Pasture development in Queensland — A success story[1]

B. WALKER AND E.J. WESTON[2]
Pasture Management Branch, QDPI, Brisbane, Queensland, Australia.

Abstract

Of a total of 172.8 million (m) ha in Queensland, an easily attainable sown pasture potential of 22.1 m ha is identified. The current development of 42.5% of this potential to sown (4.4 m ha) and naturalized pasture (5.0 m ha) reflects the success of plant introduction. Major plants to contribute to this development are the grasses *Chloris gayana*, *Cenchrus ciliaris*, *C. pennisetiformis*, *Panicum* spp., *Sorghum* spp., *Setaria sphacelata*, *S. incrassata*, *Brachiaria decumbens* and *Bothriochloa pertusa* and the legumes *Stylosanthes hamata*, *S. scabra*, *S. guianensis*, *Aeschynomene americana*, *Cassia rotundifolia*, *Medicago* spp. and *Trifolium* spp. Previously widely used legumes such as *S. humilis*, *Macroptilium atropurpureum* and *Desmodium* spp. are now less important, due to either disease or high management requirements.

About 70% of sown pastures are presently planted only to grasses, particularly on the more fertile brigalow soils. This is foreshadowed to change, with a greater use of grass-legume mixtures to improve the productivity of less fertile soils and to help restore run-down grass pastures. The need to restore soil fertility in cultivated lands will also increase the use of legume and grass-legume ley pastures. These changes will be helped by the recent development of better adapted legumes.

Overall, production losses caused by the reduced area of grazing lands due to urban and rural development, as well as decline in native pasture condition and land degradation, have been more than offset by production gains achieved through new pasture plants, resource development and improved animal husbandry. The increase in livestock equivalents to the present 11 m level, plus a reduced age of cattle turnoff, reflect a much increased level of production from the pasture resource.

Although there has been considerable progress in sown pasture research and development, there is still much to do. The greatest challenge for our future is to identify sound management practices which will ensure maintenance of the pasture resource. 43% of this resource is affected by either soil or species degradation. More resources and effort need to be allocated to these areas if improvement is to be achieved before irreversible degradation is widespread.

Resumen

De un total de 172.8 millones (m) ha en Queensland, se identificó un potencial de pasturas sembradas fácilmente alcanzable de 22.1 m ha. El desarrollo actual del 42.5% de ese potencial de pasturas sembradas (4.4 m) y naturalizadas (5.0 m ha) refleja el éxito de la introducción de plantas. La mayoría de plantas que contribuyen a este desarrollo son las gramíneas Chloris gayana, Cenchrus ciliaris, C. pennisetiformis, Panicum spp., Sorghum spp., Setaria sphacelata, S. incrassata, Brachiaria decumbens *and* Bothriochloa pertusa *y las leguminosas* Stylosanthes hamata, S. scabra, S. guianensis, Aeschynomene americana, Cassia rotundifolia, Medicago spp. *y* Trifolium spp. Leguminosas tales *como* S. humilis, Macroptilium atropurpureum *y* Desmodium spp., ampliamente usadas en el pasado, son en la actualidad menos importantes debido ya sea a enfermedades o al alto requerimiento de manejo.

Al presente, aproximadamente un 70% de las pasturas son sembradas *únicamente con gramíneas, especialmente en los suelos más fértiles de brigalow. Se vislumbra un cambio en esta tendencia hacia el uso de mezclas de*

Correspondence: Dr B. Walker, c/- Pasture Management Branch, QDPI, G.P.O. Box 46, Brisbane, Qld 4001, Australia.

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[2]Present address: QDPI, P.O. Box 102, Toowoomba, Qld 4350, Australia.

gramíneas y leguminosas para mejorar la productividad de los suelos menos fértiles y auxiliar en el re-establecimiento de las pasturas debilitadas. La necesidad de re-establecer la fértilidad del suelo en tierras de cultivo incrementará también el uso de leguminosas y pasturas de leguminosas y gramíneas en rotación con otros cultivos. Estos cambios serán auxiliados con el reciente desarrollo de leguminosas mejor adaptadas.

Las pérdidas de producción total ocasionadas por la reducción del área de las tierras de pastoreo debido al desarrollo urbano y rural, así como a la disminución de la condición de las pasturas nativas y a la degradación de la tierra, han sido más que compensadas con la ganancia en producción alcanzada a través de nuevas plantas en las pasturas, al desarrollo de recursos y al mejoramiento en el manejo de los animales. El incremento en el número de cabezas de ganado equivalente a un nivel en la actualidad de 11m, aunado a la reducción en la edad al sacrificio del ganado, refleja un mayor incremento en el nivel de producción de los recursos de la pastura.

A pesar que ha habido un considerable progreso en la investigación y desarrollo de las pasturas sembradas, aún queda mucho por hacer. El gran reto para nuestro futuro es la identificación de prácticas de manejo sensatas, las cuales asegurarán el mantenimiento de los recursos de la pastura. Más de un tercio de este recurso es afectado ya sea por la degradación del suelo o de las especies. Más recursos y esfuerzos necesitan ser puestos en estas áreas si el mejoramiento va a ser alcanzado antes que la degradación irreversible de los recursos se extienda.

