts may cause the bankruptcy of some bigger and better managed properties. In this study a run of good seasons paid off all debts and then built up cash reserves. A PITS property with large enough cash reserves may be able to survive. Such a result has important implications for land condition in areas where properties tend to be exploitatively managed and opportunities exist for well paid, off-farm employment.

Table 5.16

Constant and Variable Family Incomes and Property Performance

Type of management ('000 sheep)	PITS						AVERAGE						DPI					
	P5		P10		P15		A5		A10		A15		D5		D10		D15	
	C	V	C	V	C	V	C	V	C	V	C	V	C	V	C	V	C	V
Probability of Survival	0.04	0.00	0.40	0.02	0.50	0.15	0.6	0.72	0.90	1.0	0.9	1.0	0.75	1.0	0.97	1.0	0.98	1.0
Average Net Farm Income ($'000)	-10	-9	-7	-5	22	4	12	12	40	41	66	71	27	28	69	71	111	116
Average Equity Stress (years)	8	9	8	14	8	17	3	8	9	1	15	0	14	0	10	0	11	0
Median Peak Loan ($'000)	125	125	250	250	193	348	70	91	73	45	189	47	69	23	117	20	189	50
Median Discounted Net Worth ($'000)	44	47	178	180	797	396	337	280	679	612	762	922	314	330	578	670	841	1000

Notes: C = constant annual family income, which is equal to the average of V.
V = variable family income.

5.7.3 Viability

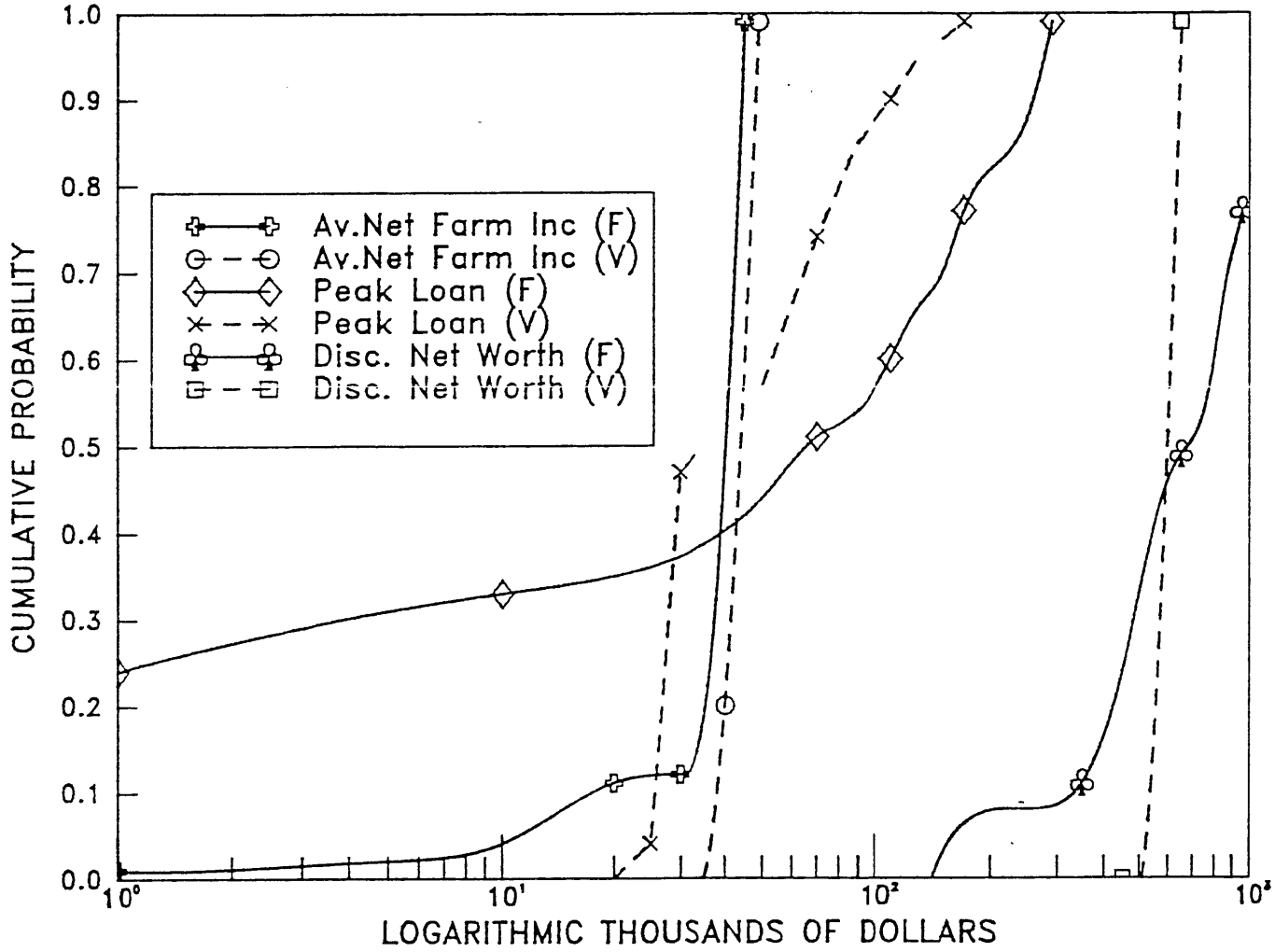
Average net farm income is similar under constant and variable family incomes.

The principal effect of constant family incomes is on debt, equity stress and discounted net worth. The bigger and better managed properties have significantly increased median debt, more equity stress and large decreases in median discounted net worth. Median debt is lowered and median discounted net worth increased for the PITS and AVERAGE properties carrying 5,000 sheep.

All nine properties examined in this research start each century of operations with a debt free status and a small positive cash balance. If the initial seasons encountered in the constant income simulations were good then large cash surpluses are accumulated instead of half of the profits being paid to the family in the variable income strategy. For smaller and more exploitatively managed properties the accumulated cash reserves covered later drought losses. If reserves become large enough devidents on investments more than match drought losses and off-farm reserves continued to enlarge. For larger, better managed properties an early run of good seasons enables the accumulation of quite massive cash reserves. An early run of bad seasons or the encountering of several two and three year droughts close together can bankrupt some of the better properties.

In essence, constant family incomes make the good years better and the drought years worse. This impact is illustrated in Figure 5.7 for the most common Charleville area property, AVERAGE 10,000. Under a variable income strategy (of $4,000 per annum and 50% of any positive cash pool), the average net farm income, peak loan and discounted net worth have high probabilities of falling in a narrow range of values. Under a variable income strategy peak lowan ranges from $20,000 to $193,000. For fixed family incomes peak loans vary from zero to $313,000.

Figure 5.7 FIXED AND VARIABLE OPERATOR INCOME: IMPACT ON A10



5.7.4 Discussion

Originally this trial was designed to compare the impact of company and family ownership, where corporate ownership was assumed to be aimed at constant dividends to shareholders equity, while families were seen as accepting more variable incomes.

This comparison is now seen as naive. Firstly, in the more remote and arid portions of the pastoral zone, corporations are able to survive not only because of their considerable vertical and horizontal integration but also because their survival is largely independent of profits (Musgrave, 1985 pers. comm.). Secondly most family properties pass through the establishment phase of the family development cycle when income expectations are likely to be large and constant.

