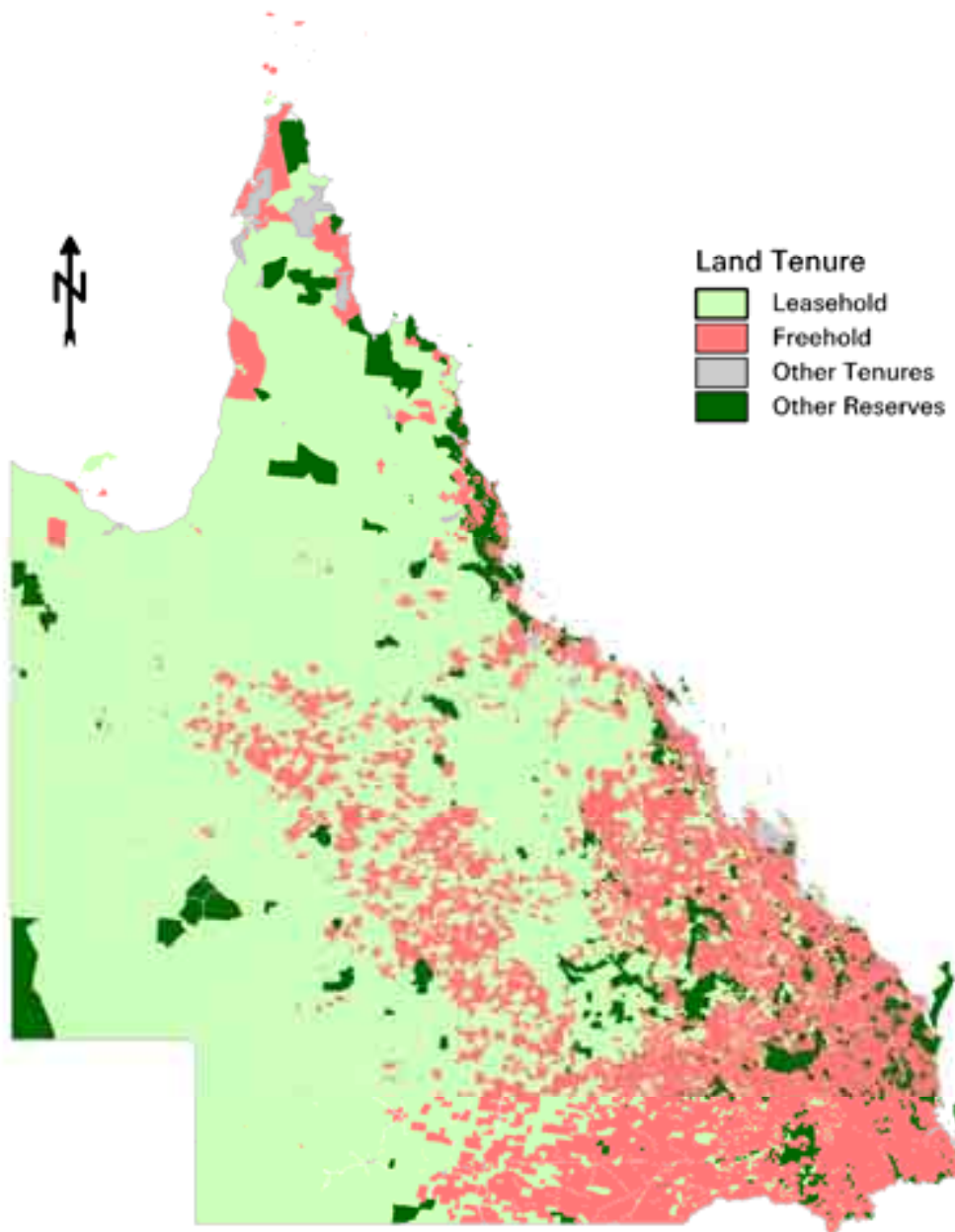


# QUEENSLAND LAND TENURES

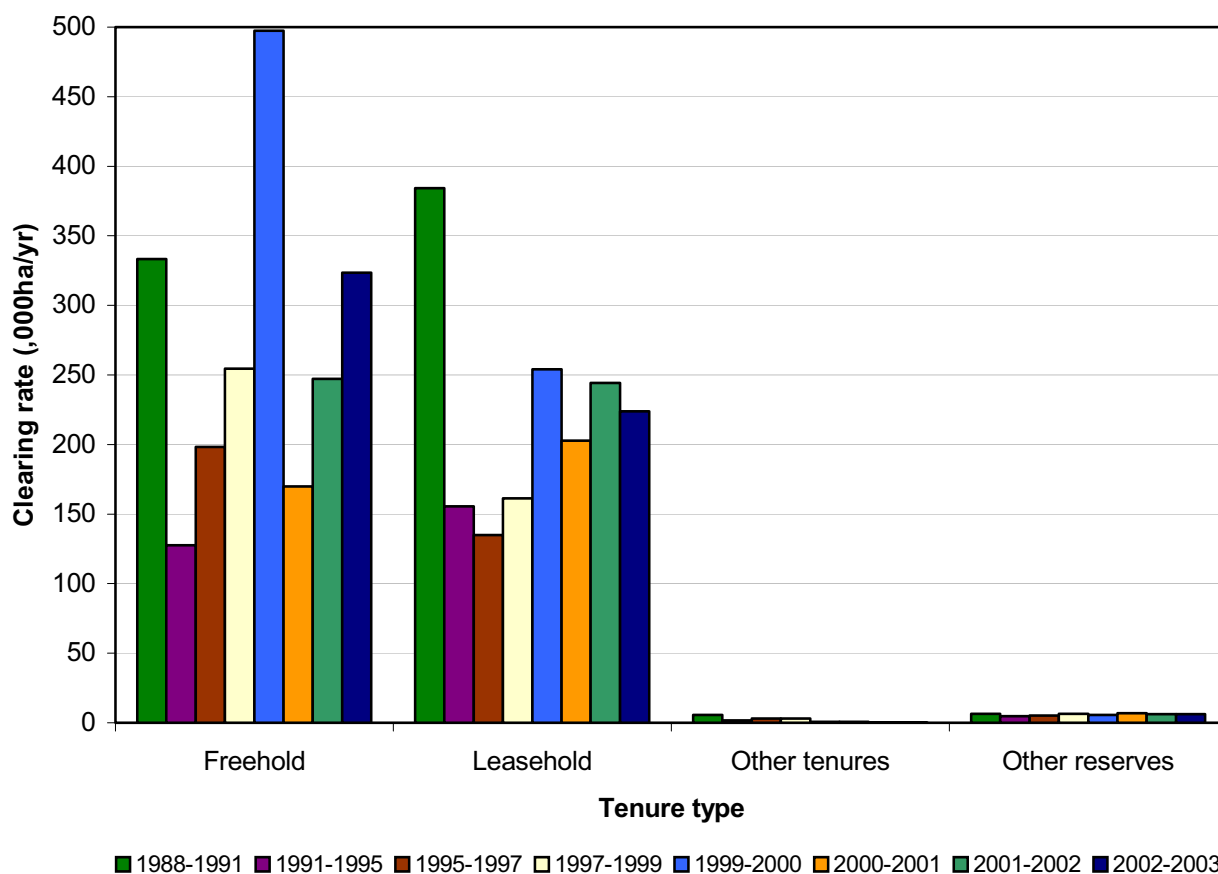


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Figure 10: Land tenures in Queensland (2001).