Introduction

Since the 1840's, when the first pastoralists settled in what was later to become Queensland, animal and plant products have been major export earners. In 1964-65 they accounted for 85% of the foreign export value (Table 1). However by 1984-85 the proportion contributed by rural production had declined to 28% and mining products became the dominant component at 57%, with manufactured items and tourism providing the balance.

During the same period the composition of the rural product changed (Table 2). Initially dairy production played an important role in land and infrastructure development, but its importance has since declined. Whereas equal value was attributed to beef, wool and dairy products in 1964-65, by 1984-85 only beef had increased in value and both wool and dairy products had decreased to one-third of their original values. Cropping industries had increased in value and by 1984-85 accounted for more than half of the rural value.

Table 1. A comparison of Queensland's foreign exports in 1964-65 with 1984-85 at 1985 values[1] (A.B.S. 1965 and 1985)

	1964-65		1984-85	
	A$ million			
Pastoral	1 283	(57)[2]	950	(14)
Crop	618	(28)	890	(14)
Metals and minerals	170	(8)	1 050	(16)
Coal	50	(2)	2 713	(41)
Others (manufactured items tourism etc.)	115	(5)	1 000	(15)
TOTALS	2 236		6 603	

[1] Adjusted using CPI index [2] % contributed to total

Table 2. Gross values of Queensland's rural industries for 1964-65 and 1984-85 at 1985 values[1] (A.B.S. 1965 and 1985)

	1964-65		1984-85	
	A$ million			
Beef	638	(19)[2]	871	(28)
Wool	637	(19)	217	(7)
Dairy	638	(19)	144	(5)
Other animal products	150	(5)	214	(6)
Crop	1 240	(38)	1 695	(54)
TOTAL	3 303		3 141	

[1] Adjusted using CPI index [2] % contribution to totals

With the introduction of cattle and sheep from Europe and development of the soil and plant resources, many changes were inevitable. What is the combined impact of these changes, some increasing, some decreasing, on pasture productivity? An estimate of their impact can be gained from livestock statistics for the State, if we assume that in the long term livestock numbers reflect the feed supply. While short-term fluctuations reflect mainly climatic variations, longer-term trends reflect overall pasture production. The major domestic grazing animals are, and have been, dairy and beef cattle, sheep and horses. Using an index (Anon. 1982) to convert these different classes of animals to livestock equivalents, the total animal grazing pressure for each year is plotted (Figure 1), and several important phases are recognized.

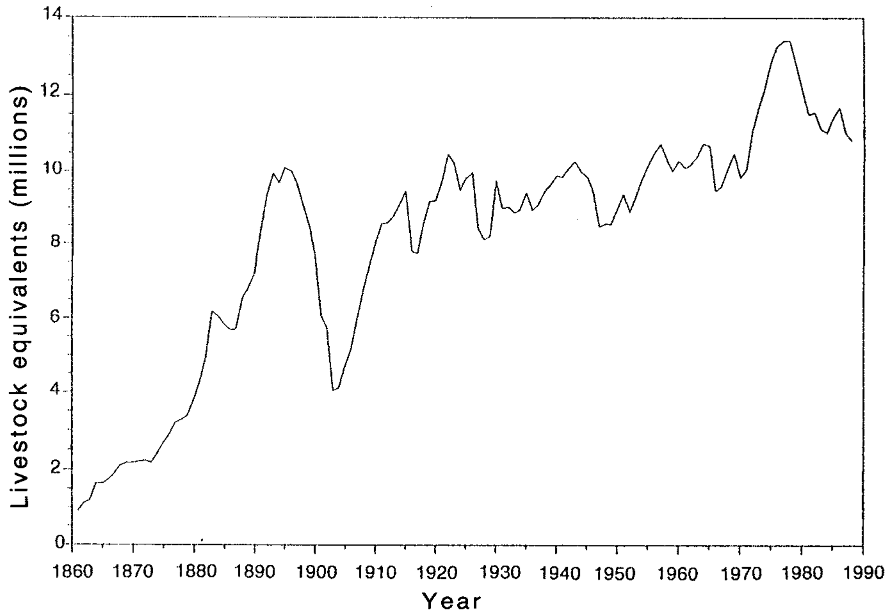


Figure 1. Stock equivalents in Queensland from 1861 to 1989.

From settlement until 1895 there was a progressive increase in livestock numbers to a peak of 10.1 m livestock equivalents. There were only small, short term fluctuations during this phase, presumably due to an abundance of productive natural pasture in good condition. At the turn of the century severe drought, plus the adverse effects of the rabbit, prickly pear invasion and a decline in pasture condition, all combined to reduce total livestock equivalents to 4.0 m by 1903. More than 2 decades passed before livestock numbers recovered, despite extensive development of the artesian basin during this period.

From 1923 to the present time, there has been a general trend of increasing livestock numbers to 11 m livestock equivalents (Figure 1). Except for the 1975–80 period, fluctuations in numbers from this trend were not large and were mainly due to seasonal effects. In the 1975–80 period there was a large increase in livestock equivalents to 13.4 m, when cattle numbers were the highest on record (11.5 m head). These high stock numbers were mainly due to depressed beef prices and the withholding of stock from sale.

While not reflected in livestock equivalent statistics, there has also been a dramatic reduction in the age of cattle sold for slaughter. In the past, finished cattle were sold at 3 to 5 years, whereas the age now is 2 to 4 years.

This paper highlights the positive achievements in sown and native pasture development which have led to the current high level of animal production.