Indeed Musgrave further proposes that the viability of grazing enterprises in the pastoral zone depends on the existence of both family and corporate business structures.

On smaller properties, and in the more closely settled areas of the pastoral zone family operations are preferred as these business structures are more able to accept low returns to capital investment, widely fluctuating and often low incomes. Corporations, on the other hand generally have a comparative advantage in the operation of the very large properties needed to maintain survival in the more remote areas of the pastoral zone. Also able to accept fluctuating incomes, the corporation is usually better equipped to service the capital needs of large properties.

Commenting on the quest for family ownership in closer settlement schemes Davidson (1981, p. 423) states that governments regretted that, "ownership of holdings by large companies proved a more efficient form of land tenure than individual ownership, in parts of the Pastoral Zone".

The only State that recognises the comparative advantage of the corporation is Queensland.

> "In the more remote areas of the State...closer settlement has never been a success...Company operations predominate in these regions

and their inherent flexibility enables them to survive the prevailing rigorous climatic and economic conditions". (land Administration Commission, 1982, p.16).

In South Australia, where there are no restrictions on corporate ownership of pastoral lases, the more remote and arid areas of the pastoral zone are mostly held as large leases by corporations.

The above comparison of constant and variable operator income flows emphasises the importance of cash reserves in the survival of property businesses. Off-farm reserves, built up before major droughts, considerably enhance property survival, lower debt thresholds and reduce equity stress.

Constant and variable income flows have particular bearing on the long term issues of survival and debt. Inflexible income policies have the most risky outcomes. Variable income policies lead to more certain future income flows and it is suggested that the increased predictability of these same outcomes is a major reason for graziers having an emphasis on "...future rather than present incomes" (Holmes, 1980, p.195).

5.8 Drought Variable Costs

5.8.1 Introduction

Over $300m was spent on drought relief by Australian governments in the period 1979-82 (WDSC, 1984c, p.118). There appears to be evidence that the present form of drought assistance is a significant cause of land degradation in the pastoral zone.

The main feature of present drought assistance schemes is a concentration on income support through subsidies that reduce cash costs in the short term. For instance there are rebates for up to 75% of the cost of transporting stock and fodder, subsidies for interest repayments of loans with interest rates in excess of 12%, stock slaughter and agistment, and low interest loans for properties valued at less than $450,000. For graziers experiencing the third consecutive year of drought carry on loans for up to $60,000, at concessional rates of interest are available. In the Charleville area there was, up till 1985, a subsidy to defray the costs of 'pushing' mulga in drought declared Shires.

The following trial compares the performance of various hypothetical Charleville area properties under different a range of drought variable costs (DVC).

Drought variable costs in the Charleveille area relate primarily to the 'pushing' of mulga. The DPI staff at Charleville estimate that it costs about four cents per sheep per day to push mulga with a bulldozer. Over a six month priod this amounts to seven dollars per sheep. It is estimated that DVC in the Charleville area range up to 300% of 'normal' variable costs. Individual property data supplied by Holmes suggests, however, that some particularly able graziers arer actually able to reduce PVC below those normally incurred. The range of DVC examined in the trial are from 50% to 300% of normal variable costs.

The results of the trial are presented in Tables 5.17 and 5.18.

5.8.2 Survival

The PITS 5000 sheep property did not survive, even with DVC being lowered to 50% of normal variable costs, while the survival of DPI properties carrying 10,000 and 15,000 sheep was unaffected, even at DVC = 300%.

It should be noted that it takes a lot of skill to push DVC below those of average years. Actual management would involve one only muster for shearing, very limited mating of ewes and opening all the gates on the property to "spread sheep out". For this policy to be practical the flock has to be in sound health to resist blow-fly strike and other diseases, and all watering points need to be working at full capacity. The nutritional status of PITS type sheep would, however, be likely to be low because of poor range condition and hence the potential for reducing DVC is limited.

Relatively small reductions in the most commonly experienced DVC significantly raises the probability of survival for PITS 15,000 and AVERAGE 5,000 sheep properties. From Table 5.17 it can be seen that reducing the DVC of PITS 15,000 from the usual 180% to 130% raises the probability of survival from 0.16 to 0.80. Reducing DVC, however, would appear to be almost impossible to achieve under PITS range condition.

Table 5.17

Drought Variable Costs and Property Performance, (SURVIVAL)
The Probability of Survival over 100 Years of Operation

Drought variable costs (b)	flock size	Property Type					
		PITS		AVERAGE			DPI
		10,000	15,000	5,000	10,000	15,000	5,000
50		1.0	1.0	-	-	-	-
70		1.0	1.0	1.0	-	-	-
100		0.87	0.98	1.0	-	-	-
130		0.49	0.80	0.97	-	-	-
150		-	0.51	0.92	1.0	1.0(a)	-
180		0.04	0.16(a)	0.84	1.0	1.0(a)	1.0(a)
200		- (a)	0.05	0.71(a)	1.0	1.0	1.0
250		-	-	0.38	0.89	0.94	0.98
300		-	0	0.08	0.63	0.75	0.89

Notes: (a) Most common level of DVC.
(b) Drought variable costs expressed as a percentage of variable costs in average years.

5.8.3 Viability

Table 5.18 shows that as DVC rise, the major initial impact is a sharp rise in debt levels and a reduction in family income. Rising DVC are also directly associated with land degradation, being expenses incurred in attempting to keep sheep alive by drawing down the 'capital reserves' of the property vegetation. In the Charleville area the capital reserves are the mulga trees. The more exploitative the management and the smaller the property size, the faster is the rate of loss in discounted net worth.

The impact of DVC variations on the survival and viability of an AVERAGE property carrying 5000 sheep can be seen in Figure 5.8.

Increases in DVC make the biggest initial impact on property debt. Doubling DVC to 200% quadruples peak loan while family income is only reduced by about half, and net worth hardly affected.

5.8.4 Discussion

The impact of short-term drought assistance on the grazing industry and land condition was recognised as early as 1947 when the (South Australian) Pastoral and Marginal Agricultural Areas Committee found that drought relief "...would achieve nothing more than a slowing down of the rate of depopulation and the ultimate complete ruin of the areas concerned".

Present drought relief measures are based on "...temporary assistance to a low cost industry to enable it to hold resources necessary for its long term development" (WDSC, 1984c, p.117).

It is the very retention of these (livestock) resources that concerned the WDSC, especially the adverse effect freight subsidies had on the rate and timing of destocking in and restocking after drought periods. Freight subsidies encouraged late destocking and early restocking.

The WDSC concluded that the present form of drought assistance encouraged graziers to be more concerned about capturing freight and other subsidies than planning land and property business management to survive drought periods and that property build up was being impeded through assistance to smaller properties.