**Table 4: Woody vegetation change by land tenure (1988–2003).**

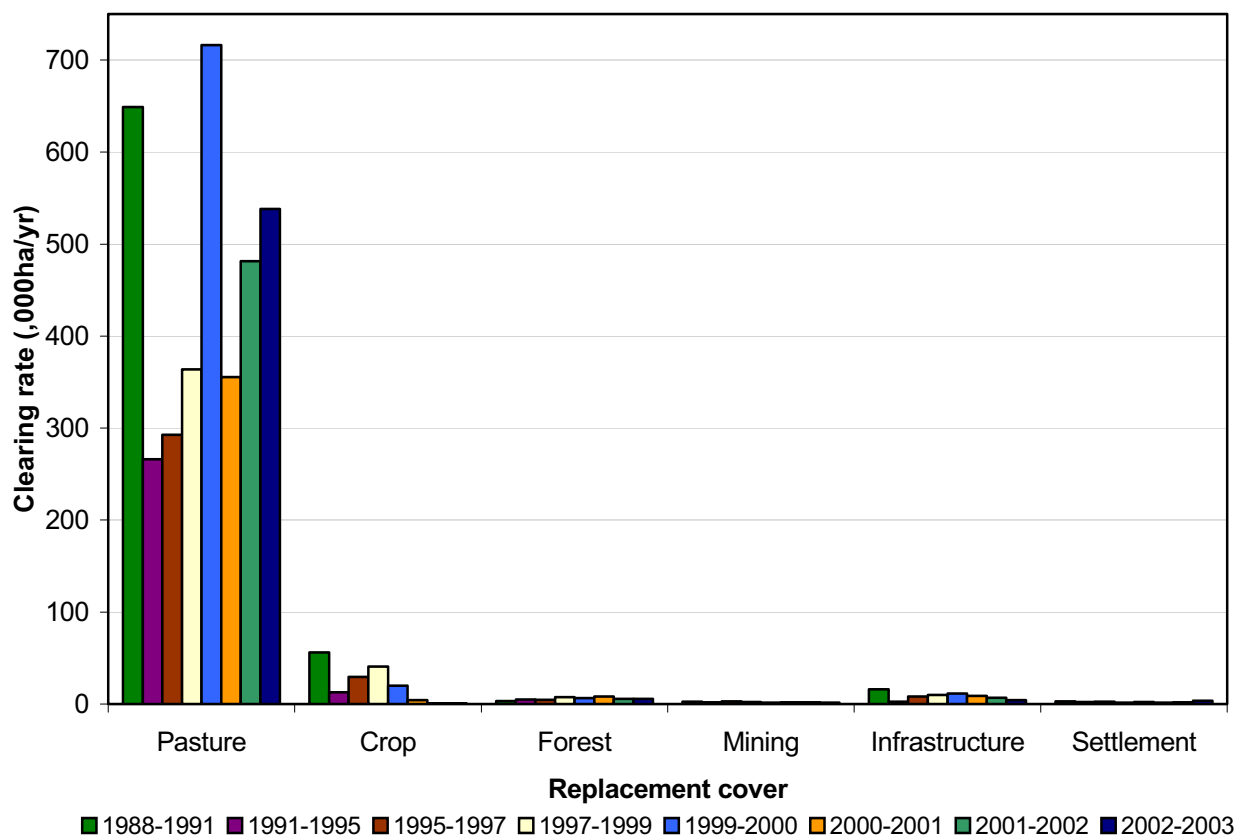
Period	Clearing	Freehold	Leasehold	Other Tenures	Other Reserves	Total
1988–1991	Rate (,000ha/yr)	333.25	384.22	5.74	6.46	729.66
	% of State clearing	45.67	52.66	0.79	0.88	100.00
1991–1995	Rate (,000ha/yr)	127.72	155.72	1.57	4.83	289.84
	% of State clearing	44.07	53.73	0.54	1.67	100.00
1995–1997	Rate (,000ha/yr)	197.97	134.03	3.10	5.18	340.28
	% of State clearing	58.04	39.53	0.91	1.52	100.00
1997–1999	Rate (,000ha/yr)	254.39	161.40	3.06	6.50	425.35
	% of State clearing	59.81	37.95	0.72	1.53	100.00
1999–2000	Rate (,000ha/yr)	497.29	254.00	0.78	5.71	757.79
	% of State clearing	65.62	33.52	0.10	0.75	100.00
2000–2001	Rate (,000ha/yr)	169.95	202.65	0.74	6.82	380.16
	% of State clearing	44.70	53.31	0.20	1.79	100.00
2001–2002	Rate (,000ha/yr)	247.18	239.62	4.86	6.23	497.90
	% of State clearing	49.65	48.13	0.98	1.25	100.00
2002–2003	Rate (,000ha/yr)	323.50	224.02	0.28	6.11	553.91
	% of State clearing	58.40	40.44	0.05	1.10	100.00