The resource and its potential

Gross sown pasture potential

Queensland's crop and pasture potential, based on soil type, climate and landform, has been assessed by Weston *et al.* (1981). They estimate that 14.2 m ha of crop, 40.6 m ha of sown pasture, 105.9 m ha of native pasture and 5.3 m ha of non-agricultural lands make up the State's long-term productive base at the present level of technology. Coupled with 6.7 m ha of national park, State forest and timber reserve, this gives a total of 172.8 m ha.

The distribution of 14 native pasture communities (Weston and Harbison 1980) is shown in Map 1. These communities are convenient units for considering the pasture resource. The potentials for crop, sown pasture and native pasture are presented for each community (Table 3). The gross potential for sown pasture is in close agreement with previously published estimates (Table 4).

Table 3. Crop and sown pasture potential and residual native pasture for 14 native pasture communities (Weston *et al.* 1981)

Community	Total Area	Crop Potential	Sown Pasture Potential	Residual Native Pasture	Sown Pasture Area (1978)
			('000 ha)		
Pasture sparse or absent	4 360	207	725	1 382	101
Blady grass	2 718	655	752	585	140
Black spear grass	25 000	2 187	10 485	10 224	569
Queensland blue grass	2 379	1 427	741	205	99
Brigalow pastures	8 661	4 308	3 132	1 068	1 523
Aristida/Bothriochloa pastures	33 526	2 179	12 578	15 675	612
Gidgee pastures	4 842	369	861	3 552	343
Mulga pastures	19 067	54	2 910	15 393	61
Mitchell grass	29 526	1 426	2 150	25 755	222
Spinifex	21 162	0	2 356	16 820	188
Channel pastures	5 434	0	51	5 375	13
Blue grass-browntop	5 646	453	535	4 602	33
Schizachyrium	9 402	581	2 869	5 213	8
Native sorghum	1 010	372	461	94	0
TOTAL	172 782	14 217	40 606	105 944	3 912

Table 4. Estimates of the potential for sown pasture in Queensland

Source	Area
	(m ha)
Davies and Eyles (1965)	58
Ebersohn and Lee (1972)	52
Weston *et al.* (1981)	
— excluding potential crop	41
— including potential crop	55

Easily attainable sown pasture potential

The estimate of gross pasture potential includes areas where pasture development is technically difficult, is remote from existing infrastructure, or where development costs would be very high. We believe that it is more useful to interpret gross potential in terms of ease and likelihood of development to obtain an easily attainable sown pasture potential.

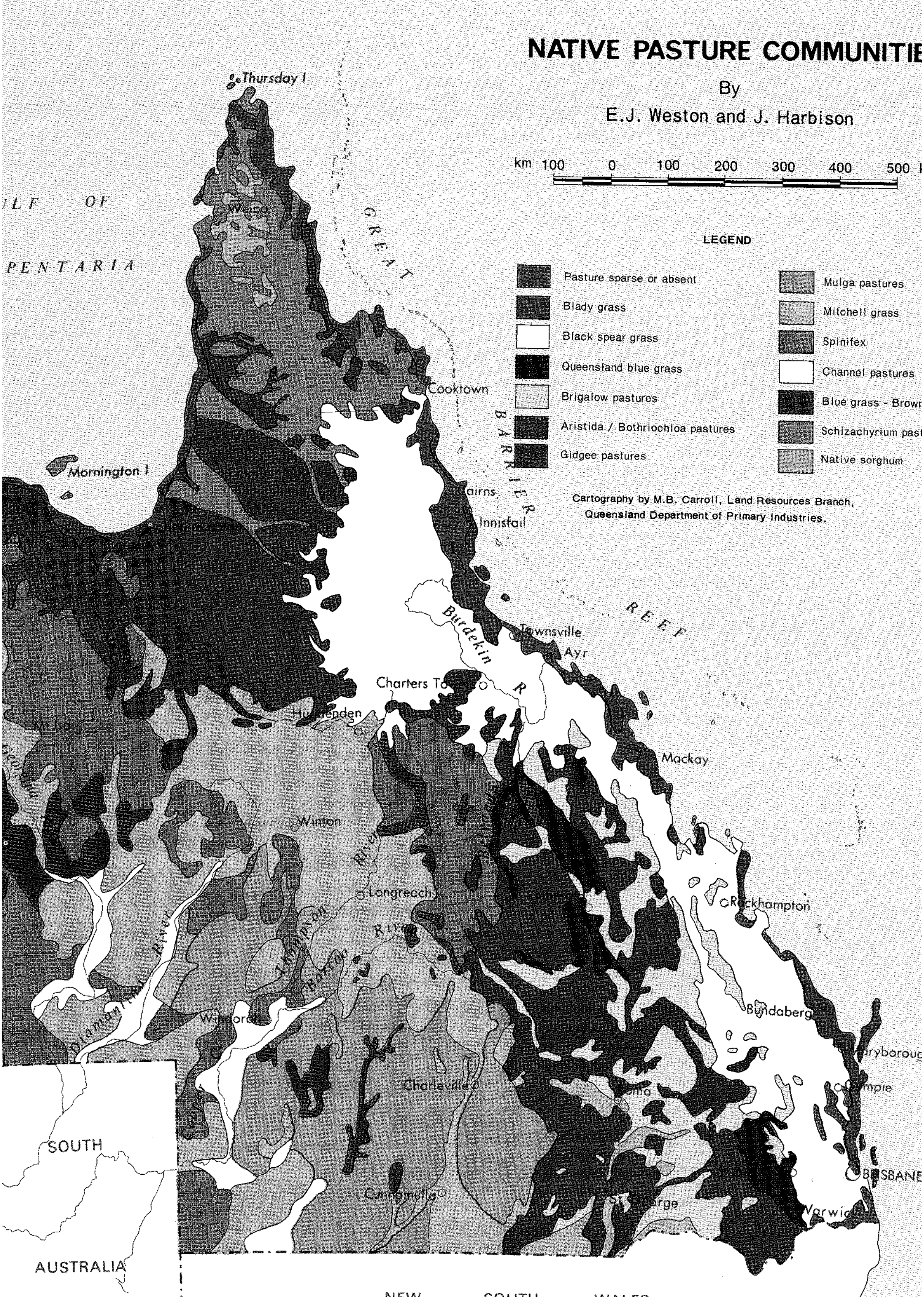
For revised estimates we have used soil texture groups (Weston *et al.* 1981), where soils with similar productivity are grouped and arranged in decreasing order of productivity. These are derived using Northcote's (1974) classification. Within these groups the gross potential for crop and sown pasture is discounted by 25 to 80% according to a number of constraints, or is not adjusted. For example, within cropping land, permanently arable land of high productivity is unlikely to be developed to pasture, while undeveloped arable land subject to high soil losses through erosion or to rapid fertility decline under cropping (potential crop-pasture rotation) is preferred for sown pasture. Within sown pasture potential, those areas based on infertile soils, remote from established infrastructure, are unlikely to be developed and are discounted (Table 5).