Table 5.18

Drought Variable Costs and Property Performance (Viability)

Median values in thousands of dollars

Property type	PITS						AVERAGE					
	P10,000			P15,000			C5,000			C10,000		
Drought Variable costs (%)	AFI	PL	DNW	AFI	PL	DNW	AFI	PL	DNW	AFI	PL	DNW
50	20	27	447	28	35	672	17	18	313			
70	19	40	442									
100	16	80	427	23	69	656	15	22	307			
130	13	227	387	19	149	627	13	35	301			
150				17	280	580	13	46	297			
180	9	250	205	13	375	420	11	73	287	25	45	612
200				11	375	318	10	91	278	23	65	606
250							8	148	238	20	131	580
300				6	375	138	7	150	176	16	250	531

Note: AFI = Average family income
PL = Peak Loan
DNW = Discounted net worth

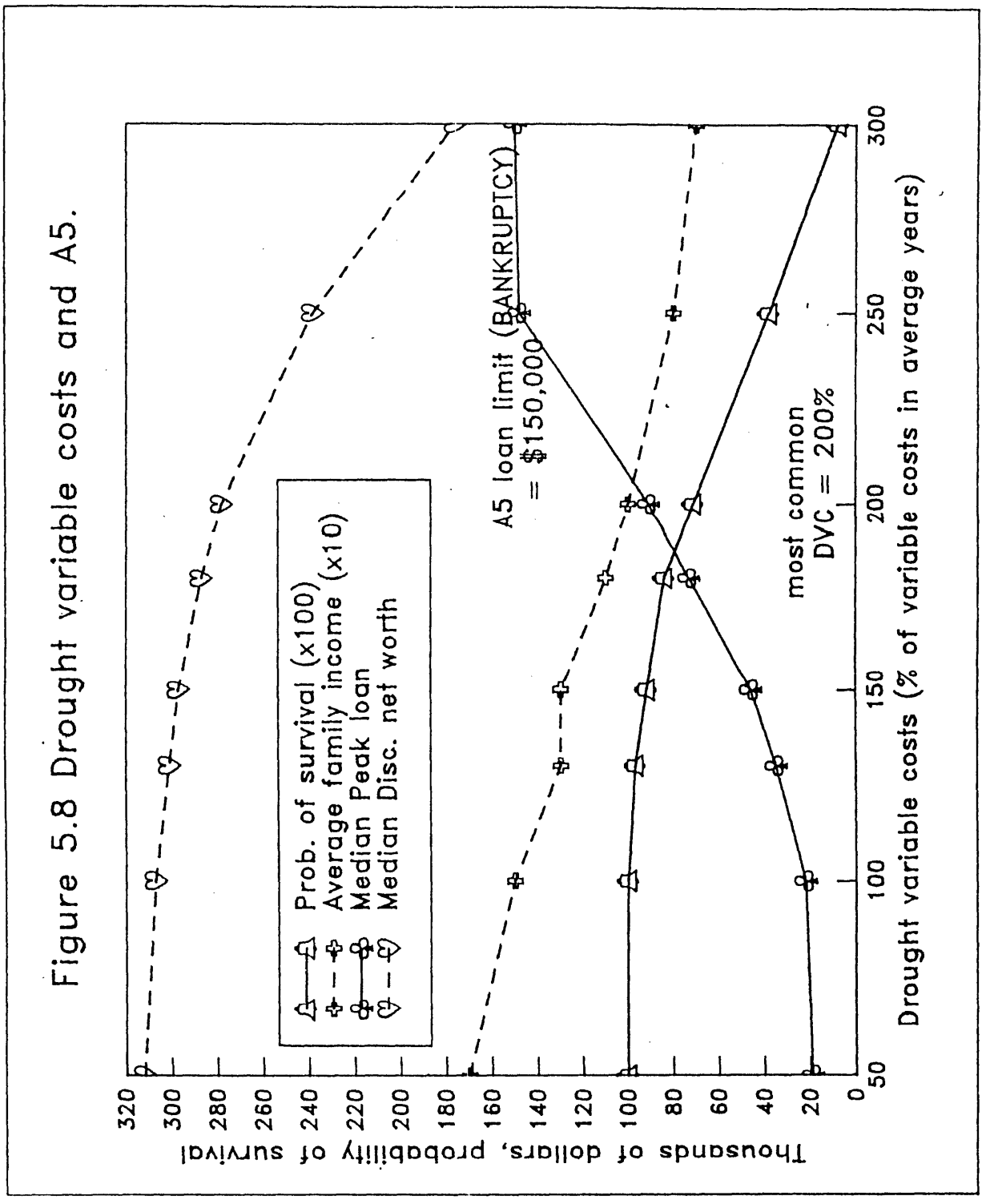


Figure 5.8 Drought variable costs and A5.
Prob. of survival (x100)
Average family income (x10)
Median Peak loan
Median Disc. net worth
A5 loan limit (BANKRUPTCY) = $150,000
most common DVC = 200%
Thousands of dollars, probability of survival
Drought variable costs (% of variable costs in average years)
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
50
100
150
200
250
300

Data supplied by Holmes (1986 pers. comm.) indicates that in the 1982/83 drought, mulga pushing subsidies amounted to about two dollars per sheep. Reference to Table 5.7 indicates that variable costs on Charleville area properties are about four dollars per sheep.* For a PITS 15,000 sheep property a two dollar subsidy increases the probability of survival from 0.16 to 0.51. For larger and better managed properties a two dollar mulga pushing subsidy makes no improvement on survival and very little impact on family or farm business income. The mulga pushing subsidy would appear to be promoting the persistence exploitative management practices, and providing no incentives for conservative management.

The provision of low interest carry-on loans to graziers with less than $450,000 in assets aids small properties and exploitative management. For PITS management a $450,000 property should carry about 9,000 sheep; for AVERAGE management some 7,500 sheep, while DPI enterprises would carry 6,400 sheep at valuations of 50, 60 and $70/sheep carried.

It would appear that, apart from considerations of impeding property build up, present drought assistance schemes could be encouraging land degradation.

* Table 5.17 indicates that the most common DVC for AVERAGE 5,000 properties is 200% of variable costs in average years, or about eight dollars per sheep. A mulga pushing subsidy of two dollars would reduce DVC from 200% to 150% and raise AVERAGE 5,000 survival from 0.71 to 0.92.

Chapter 6

SALTBUSH-BLUEBUSH COUNTRY (Broken Hill)

6.1 Nature of the Region

6.1.1 Background

The 'Broken Hill area' described in this chapter, is taken to mean the Unincorporated area of N.S.W., which is shown in Figure 6.1.

The economy of the Broken Hill area has been dominated by the mines at the City of Broken Hill since 1883. Ninety six per cent of the 28,000 people in the Broken Hill area live in the City.

Properties in the Broken Hill area carry large-framed, heavy wool cutting Merino sheep. Few cattle are run as can be seen from Table 6.1.

6.1.2 Climate

The Broken Hill area is characterised by low rainfall, high average temperatures and large extremes of temperature. Rainfall can be received throughout the year at Broken Hill, but it is most frequent in winter. The average annual rainfall is 242 mm, which also approximates the median. The annual rainfall frequency for Broken Hill is shown in Figure 6.2.

6.1.3 Soil and vegetation

The landscape of the Broken Hill area is a mixture of treeless plains and open, low mulga country. The treeless plains are mostly on heavy clays, clay loams and texture contrast soils which mainly carry salt/bluebush and xerophytic mid-grass communities (Hassall and Associates, 1982, p. 44).

Apart from providing browse in times of seasonal drought, Graetz and Wilson identify the key role of the salt and bluebushes as that of maintaining landscape stability, particularly in areas of unstable duplex soils or those susceptible to invasion by low value species.