**Figure 11: Trend in clearing rate by tenure type (1988–2003).**

**Table 5: Woody vegetation change by replacement land cover (1988–2003).**

Period	Clearing	Pasture	Crop	Forest	Mining	Infrastructure	Settlement	Total
1988–1991	Rate (,000ha/yr)	649.12	55.79	3.27	2.43	16.01	3.05	729.66
	% of State clearing	88.96	7.65	0.45	0.33	2.19	0.42	100.00
1991–1995	Rate (,000ha/yr)	266.12	12.59	4.78	1.56	2.45	2.34	289.84
	% of State clearing	91.81	4.34	1.65	0.54	0.85	0.81	100.00
1995–1997	Rate (,000ha/yr)	292.74	29.40	4.70	2.68	8.25	2.51	340.28
	% of State clearing	86.03	8.64	1.38	0.79	2.42	0.74	100.00
1997–1999	Rate (,000ha/yr)	363.75	40.77	7.37	2.08	9.90	1.48	425.35
	% of State clearing	85.52	9.58	1.73	0.49	2.33	0.35	100.00
1999–2000	Rate (,000ha/yr)	716.40	19.98	6.50	1.44	11.49	1.98	757.79
	% of State clearing	94.54	2.64	0.86	0.19	1.52	0.26	100.00
2000–2001	Rate (,000ha/yr)	355.31	4.36	8.24	1.93	8.84	1.48	380.16
	% of State clearing	93.46	1.15	2.17	0.51	2.33	0.39	100.00
2001–2002	Rate (,000ha/yr)	481.49	0.73	5.70	1.69	6.66	1.63	497.90
	% of State clearing	96.70	0.15	1.14	0.34	1.34	0.33	100.00
2002–2003	Rate (,000ha/yr)	538.14	0.67	5.73	1.53	4.27	3.57	553.91
	% of State clearing	97.15	0.12	1.04	0.28	0.77	0.64	100.00



**Figure 12: Trend in clearing rate by replacement cover (1988–2003).**

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#### 4.4 Woody Vegetation Change by Foliage Projective Cover and Basal Area

The woody vegetation change data for all SLATS measurement periods were cross tabulated with the 1991 woody vegetation cover (overstorey and shrub FPC) layer generated from the Landsat imagery, to produce a frequency distribution showing clearing in relation to woody vegetation cover (Figure 13).

For the 1988–1991 period, the woody FPC mapping used was based on mapping developed using the Woody FPC Index, (previously referred to as the MRVI) described by Goulevitch *et al.* (2002), Armston *et al.* (2004B) and Danaher *et al.* (2004). For all other change periods, the 1991 baseline FPC mapping described by Kuhnell *et al.* (1998) was used. To ensure the interpretation of FPC was consistent between methods, areas of woody vegetation in the 1991 mapping were compared to the 1988 mapping and regression analysis was used to relate the 1988 FPC to the 1991 FPC using a polynomial function.

The highest frequency of clearing occurs at an FPC value of:

- 24% for 1988–1991 and 1991–1995
- 28% for 1995–1997
- 29% for 1997–1999
- 23% for 1999–2000
- 24% for 2000–2001
- 23% for 2001–2002
- 21% for 2002–2003.

The mode value for the 1999–2001 and 2001–2003 periods are the lowest of all change periods analysed by SLATS. These figures indicate that the vegetation cleared recently is of lower FPC than earlier periods, which is consistent with the increase in clearing in the mulga communities. The increased clearing of lower FPC vegetation highlights the importance of using techniques that are able to map clearing of vegetation communities with low FPC.