Using this discounting approach, there are 22.1 m ha easily available for sown pasture

Table 5. Adjustment of gross potential to estimate easily attainable sown pasture potential[1]

Soil Texture Groups	Land Suitability Groups: crop gross	crop adjusted	crop-pasture gross	crop-pasture adjusted	sown pasture gross	sown pasture adjusted	total gross	total adjusted
				(m ha)				
Clays	5.6	0.0	2.9	1.4	4.4	2.2	12.9	3.6
Fertile loams/earths	0.3	0.1	1.0	0.5	2.0	1.5	3.3	2.1
Fertile duplex	1.2	0.6	1.7	1.3	4.1	4.1	7.0	6.0
Infertile earths	0.8	0.4	3.3	0.7	12.9	3.2	17.0	4.3
Infertile duplex	0.7	0.4	2.3	0.5	11.5	5.2	14.5	6.1
TOTALS	8.6	1.5	11.2	4.4	34.9	16.2	54.7	22.1

[1] The % discounting for calculating the easily attainable sown pasture potential can be calculated from "gross" and "adjusted" values


NATIVE PASTURE COMMUNITIE
By
E.J. Weston and J. Harbison
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LEGEND
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Gidgee pastures
Mulga pastures
Mitchell grass
Spinifex
Channel pastures
Blue grass - Brown
Schizachyrium past
Native sorghum
Cartography by M.B. Carroll, Land Resources Branch, Queensland Department of Primary Industries.
Thursday I
Weipa
Mornington I
PENTARIA
GREAT BARRIER REEF
Cooktown
Innisfail
Burdekin R
Townsville
Ayr
Mackay
Winton
Longreach
Rockhampton
Thompson
Barcoo River
Diamantina River
Windorah
Bundaberg
Charleville
Cunnamulla
BRISBANE
Warwick
SOUTH
AUSTRALIA
NEW SOUTH WALES

development in Queensland. Table 5 shows the compositions of this total, 1.5 m ha from potential crop lands, 4.4 m ha from potential crop-pasture rotation lands and 16.2 m ha from potential sown pasture lands.

Development of the vegetation resource

Native pasture

Despite significant progress in crop and sown pasture development in Queensland, 85% of land is still considered to be native pasture and this area carries 80% of domestic stock. The most important practice which has increased native pasture production since settlement is tree clearing, historically of forests, more recently of shrublands and woodlands.

The relationship between tree density and herbage yield has been reported for eucalypt woodland in southern inland (Walker *et al.* 1972) and central Queensland (Scanlan 1986), and for mulga shrubland in south-west Queensland (Beale 1973). A curvilinear relationship exists between density of woody plants and pasture yield (Figure 2). Increased pasture production following tree removal is reflected in an approximate 2-fold increase in stocking rate and a 3-fold increase in beef production per hectare (Tothill 1983). Increases in ground water height are also attributed to clearing. As a consequence dryland salting has occurred in some areas, but the total area is not yet extensive and only 7 900 ha have been identified (Hughes 1979).

Although records are limited, large areas of Queensland's forests and woodlands have been modified. In the past, tree communities in the higher rainfall environments closer to the coast have been preferentially cleared (Figure 3). It is estimated that timber treatment for woodland management and woody weed control is 0.5 m ha annually, either by clearing, blade ploughing or chemical treatment (W.H. Burrows, personal communication).