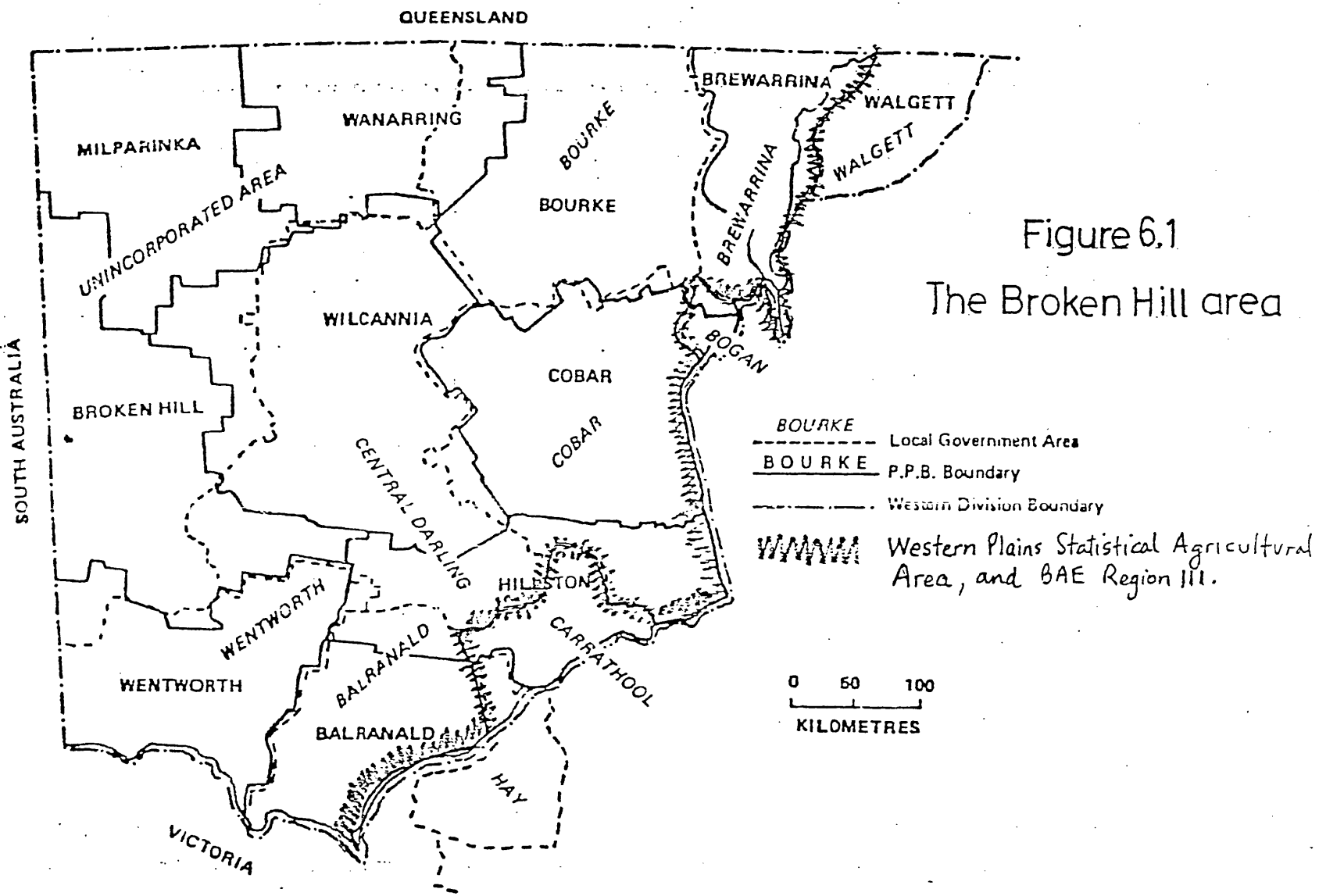


Figure 6.1

The Broken Hill area

Source: WDSC 1984b

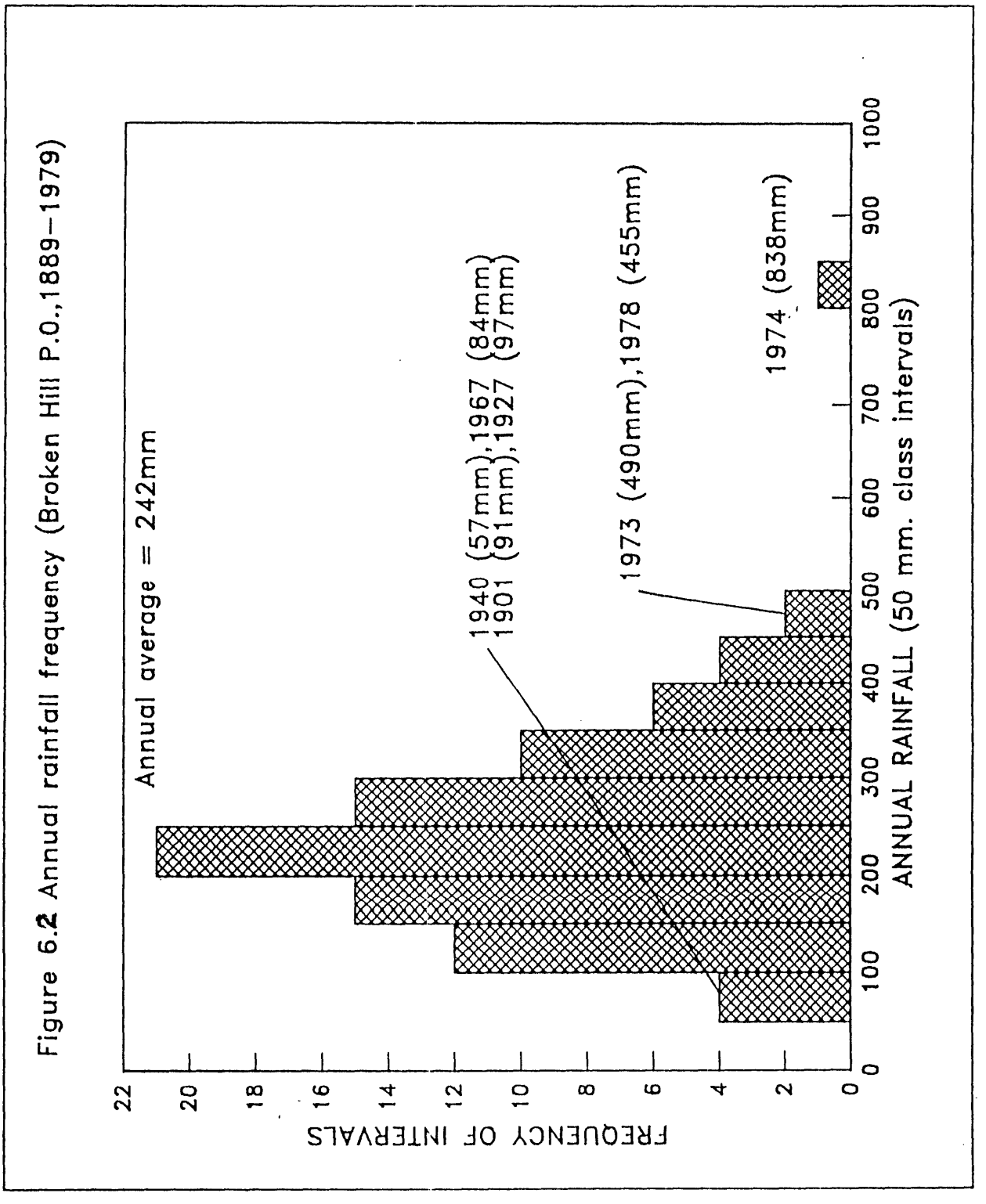


Figure 6.2 Annual rainfall frequency (Broken Hill P.O.,1889–1979)

Table 6.1

Numbers of Livestock and Woolcut in the Broken Hill area (1968-84)

Year	Sheep ('000)	Cattle ('000)	Wool Cut (kg. greasy/sheep shorn)
1968	1200	15	5.1
1969	1470	21	5.4
1970	1360	18	5.0
1971	1210	21	4.8
1972	1460	33	5.0
1973	1400	36	4.7
1974	1420	50	4.7
1975	1480	58	4.9
1976	1450	48	4.7
1977	1490	78	4.8
1978	1210	63	4.4
1979	1170	51	4.8
1980	1200	37	4.8
1981	1060	32	4.8
1982	1110	34	5.0
1983	890	20	4.7
1984	1030	22	5.1

Source: A.B.S. 'Livestock and Livestock Products', (various issues).