There are areas of young regrowth which were not mapped as woody vegetation in the 1991 vegetation cover mapping and could not be included in the histogram. The rates of young regrowth are shown in Table 6. The area of young regrowth (not mapped in 1991) has been increasing since 1991 and there was a significant increase in the 1999–2001 period. As noted in the methods section of this report, the mapping of regrowth and regrowth clearing is more uncertain than the mapping of clearing of denser vegetation and more affected by seasonal conditions. Table 6 also shows rates for the clearing of vegetation considered to be greater than or equal to 12% foliage cover. This 12% FPC definition approximates the 20% crown cover definition that is commonly used in vegetation remote sensing studies (Kitchen and Barson, 1998). However, there is no direct relationship between tree crown cover and woody FPC and generally 20% tree crown cover could range from 1–15% woody FPC, depending on location and vegetation community.

The inability to assign an FPC value to areas not mapped in the 1991 vegetation cover mapping was noted as a problem in earlier SLATS reports. The development of the new Woody FPC Index was discussed in the methods section. It provides a means of assigning FPC values to all vegetation mapped as cleared but was not implemented for the entire imagery time series at the time this report was written.

The SLATS woody vegetation cover data were divided into the four foliage cover classes used by Carnahan (1988) and intersected with the 2001–2003 clearing rate data. These clearing rates by woody vegetation cover data are given in Table 7.

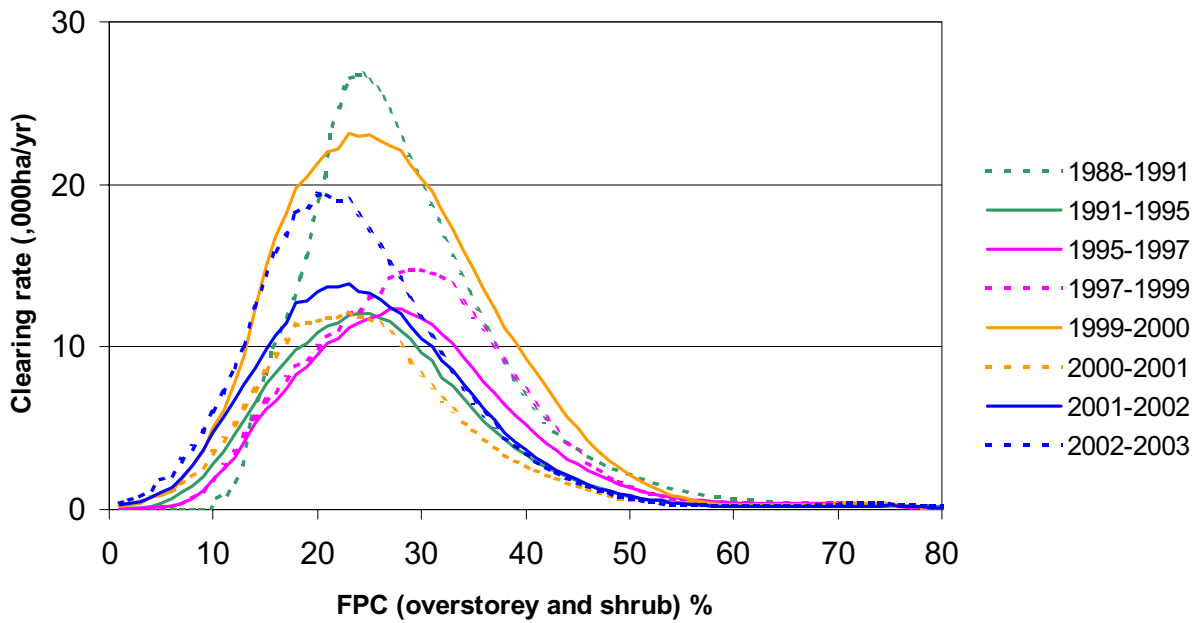


Figure 13: Frequency distributions of woody vegetation clearing using 1991 woody vegetation cover (FPC) mapping (1988–2003).