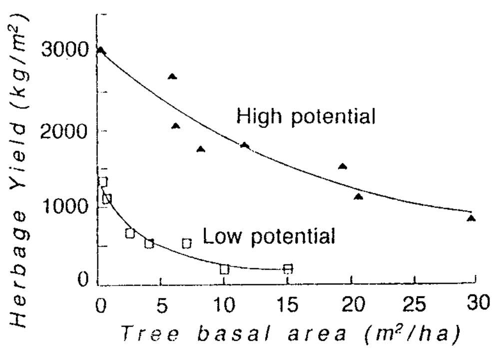

Figure 2. The relation between tree basal area and yield of pasture in contrasting environments (Scanlan and Burrows 1990).

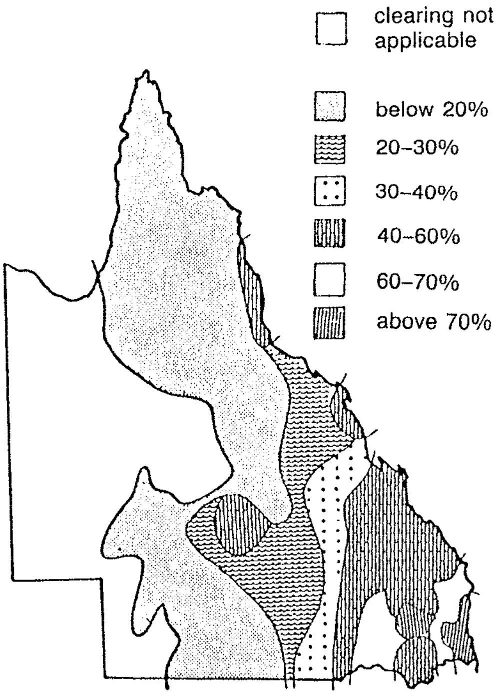

Figure 3. The extent of clearing of open forests and woodlands in Queensland up to 1983 (Burrows *et al.* 1988).

After pastoral occupation of up to 150 years, the loss of potential pasture production due to competition from trees and woody weeds is still a problem of high priority. Where cultivation is practised, woody weed control measures are readily available. However, on less fertile soils, or in drier regions where land is of lower value, the problem is recurrent. In the absence of cultivation, few cleared communities have remained as grassland and some have been re-cleared as many as 3 times (Weston *et al.* 1975).

Broad estimates of the condition of native pastures are available (Weston *et al.* 1981) and these indicate significant areas of pasture decline. The northern mitchell grass community has been relatively resilient, although *Acacia nilotica* currently threatens that condition. In the south,

Table 6. Estimates of soil and vegetation degradation in Queensland (Anon 1978)

Land use and form degradation	Grazing	Non Arid Extensive cropping	Intensive cropping	Totals	Arid	Totals of arid and non arid land
			(m ha)			
Area in use	75.2	2.4	0.45	78.0	84.0	162.0
Area not requiring treatment	52.2	0.2	0.10	52.5	40.4	92.9 (57)[1]
Total areas degraded	22.9	2.2	0.36	25.5	43.6	69.1 (43)[1]
— Vegetation degradation	5.7	—	—	5.7	23.4[2]	29.1
— Soil degradation	17.2	2.2	0.36	19.8	20.2[3]	40.0

[1] % of total area
[2] vegetation degradation with little soil erosion
[3] some to severe erosion, accompanied by some vegetation degradation

mulga, *Aristida/Bothriochloa*, mitchell grass and black spear grass communites have areas of serious degradation. In Queensland there are estimated to be 29.1 m ha of pastoral land with vegetation degradation and 40.0 m ha of crop and pastoral land affected by soil erosion (Anon. 1978) (Table 6). These represent 43% of the total pasture and cropping areas and illustrate the magnitude of the land and vegetation degradation problem.

Table 7. Estimates of area of naturalized pasture species in Queensland

Species	Area
	(m ha)
Cloncurry buffel and commercial buffels	1.4
Indian bluegrass	0.8
Couch grasses and angleton grass	0.1
Rhodes grass, green panic and guinea grass	0.3
Kikuyu, white clover and Paspalum	0.4
Para grass	0.1
Annual medics	1.7
Townsville stylo	0.2
TOTAL	5.0

Naturalized pasture

Within areas currently classified as native pasture, there are useful introduced species so well adapted that they have naturalized. They are the result of spread from deliberate plantings or from accidental introductions. Because of suitable adaptive mechanisms they have established and spread without the disturbance normally essential for sown pasture development. Previous reviews of pasture development have ignored the presence and positive contribution of these species. However, they occupy substantial areas of land and should be considered in an overview of pasture development.

The major useful naturalized species are conservatively estimated to occupy 5.0 m ha (Table 7). Where plants are known to have specific soil preferences, estimates are derived in part from measured areas of the Atlas of Australian Soils (Isbell *et al.* 1967, 1968, Northcote 1966 and Northcote *et al.* 1968). Other estimates are based on published information and on local knowledge.

Cenchrus pennisetiformis (Cloncurry buffel grass) is widely naturalized in the Gulf watershed of north-west Queensland and to a lesser extent in the far west. Estimates of its extent in the north were reported (Hall 1978) for three zones. There has been continued spread since then and a total of 1.0 m ha of Cloncurry buffel is now estimated for these 3 zones. The Flinders River catchment also has significant stands of Cloncurry buffel on alluvial soils. Combining these 2 areas gives an estimated 1.2 m ha of Cloncurry buffel grass, predominantly in north-west Queensland.