Sheep grazing saltbush/bluebush rangelands require a considerable intake of fresh water. Good management of these lands depends heavily on limiting animal numbers on watering points. Graetz and Wilson suggest that, over most saltbush/bluebush country, and based on an effective grazing radius of 3 km, that the maximum number of sheep to a watering point should be 350.

The Collaborative Soil Conservation Study (Department of Environment, 1978) estimated that the whole of the 335,000 km^2 of arid N.S.W. required treatment for land degradation, (with 90 per cent of it suffering some soil erosion and half of it at least 10 per cent eroded). It also concluded that only 16 per cent needed urgent treatment before 1988, and that the trend of land condition was to general improvement with only small, isolated areas suffering declining range condition.

The Western Division Select Committee nevertheless found it could not find any objective data on land condition or trend over the whole Western Division. The Committee was unwilling to accept the assessment of the Western Lands Commission, or the grazier community, that land condition had improved since the 1940's as evidenced by the 'grassing' over of previous scalds and increased livestock productivity. The Committee concluded that there was evidence "...to believe that the condition of land demands concern and further action", (WDSC, 1984c, p.30).

6.1.4 Economic parameters

Hassall and Associates, 1982 found that the 'treeless plains' landscape, most of which is saltbush/bluebush country gave the highest average net farm income in the Western Division. Properties on these plains had the highest level of total liabilities per sheep equivalent and the largest capital value per sheep equivalent, as saltbush/bluebush country requires a large investment in stock watering facilities. Further, these properties had the best return to capital, in part because saltbush/bluebush country supports the highest clean wool cuts and lamb marking percentages of any Australian rangeland (Graetz and Wilson 1984, p.215).

From 1978 to 1980 the average number of sheep equivalents carried on treeless plains properties was 6010 head (Hassall and Associates, 1982, p.173). Average net farm income on such properties over the period 1978-80 was about $21,000, or about $4.50 per sheep equivalent, (ibid, p.57). Over the period 1978-80 the saltbush/bluebush lands had the least variation in income per sheep equivalent of the landscapes studied, an indication of the stability of production under climatic variation.

Wool makes up about half the property income with another quarter contributed from the sales of sheep and lambs, and about 10% from cattle operations. Sheep trading is an important element of production. Over the period 1977-80 the average treeless plains property purchased an average of 470 sheep, but sold an average of 2500 sheep per year (ibid, pp. 82-84).

The most important costs are those of shearing and livestock trading, followed by repairs and maintenance, and wages.

Total liabilities per sheep equivalent over the period 1978-80 ranged from $4.70 to $9.16 (ibid, p.95).

The pastoral industry in the Western Division of New South Wales is made up of small properties. In 1983 it was found that 68% of grazing properties carry less than 5,000 sheep in most years, 13% carry between 5,000 and 6,000 sheep, 19% have flocks in excess of 6,000 sheep while only 8% of properties had more than 8,000 sheep (WDSC, 1984a).

Pastoral zone wool producers face similar production costs and commodity prices across all States. Average property size should be similar in all States, and give a broad measure of viable property size. The average number of sheep on W.A. properties in 1979 was 9,400 (Jennings et al, 1979), on S.A. properties in 1981 was 12,600, and N.S.W. Western Division properties in 1982 was 5,400 (WDSC, 1984a).

It is proposed that the wide variation in property size between states is due to differences in pastoral land tenure. In South Australia there are no limits on pastoral property size and the average property size is 12,600 sheep. At the time of the Jennings Report, Western Australian legislation limited property size to 404,000 hectares and average property size was 9,400. In N.S.W., where property size had been deliberately broken down to a maximum of about 4,000 sheep until 1968, average property size remained smallest at 5,400 sheep. Further, if the South Australian average property size of 12,600 is a broad measure of viability for most pastoral zone wool producers, then many N.S.W., and some W.A. graziers will have problems of low living standards, while the respective State governments will have structural adjustment and land condition problems for many years to come.

Johnston 1973 used a budgeting simulation model to assess the profitability of a Broken Hill sheep station enlarging from 5,100 to 9,000 or 12,000 sheep equivalents. The study concluded that the greatest net social benefits arose from property buildup to 12,000 sheep equivalents while this property size also maximised long term average annual income. Table 6.2 indicates that almost all of the 264 properties sold between 1969 and 1977 were used to create properties carrying in excess of 10,000 sheep, and possibly creating net social benefit to western N.S.W. Severe drought from 1978 to 1983 reduced flock sizes on all properties and reduced the number of properties by 122, with the heaviest losses being among properties carrying less than 10,000 sheep.

6.2 Land administration and property size

Western N.S.W. was first settled by graziers who had begun to lose their vast sheep runs to farmers under the 1861 'free selection before survey legislation'. The light framed Merino sheep shepherded to Western N.S.W. were not suited to the prevailing conditions. Transport and development costs were very high and permanent water supplies limited, even for those graziers who took up runs along the main rivers. Sheep grazing was abandoned over most of the area by 1870, as a series of droughts gripped the region.

A second 'wave' of settlement begain in the 1870's when the invention of wire fencing and water drilling technology overcame critical labour and permanent water shortages. In addition this second wave of settlement introduced a bigger framed type of merino sheep more suited to the arid western plains environment. In 1860 the average Western Division fleece weight was 1.4 kg, while in 1890 it was nearly double this figure. (Shaw, 1982, p.12). Production was increased in the period 1872-1890 by above average rainfall, high sheep prices and considerable capital investment.

Table 6.2

Adjustments in property size Western N.S.W. (1969-84)

YEAR	TOTAL PROPERTIES	SIZE OF PROPERTY SHEEP FLOCK							TOTAL SHEEP ('000)
		< 1,000	1-2,000	2-5,000	5-10,000	10-20,000	20-50,000	50,000+	
1969	1503	148	107	686	509	50	3	0	6,700
1971	1470	133	75	625	574	60	3	0	7,100
1975	1297	112	74	472	534	98	7	0	6,900
1977	1239	87	68	473	495	108	8	0	6,900
1979	1170	104	77	452	458	73	6	0	6,000
1982	1117	115	94	418	416	71	3	0	5,500
1983	1109	-	-	-	-	-	-	-	4,700
1984	1092	-	-	-	-	-	-	-	5,700

Source: ABS, 'Land and Land Settlement (N.S.W.)', various issues.