Table 6: Woody vegetation change using a 12% FPC definition (1988–2003).

Period	Rate of woody vegetation change (,000ha/yr)			
	Not mapped as woody in 1991	FPC <12% and mapped as woody in 1991	FPC >=12%	Total
1988–1991	n/a	3.95	726.80	730.75
1991–1995	0.00	12.90	276.00	288.9
1995–1997	34.48	7.24	298.78	340.5
1997–1999	64.18	6.99	354.33	425.5
1999–2000	166.40	23.02	568.36	757.78
2000–2001	99.05	17.53	261.39	377.97
2001–2002	160.96	23.11	313.84	497.9
2002–2003	133.58	31.77	388.54	553.9

**Table 7: Woody vegetation change by FPC (2001–2003).**

Woody vegetation cover % (overstorey and shrub FPC)	2001–2003 Clearing rate (,000ha/yr)	% of State clearing total
<10	164.44	31.11
10–29	260.01	49.24
30–69	100.60	19.05
70–100	2.96	0.56
Total	528.0	100.0

A tree basal area layer was derived from the 1991 baseline woody vegetation cover layer using relationships between FPC and basal area based on site measurements (Kuhnell *et al.*, 1998). This relationship only holds for mature vegetation, therefore areas which are known to be young regrowth were not included. The tree basal area layer will continue to be improved using historical Landsat TM and Multi Spectral Scanner analyses (possibly as far back as the 1970s) to identify previously cleared vegetation. Kuhnell *et al.* (1998) and Armston *et al.* (2004) describe the development of the basal area data. Figure 14 shows the frequency distributions of clearing rates in relation to basal area. The highest frequency of clearing occurs at the values of:

- 9 m<sup>2</sup>/ha for 1988–1991 and 1991–1995,
- 10 m<sup>2</sup>/ha for 1995–1997
- 11 m<sup>2</sup>/ha for 1997–1999
- 8.4 m<sup>2</sup>/ha for 1999–2000
- 8.4 m<sup>2</sup>/ha for 2000–2001
- 8.4 m<sup>2</sup>/ha for 2001–2002
- 7.6 m<sup>2</sup>/ha for 2002–2003.

Examples of basal area values of woody vegetation found throughout Queensland are displayed in Figure 15.

The change mosaics for each SLATS period were intersected with the foliage cover classes from the 1:5 000 000 Carnahan Present Vegetation Map (Carnahan, 1988) to produce Table 8. All vegetation classes where clearing occurred have been included in this table. In the previous National and State greenhouse gas inventories, clearing was grouped into three vegetation types that are combinations of the Carnahan classification. The three groups are tropical and temperate closed forests (T4, M4, L4, T3), dense woodlands and open forests (M3, L3), and open woodlands (M2, L2). In Queensland, the only additional classes with extensive clearing were added to the open woodland class. The Carnahan classes when mapped are geographically large and represent the dominant vegetation formation but may include significant areas of other vegetation types. Apparent anomalies, such as no clearing in T4 (trees > 30 m height and 70% foliage cover) in Queensland, are due to this problem.