Cenchrus ciliaris cultivars Gayndah, American, and Biloela have colonized roadsides and railway lines and spread on fertile loamy soils throughout Queensland. The area involved is conservatively estimated to be 0.2 m ha. Buffel grass is adapted to extensive areas in semi-arid Queensland and it will continue to colonize on moderate to high phosphorus soils, when suitable conditions occur.

Bothriochloa pertusa (Indian bluegrass) has replaced *Heteropogon contortus* (black spear grass) in parts of coastal and sub-coastal north Queensland as a result of heavy grazing. Estimates of the area involved are 0.1 m ha in Burdekin shire, 0.2 m ha in Dalrymple shire and 0.5 m ha in Bowen shire. There is little indication that stocking pressure will be reduced on these pastures in the short-term and the area of Indian bluegrass will continue to increase.

Digitaria didactyla (Queensland blue couch), *Cynodon dactylon* (green couch) and *Dichanthium aristatum* (angleton grass) occur in coastal and sub-coastal lands on clay and clay loam soils, mainly in southern Queensland. They have replaced native grasses on 0.1 m ha of old cultivation and overgrazed native pasture areas.

Chloris gayana (rhodes grass), *Panicum maximum* var. *trichoglume* (green panic) and *P. maximum* (guinea grass) have naturalized along roadsides and in commercial pastures in coastal and sub-coastal Queensland. Their area of occurrence is difficult to estimate, but would exceed 0.3 m ha.

Pennisetum clandestinum (kikuyu), *Paspalum dilatatum* (paspalum) and *Trifolium repens* (white clover) are naturalized on 0.4 m ha of fertile tableland and coastal soils.

Brachiaria mutica (para grass) has a potential of over 0.2 m ha in swampy coastal areas and already 0.1 m ha have spread naturally.

Annual *Medicago* spp. (annual medics) are estimated to occupy 30% (1.7 m ha) of the fertile clay and clay-loam soils of southern inland Queensland.

Stylosanthes humilis (Townsville stylo) occupied extensive areas in northern Australia, until *Colletotrichum gloeosporioides* (anthracnose) seriously reduced its distribution in the mid 1970's and it is now estimated that only 0.2 m ha remain.

Sown pasture

Investment in sown pastures tends to increase during periods of higher profitability for animal products. Other important stimuli have been favourable seasons, highly profitable development situations (gidgee clearing), extensive land development schemes (Brigalow Development Scheme), suitable species and technology, adequate seed availability, tax incentives and poor returns for crop products. Conversely, cropping expansion in brigalow lands has reduced sown pasture areas.

There was a slow increase in the area of sown pasture from 1900 to 1960 (Figure 4). In the next 15 years to 1975, there was a 4-fold increase. A period of decline followed until 1980 and this was associated with the loss of extensive areas of Townsville stylo devastated by anthracnose, poor returns in the pastoral industries and expansion of cropping areas. From 1980 to 1989 there was an increase of over 1.0 m ha of sown pasture. Details of the last 5 years' development are summarized in Tables 8 and 9. These data show that a record level of pasture development took place in 1988–89.

The importance of brigalow, gidgee, black spear grass and *Aristida/Bothriochloa* native pasture communities for sown pasture development was highlighted by Weston *et al.* (1981), who showed that 78% of sown pastures were on these four communities (Table 3).

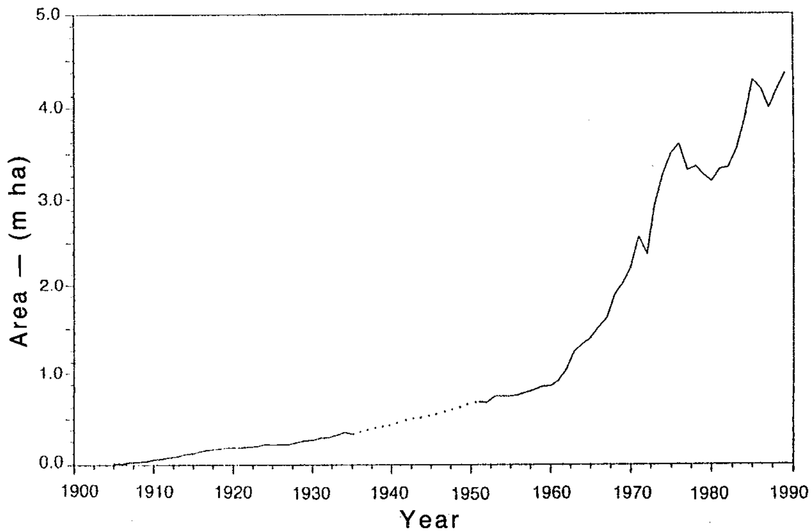

Figure 4. Area of sown pasture in Queensland.