Following the failure of the 1861 legislation to break down many of the large pastoral properties, the Crown Lands Act of 1884 forced every pastoral lease to be divided in half. One half was retained by the grazier on a 15 year lease, the other half resumed by the Crown for subdivision and distribution to other graziers. If the resumed portion was not immediately required for 'closer settlement' it was offered back to the grazier on an annual lease.

The impact of this legislation was to effectively double the stocking rate on half the land that had been developed up to 1884. No care was taken with, and no investment made in the resumed areas under annual lease. Apparently abundant grazing resources, buoyant markets, good seasonal conditions and high debt loads associated with capital investment encouraged ever-increasing livestock populations, which rose to a peak in 1891.

Four concurrent events caused a dramatic crash of the Western Division pastoral industry from 1893 to 1902. The capital markets crashed in 1893, the prices for breeding sheep and wool declined in the 1890's, a decade of below average rainfall culminated in one of the worst droughts on record (1898-1902), and rabbits reached plague proportions after introduction in the 1880's.

These events were compounded by short and insecure lease title and the allocation of small areas of land to settlers, according to the 1901 Royal Commission into the state of the Western Division. The Commission recommended that, leases carry not less than 4,000 sheep, and up to 8,000 sheep in 'inferior parts' of the Division.

From 1902 to 1947 rainfall was generally below average. From 1948 to the present, rainfall was above average except for severe droughts about the years 1965, 1973 and 1982.

The Broken Hill area was originally taken up on five year leases. Tenure was gradually extended, to 15 years in 1884, and 42 years in 1902. In 1932 the first perpetual leases were issued. In 1984 there were 7637 such leases in the Western Division covering an area of 304,000 km^2 (Western Lands Commission, 1985, p.27).

The policy of closer settlement, which began by resuming one half of all leases in 1884, continued till the 1960's. In 1901 up to one eighth of the biggest leases were resumed, in return for 42 year leases on the remainder. More forced resumptions were made in the thirties, forties and fifties. By 1960 almost all the properties in the Western Division had been reduced to one 'home maintenance area' (HMA), defined in the Western Lands Act of 1901 as a property size "...sufficient for the maintenance in average seasons and circumstances of an average family". This definition was interpreted to mean a property carrying 4-6,000 sheep, depending on the district.

While such a property size was viable in the 1950's, by the mid 1960's it became apparent that declining wool prices and the rising costs of inputs required larger production units. In 1968 the maximum size of a pastoral lease in N.S.W. was extended to two HMAs, releasing some of the pressures existing at the time for property buildup.

The impact of the 1968 decision to partially lift property size restrictions can be seen in Table 6.2.

The period from 1969 to 1977 saw a rapid reduction in the number of properties carrying less than 5,000 sheep from 941 to 628, while the number of properties carrying more than 10,000 sheep increased from 53 to 116. Despite a run of relatively good years and stabilised wool prices the number of properties in the Western Plains steadily declined from 1503 to 1239, as a change on land tenure allowed properties to improve their viability.

From 1969 to 1971 wool prices were severely depressed. The stabilisation of wool marketing and prices in 1972 led to very large investment in property buildup, seen in the growth of properties carrying in excess of 10,000 sheep, from 1971 to 1977.

Severe drought in the years 1978 to 1982 reduced total sheep numbers in the Western plains from 6.9m in 1979 to 4.7m in 1983. The losses were spread across all property size categories from 2-5,000 upwards, but were most severe for properties carrying less than 10,000 sheep.

An important influence on land use in the 1970's was the increased cropping activity catalysed by the lifting of wheat quotas. The WDSC (1984b, p. 39) estimated that there were 228,000 hectares of crop in the Western Division in 1980, a fivefold increase from the early 1970's. Most of this cropping occurred on the more productive alluvial soil types which would normally carry one sheep to the hectare. (Hassall and Associates, 1982 p.47). It is suggested that most of the cropping was carried out by lessees with small properties (ibid, p.89) or specifically purchased by farmers for extensive crop production, and that sheep were largely displaced from these areas which were often continuously cropped with wheat, leading to some severe erosion.

The decline in grazing pressure on the Western Plains from 9.4m sheep equivalents in 1977 to 5.4m in 1983 can be seen in Figure 6.3. Drought was the major cause of this destocking. Some destocking may also be due to the impact of larger property size on overall Western Plains stocking levels. Hassall and Associates 1982 found that stocking rates declined as property size increased in the Western Division. This more conservative management may be evident in the general fall in sheep numbers from 1971 to 1984, and the very stable level of wool cuts from 1972 to 1981, leading to a steady increase in wool cut from 1981 to 1984.

The rise in wool cuts from 1978 to 1984 is significant because it occurred despite one of the worst droughts on record in 1983, which was probably as severe as that in 1965/66, which reduced average wool cuts to 4.1 kg per adult sheep (Figure 6.3).

The above discussion points to the considerable influence of economic forces on the size and structure of Western Plains properties and how important it is that pastoral land legislation be flexible enough to allow these forces to work. It would appear that much of the closer settlement forced on the region by the soldier settler schemes of the 1950's and 1960's has been reversed in the period 1969 to 1984. In an aggregate sense it would appear that the partial removal of property size restrictions in 1968 was a case of "too little, too late" for full advantage of economies of scale to be realised in the period 1974-1978. The partial easing of legislative and administrative restrictions on property size and management may have resulted in increased adoption of more conservative management strategies.