Table 8. Annual sowings of pasture and fodder crop in Queensland from 1984-85 to 1988-89 (A.B.S. 1985 to 1988)

	1984–5	1985–6	1986–7	1987–8	1988–9[1]
			('000 ha)		
Sown pasture					
Lucerne	7	8	8	7	8
Legume based	79	92	82	108	109
Grass	250	175	180	180	260
Total Sown	336	274	270	296	378
Fodder crop	338	443	580	582	521
Pasture ploughed out for crop	59	80	77	43	54

[1] data provided by P. Lloyd

Table 9. Cumulative areas sown to pastures in Queensland from 1984-85 to 1988-89 (A.B.S. 1984 to 1989)

	1984–5	1985–6	1986–7	1987–8	1988–9
			('000 ha)		
Sown pasture					
Lucerne	25	31	27	32	33
Legume-based	1 116	1 124	990	1 005	1 201
Grass	3 143	3 034	2 962	3 142	3 020
Total sown pasture	4 284	4 189	3 979[1]	4 179[1]	4 354[1]

[1] excludes an estimated 130 000 ha of pastures grown by farmers not producing more than $20 000 gross income per year, which were included in the previous years' totals

Of the area sown to pasture, about 70% is sown solely to grasses, a trend which has been consistent for 14 years of recording. The distribution of sown pastures with grass alone and those with legumes (including lucerne) is shown in Figures 5 and 6. Sown grass pastures have been mainly concentrated on the more fertile brigalow clay soils, the gidgee clay-loams and the alluvial soils of the arid and semi-arid zones. On the other hand, sown grass-legume pastures are widely distributed on less fertile soils in coastal and subcoastal areas and do not extend into the drier western areas.

Estimates of the amount of seed of the major pasture species recorded as commercially produced in 1986–87 (Table 10) are used to highlight the grasses and legumes currently being used. Rhodes grass, buffel grass, *Sorghum* spp. hybrid, cv. Silk (silk sorghum) and *Setaria incrassata* (purple pigeon grass) are the most commonly used grasses. All 4 are traded farmer to farmer and these statistics understate total seed production to a considerable extent. The use of silk sorghum and purple pigeon grass has increased substantially in the last 5 years, reflecting, in part, the high acceptance of easily established grasses. The high totals for *Brachiaria decumbens* (signal grass) and *B. humidicola* (koronivia grass) were largely associated with export markets, though increasing quantities of koronivia grass are expected to be planted across northern Australia in the future. A more recent development has

Table 10. Tropical pasture seed produced in Queensland (tonnes) in 1986–87[1]

Grasses	tonnes	Legumes	tonnes
Buffel grasses	100	Verano stylo	80
Rhodes grasses	200	Seca stylo	40
Green panic	35	Fine stem stylo	8
Guinea grasses	10	Siratro	30
B. decumbens	60	Glenn jointvetch	30
B. humidicola	20	Leucaena	5
Bambatsi panic	5	Lotononis	7
Silk sorghum	300	Wynn cassia	10
Purple pigeon grass	40	Greenleaf desmodium	8
Setaria spp.	30	Glycine	5

[1] Based on A.B.S. (1986–87) data, with adjustment where additional local information was available

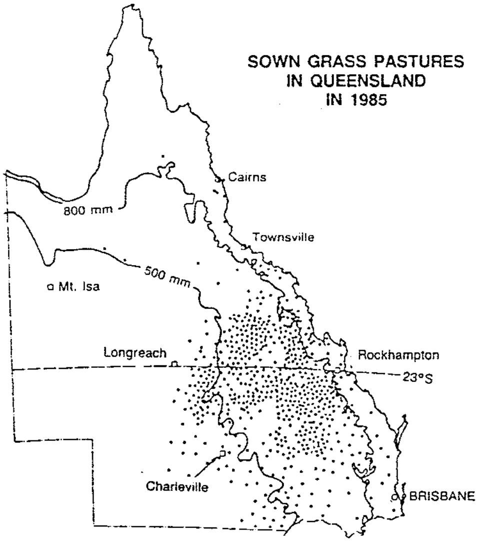

Figure 5. Distribution of sown grass pastures in Queensland in 1984–85. Each dot represents 5 000 ha.

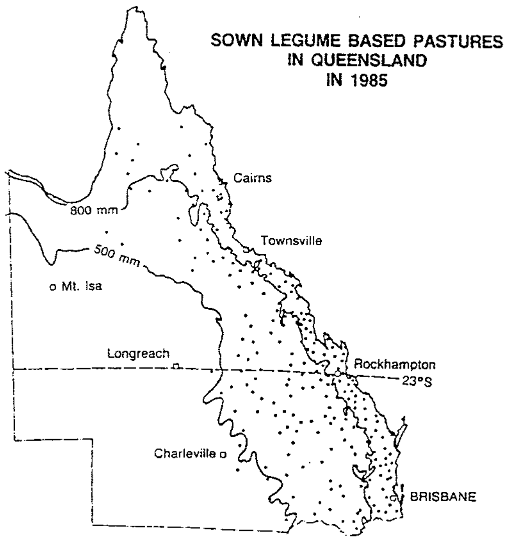

Figure 6. Distribution of pastures sown with legumes in Queensland in 1984–85. Each dot represents 5 000 ha.

been the use of 2 new grasses, *Echinochloa polystachya* cv. Amity (aleman grass) and *Hymenachne amplexicaulis* cv. Olive (hymenachne), which are complementing *B. mutica* (para grass) for ponded pastures in central and northern Queensland.

Stylosanthes hamata cv. Verano (Caribbean stylo) and *S. scabra* cv. Seca (shrubby stylo) are the major tropical legumes now being sown. More recent information (J.M. Hopkinson, personal communication) is that Seca stylo is now the most popular tropical legume, because it is adapted to a range of edaphic and climatic conditions. Legumes of increasing importance are *Cassia rotundifolia* cv. Wynn (roundleaf cassia) and *Aeschynomene americana* cv. Glenn (jointvetch). Although the use of *Leucaena leucocephala* (leucaena) has been enhanced by the resolution of mimosine poisoning (Jones and Megarrity 1986), its prospect is now threatened by the psyllid insect (*Heteropsylla cubana*). Since the 1970's the use of such legumes as *Macroptilium atropurpureum* (siratro), *Desmodium intortum* and *D. uncinatum* (greenleaf and silverleaf desmodiums) and *Neonotonia wightii* (glycine) has diminished due to diseases and their higher management requirements.

Seed production estimates for Queensland do not indicate the use of temperate species, as this seed is produced in southern Australia. At least 50 000 ha of pastures based on the temperate *Trifolium* and *Lolium* species (clovers and ryegrasses) are used on dairy farms, usually with irrigation. In addition, considerable areas are sown to *Medicago sativa* (lucerne) and annual *Medicago* spp. (annual medics). Prior to the appearance of the lucerne aphid in 1977, some 51 000 ha of lucerne were grown (A.B.S. 1975–76). Following a substantial decline, the area sown to lucerne increased to 33 000 ha in 1988–89 (Table 9); present indications are for a major increase in annual sowing. In 1986, 20 tonnes of annual medic seed was sold in Queensland. By the following year this had doubled and in 1990 more than 250 tonnes were sold in southern inland Queensland. The growing interest in the use of legume leys in crop-pasture rotation is reflected in these seed sales.

The condition and productivity of sown pasture are under constant challenge from inappropriate grazing management and natural run-down processes. Most grass alone pastures are vigorous for only a limited number of years, generally from 4 to 10 years. Productivity and stability decline is mainly due to the tie-up of available soil nitrogen. The associated loss of production is valued at around $40 million per year (Robbins *et al.* 1986).

The lack of reconciliation between the statistics for sown pasture cumulative areas, annual sowings and pasture ploughed out, is, in part, due to pasture run-down (Tables 8 and 9). Other losses of production, attributed to poor sown pasture condition, are those associated with woody weed problems, as in the northern brigalow region (Anderson *et al.* 1984), or the overall decline in legume content of pastures such as those sown to siratro (Walker 1983) and lucerne. A wide range of pest species reduce the value of the sown pasture resources, prominent weeds for example being *Lantana camara* (lantana), *Parthenium hysterophorus* (parthenium weed) and *Baccharis halimifolia* (groundsel bush).

Forage crop

There has been a steady increase in forage crop areas to a peak of 582 000 ha in 1986–87 (Table 8). While the major planting is with forage oats for cattle finishing, there is a substantial area sown to sorghum forages and forage legumes such as *Lablab purpureus* (lablab).

A perspective on pasture development

Various factors have combined to improve pasture productivity and more than balance the loss of land to urban, rural and infrastructure developments, to crop expansion and to vegetation and soil degradation in native pastures. A large increase in dry matter production has accrued from timber clearing and thinning and from increased areas of introduced pasture and forage crop. Improved animal husbandry, better adapted tropical beef breeds and the widespread use of feed supplements have improved animal health, adaptation and survival.

In future, large production gains will not be achieved by timber clearing on fertile soils as these areas are diminishing. Smaller gains can be achieved on woodland areas, but these gains may be short lived unless adapted legumes are available to maintain soil nitrogen. Woody weed control will continue to be important on all land types. In the more fragile pasture communities improved management could, at best, sustain pasture production. Current management could, at worst, cause severe pasture and land degradation (Table 6). In the light of our positive achievements elsewhere we should not ignore the pasture degradation which has occurred.

The current level of livestock equivalents (11 m), plus a reduced age of cattle turnoff, would not have been possible without those developments which have maintained the overall productivity of the pasture resource.

While the 4.4 m ha of current sown pasture (A.B.S. 1988–89) is only 7.8% of the overall pasture potential reported by Weston *et al.* (1981) (Table 4), the proportion is quite different when naturalized species and easily attainable sown pasture potential areas are considered. With 5.0 m ha of land occupied by naturalized grasses or legumes, the total area influenced by introduced species is 9.4 m ha or 17.0% of the gross crop and pastures potential. When this area is considered in relation to the easily attainable sown pasture potential area of 22.1 m ha (Table 5), then 42.5% of that potential contains some introduced species. This is a major achievement.

Historically, pastures on fertile soils (cleared forests of brigalow and gidgee) were sown to grasses. While the current statistics (Tables 8 and 9) still reflect the dominance of sowing grass alone pastures (about 70% of plantings are pure grass; 30% contain legumes), we expect more pastures to contain legumes in the future. Several important factors should contribute to this change. In addition to the availability of better adapted legumes, there will be the greater use of legumes to halt the declining productivity of sown grass pastures, the planting of legume based pastures on soils of inherently lower fertility, the augmentation of native pasture with legumes, and the use of legume leys and grass-legume pastures in soil fertility restoration of increasing areas of older cropping land.

We have proudly achieved much progress in sown pasture research and development and much more remains to be done. Our greatest challenge is to convince our institutions and funding organizations to support the necessary research and development that will be required to maintain the expansion of sown pastures, maintain the productivity of the native and sown pasture and identify management practices which will maintain the productivity of the total pasture resource. If this is not done, then much of the land and vegetation, that we value so much, will be lost.

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