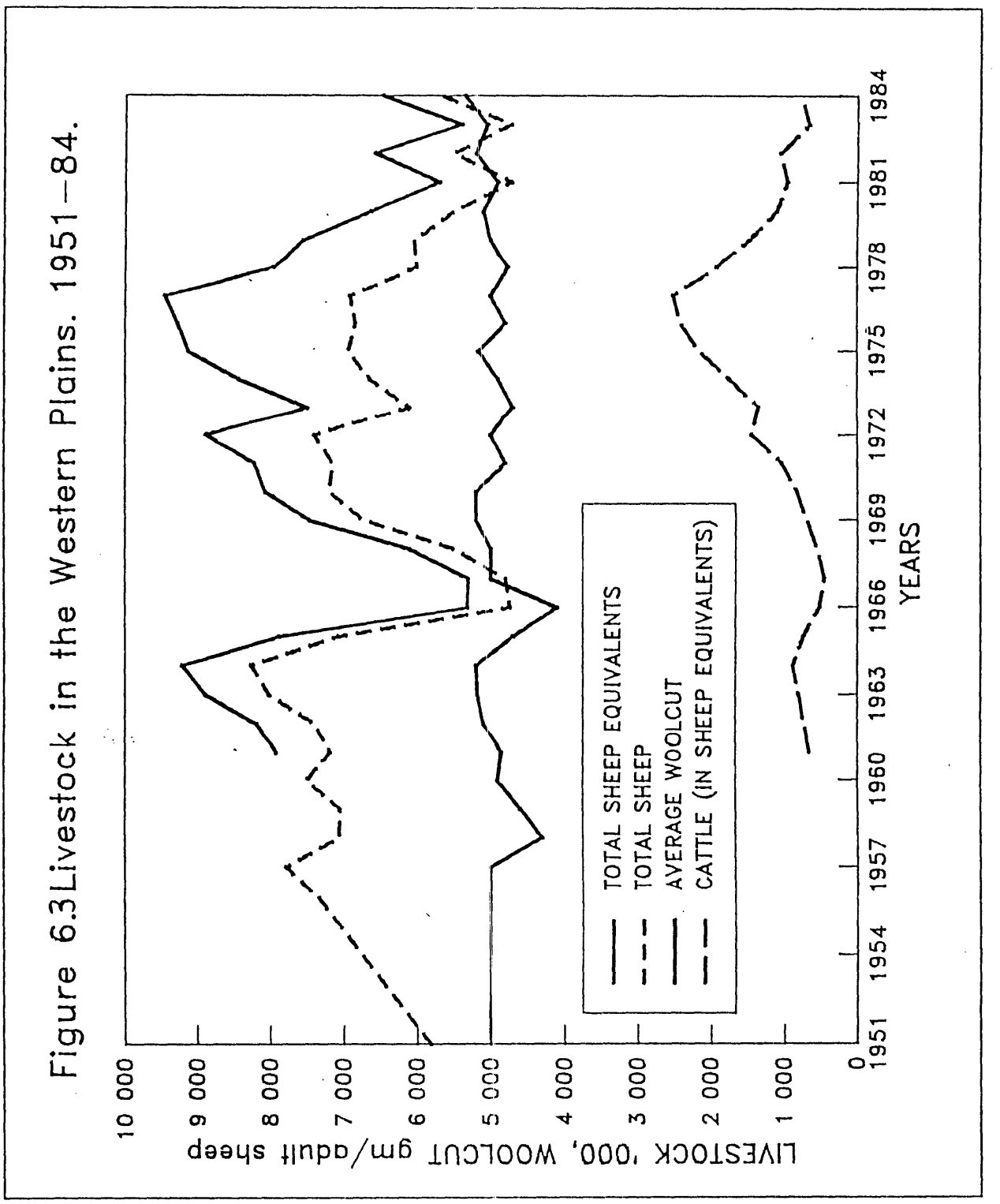


Figure 6.3 Livestock in the Western Plains. 1951–84.

Chapter 7

CONCLUSIONS

7.1 General Conclusions

The major hypothesis tested in this study is that present land tenure and administration is a significant cause of pastoral land degradation. The results of this study support the hypothesis. There is historical evidence that insecure and short-term leases, property size restrictions, forced resumptions, high lease rents and other restrictions on the management of pastoral land have caused pastoral land degradation. The results from computer based simulations of various contemporary pastoral production scenarios suggest that, in Queensland, land tenure and administration may continue to be a significant potential cause of degradation.

The computer simulations also indicate that property survival (over the long run) and viability increase with more conservative management and larger property size (up to 15,000 sheep equivalents).

It is essential to point out that this study was first proposed in 1984, and that during the research (1985-86) there were some very significant changes made to pastoral land legislation, particularly in New South Wales and Queensland. In order to avoid confusion in such a rapidly changing legislative environment, the word 'present' in the hypothesis refers to land legislation as it existed in 1984.

7.2 Conclusions from the property model simulations

The model simulations of this study examined the impact of property size, drought management, family income flows and drought assistance on the survival and viability of a range of pastoral property scenarios in the Charleville area.

7.2.1 Property size and management

Simulations demonstrated that increasing property size from 5,000 to 15,000 sheep and adopting more conservative mangement gave a grazier an increased probability of survival, a higher level of income, increased flexibility in management, lower levels of debt and a higher discounted net worth. These benefits are probably well known to graziers in Queensland. Property size restrictions were lifted only recently. Structural adjustment to larger property size will require perhaps at least a decade.

The more important determinant of property business survival and viability, however, was found to be the form of property management. With conservative (DPI) management, survival was found to be possible on properties carrying 5,000, 10,000 and 15,000 sheep. On the other hand, with exploitative management a history of poverty, debt and ultimate bankruptcy was almost ineviable for the same three porperty sizes. More conservative management would seem to result in a wide range of property sizes that would ensure survival and viability. This suggests that the proposition of Hassall and Associates (1982, p.167) that future productivity in the pastoral zone depended totally on increasing property size was not absolutely correct. It would be correct, however, if there was no proven alternative to current (AVERAGE) management. Model simulations indicated that large properties of, say, 18,000 sheep or more could be viable under exploitative management.

Property size limitations lead government and graziers to false expectations of long term survival and viability of property sizes below the limit. In times of rapid economic change, the limitations both increase the costs of structural adjustment and limit the policy options for property buildup. Lastly size limitations divert attention away from the more important issue of land management by occupying a lot of land administration resources.

7.2.2 Conservative and exploitative property management

Model simulations suggest that there are few long term incentives for graziers to adopt exploitative management.

Further, conservative management persists under a much wider range of costs, suggesting that it is better suited to coping with not only severe drought, but also the wide variation experienced in commodity prices, and the present situation of declining terms of trade.

Over the long term, the adoption of more conservative management by more graziers should also reduce the need for government to become involved in drought assistance schemes.

For long term survival and viability of property businesses, under AVERAGE management, it is suggested that the property carry at least 12,000 sheep. Under the best available (DPI) management it appears to be possible to be viable with as few as 5,000 sheep, and to achieve a similar standard of family income. The two alternative strategies have, however, important differences. Table 5.9 shows that the AVERAGE 10,000 sheep property has much higher average net farm income and discounted net worth. Many graziers may prefer these gains even if it means more equity stress and peak debt than that experienced on the DPI 5,000 property. Most importantly DPI management has yet to be proven, and the small property size problem in the Charleville area may be preventing its adoption.

7.2.3 Fixed and variable income flows

The simulation of fixed and variable family income flows demonstrated the need for flexible income demands, especially on smaller properties, to ensure survival.

It was found that a fixed family income strategy provided high probabilities of failure. Income streams that varied with profitability avoided the worst debt situations that are the primary cause of pastoral property failure. For pastoral land administrations it will be important that any demands made on graziers for greater investments in more conservative land management be flexible to avoid unnecessary hardship to graziers.

7.2.4 Drought assistance schemes

The model simulation of various levels of drought variable costs suggests that the present forms of drought assistance enable smaller and more exploitatively managed properties to persist. This persistence leads to land degradation and retards the process of structural adjustment.

7.2.5 Other conclusions

Model simulations supported the contention that there should be real concern for graziers who have less than 80% equity in their property business. The simulations in this study suggested that the demise of property businesses was very rapid indeed, once having got to a threshold of about 80% equity. Recovery, if at all possible from such high levels of debt depended absolutely on the occurrence of good seasons.

For all sizes of properties the avoidance of debt is suggested, to be a key contributor to property survival. This highlights the need for graziers to develop good financial as well as biological management skills.

The key influence of climate on survival and viability of pastoral properties is also indicated in the model simulations.

7.3 The legacy of closer settlement

The legacy of a century of closer settlement policy in the Australian pastoral zone has been:

(a) the existence of too many small properties.

(b) some extensive areas of land degradation and the possibility that land degradation will continue until the number of small properties has been reduced;

(c) complex legislation;

(d) unsustainable intrusions of rainfed cereal cropping into the pastoral zone, and

(e) hardened attitudes against corporate ownership of pastoral land.

(a) Property size

The active implementation of property size and ownership restrictions in New South Wales and Queensland in particular has resulted in a large population of small pastoral properties, owned and operated by families. While it has been argued earlier that property size is not an absolute determinant of productivity, there is a real need for many families to increase the size of their present holdings to raise the probability of survival and viability and reduce the potential for degradation. Many small properties are currently carrying considerable debt loads which hinder them purchasing additional land. In moving to a more deregulated land market it is essential that government assist in the property buildup process so that the costs of overcoming past deficiencies in land policy are not borne entirely by the pastoral industry.

(b) Lease consolidation

There is a special need in New South Wales and Queensland for the consolidation of the large variety and number of pastoral leases. Many of these leases have quite different conditions, thus reducing the flexibility of property management. The large number of leases unnecessarily raises the cost of land administration.

(c) Mortagee rights

The rights of mortgagees of pastoral leases in Australia are very attenuated, and this situation is suggested as a major reason why pastoral lessees find difficulty in borrowing on the security of pastoral lease title. Reform of present mortgagee rights would enable the private financial market to play a more active role in the proeprty adjustment process.

(d) Corporate ownership

It is suggested that corporations, because of their capacity to spread risk may have a useful role in the operation of large and remote holdings in the pastoral zone.

7.4 Future land management issues

Future pastoral land management needs to be based on sound economic and ecological research, guided by simple legislation, administered by state agencies that recognises the wide range of objectives and management skills of graziers and which relies, in the first instance on peer group pressure to curb exploitative land managers.

7.4.1 Deficiencies in land administration

The two critical deficiencies in present pastoral land administration are a lack of reliable methods for assessing rangeland condition and trend, and a very limited knowledge about the economic efficiency of various land management strategies currently being recommended. These deficiencies may constrain the extent to which land administrations can assist in the process of structural adjustment.

7.4.2 Consolidation of land administration structures

At present, a considerable array of government agencies are involved in pastoral land management. These agencies often have conflicting objectives. Some of the serious problems facing graziers today, such as the externalities to production associated with wildlife and public access to pastoral leases, could be more efficiently handled if they were regulated from within the same agency that administered pastoral lands.

7.5 Suggested future research

7.5.1 Research objectives

To date the research has been both topical and useful with respect to changes now underway in pastoral land legislation but expansion in two ways is desirable.

Firstly, it is suggested that the issue of fauna control needs to be included as an aspect of research because;

(1) In 1985 the research team observed trials at Charleville that demonstrated the potential of kangaroos to retard the regeneration of degraded land. There is also much documented evidence suggesting that the regeneration of degraded pastoral zone land is dependent on control of rabbit and kangaroo populations. (Condon, 1982, Wilson, Harrington, and Beale, 1984, Foran, 1984, p. 311).

(2) Graziers are responsible under existing legislation for the control, if not eradication of pests and noxious weeds from their leases. In the case of kangaroos, however, very extensive State intervention severely restricts the ability of land managers to control kangaroo populations.

(3) The income lost due to excessive numbers of (pest) fauna, and the costs involved in their control is estimated to be considerable on pastoral properties and a major production constraint to graziers. (Foran, 1984, p. 311).

The second suggested amendment is that a further, (human) behavioral model needs to be developed to better probe the interface between graziers and pastoral land legislation. Much research needs to be carried out on grazier perceptions of land degradation as there is little objective scientific information available to guide legislators, (WDSC 1984b, p. 30).

7.5.2 Methodology

The expert systems approach used in this study has so far proved robust, cheap and relatively effective. Maximising the use of public goods such as a wide variety of secondary and primary data, the current methodology also enables the researcher to readily interact with a wide range of experts.

7.5.3 Research topics

It is suggested that future research be directed at property level issues where there is an increasing trend for the Crown to pass the responsibility for land management and condition to the grazier. There is, consequently, an increasing need to have a better understanding of the goals and values of graziers.

Research, at the property level, which investigated the costs and benefits to graziers of various standards of land management would help identify practical limits to land management changes and the rate of structural adjustment.

The third area of research could be to define the major constraints to the implementation of the more conservative management standards.

It is suggested that the study area remain as N.S.W. and Queensland. There are important continuing differences in land tenure and administration between the two States that deserve attention.

It is suggested that the properties to be studied be limited to no more than three in each of the Broken Hill and Charleville areas.

7.6 Policy Recommendations

The ultimate benefit of this study should be the identification of efficient forms of pastoral land tenure and administration.

While pastoral land tenure and administration is nominally a State issue, the growing fiscal powers and influence of the Commonwealth Government requires that policy recommendations be directed at both levels of government.

7.6.1 State Government

7.6.1.1 Land tenure

(a) Perpetual lease recommended for pastoral lands. Perpetual leasehold is seen as an optimal form of tenure from the point of view of government and grazier. Provided the conditions covenants and reservations attached to those leases are able to be reviewed on a regular basis, perpetual lease gives graziers the security of tenure they need. Perpetual lease tenure facilitates government involvement in structural adjustment of the pastoral industry.

(b) Property size, stocking rate, land price and ownership controls should be discarded. It is suggested that these particular controls were never based on objective evidence and that they inhibit the conservative management of the land resource. Most importantly these controls divert resources away from issues of land management.

(c) Consolidation of land (management) Acts. It is recommended that the present plethora of Acts (Soil Conservation, National Parks, Environmental Protection, National Parks, etc) relating to pastoral land management be consolidated into a single Act especially designed for management of arid rangelands. At present there are too many, often contradictory Acts which in sum represent an unrealistic expectation of grazier performance. Such a procedure would also reduce the cost of pastoral land administration.

(d) Lease document. Not all the conditions of pastoral leases are laid out in the lease document. The lease should be a guide to improved land management.

7.6.1.2 Land administration

(a) The emerging issues which remain to be resolved for the grazier are the externalities of production associated with wildlife control, public access and the various demands of a range of government land agencies.

(b) Grazier involvement in pastoral land administration. There is a tendency for new administrative structures to dispense with grazier involvement in pastoral land administration and policy formation. Grazier involvement in the implementation of new land management policies should reduce the potential for new policies to cause hardship and land degradation. Secondly if graziers are made more directly responsible for the monitoring and enforcement of pastoral land condition through the use of peer group pressure it is essential that they have an involvement in administration and policy formulation.

(c) Containment of land administration costs. While the addition of extra (graduate level) staff to present pastoral land administration agencies may result in improved land condition monitoring, it is important that these extra costs are justified, something not attempted in the Vickery or WDSC Reports.

7.6.2 Commonwealth Government

The influence of Commonwealth Government policy on land condition has been considerable for many decades.

(a) The present form of Commonwealth/State drought assistance schemes needs review to reduce the short term nature of the policy which, it is suggested, has contributed to land degradation and impeded structural adjustment in the pastoral industry.

(b) The legacy of closer settlement. It is important that as pastoral property size is increasingly influenced by market forces that the 'losers' in the process of property build-up be adequately compensated. The present extent of small pastoral property size could not have been achieved by the various State land administrations without Commonwealth financial assistance. With the removal of many property size and transfer restrictions from State land tenure, the Cmmonwealth Government should play a role in the compensation of owners whom have been obliged to maintain a small property size.

(c) Continuation of the National Soil Conservation Programme. It is suggested that, in the case of the pastoral zone more effort is needed to implement the third (landholder) component of the Programme. As the implementation of land management policy emphasises the use of peer group pressure and regular covenant reviews to monitor and enforce standards of land management, more research will be needed at the grazier community level to devise simple and efficient methodologies for assessing rangeland condition.