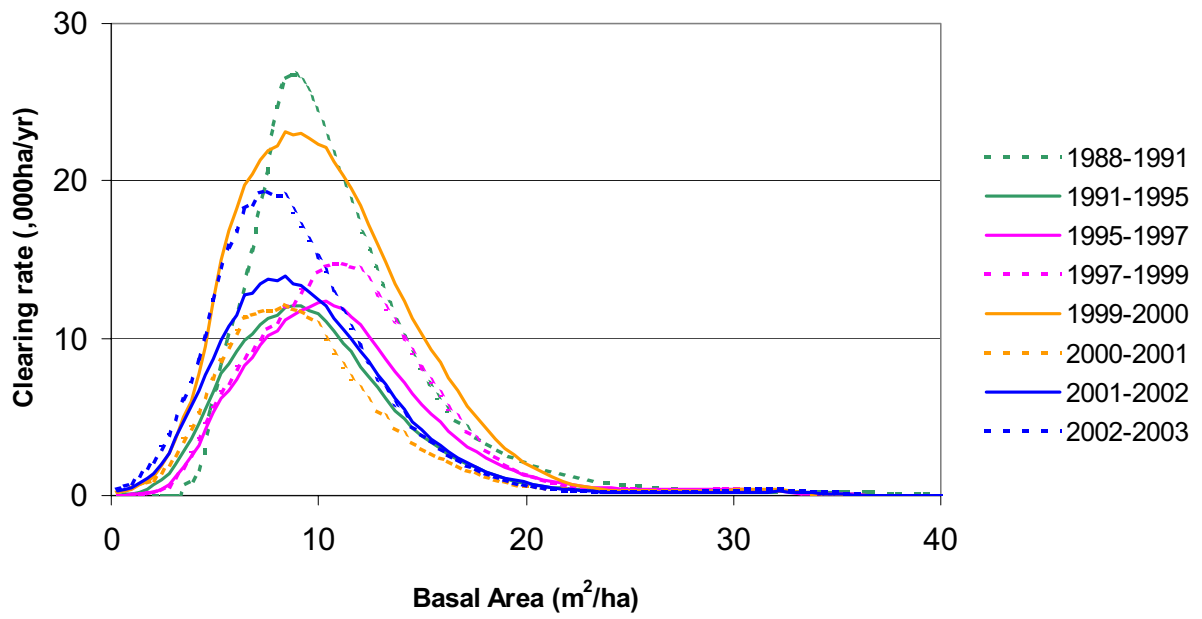


Figure 14: Frequency distributions of woody vegetation clearing using 1991 basal area mapping (1988–2003).



**A. Basal area of approximately 2 m<sup>2</sup>/ha**



**B. Basal area of approximately 4 m<sup>2</sup>/ha**



**C. Basal area of approximately 11 m<sup>2</sup>/ha**



**D. Basal area of approximately 17 m<sup>2</sup>/ha**



**E. Basal area of approximately 23 m<sup>2</sup>/ha**



**F. Basal area of approximately 29 m<sup>2</sup>/ha**

**Figure 15: Examples of various basal areas (m<sup>2</sup>/ha) of woody vegetation.**

**Table 8: Woody vegetation change by Carnahan Present Vegetation Map class (1988–2003).**

Carnahan vegetation class	Description	Clearing 1988–1991		Clearing 1991–1995		Clearing 1995–1997	
		rate (,000ha/yr)	% of State clearing total	rate (,000ha/yr)	% of State clearing total	rate (,000ha/yr)	% of State clearing total
F3	Other herbaceous plants 30–70% foliage cover	0.00	0.00	0.04	0.01	0.05	0.01
F4	Other herbaceous plants >70% foliage cover	3.41	0.47	1.39	0.48	3.79	1.11
G2	Tussocky or tufted grasses 10–30% foliage cover	18.11	2.49	4.09	1.42	7.67	2.24
G3	Tussocky or tufted grasses 30–70% foliage cover	102.20	14.06	33.36	11.58	44.51	13.02
G4	Tussocky or tufted grasses >70% foliage cover	2.60	0.36	2.02	0.70	2.08	0.61
H2	Hummock grasses 10–30% foliage cover	0.00	0.00	0.00	0.00	0.00	0.00
L1	Low trees (<10m) <10% foliage cover	69.23	9.52	33.93	11.77	19.28	5.64
L2	Low trees (<10m) 10–30% foliage cover	50.64	6.96	33.92	11.77	25.57	7.48
L3	Low trees (<10m) 30–70% foliage cover	3.36	0.46	0.92	0.32	1.00	0.29
L4	Low trees (<10m) >70% foliage cover	0.02	0.00	0.03	0.01	0.02	0.01
M1	Medium trees (10–30m) <10% foliage cover	199.96	27.50	68.42	23.74	102.86	30.09
M2	Medium trees (10–30m) 10–30% foliage cover	228.83	31.47	82.86	28.75	109.22	31.95
M3	Medium trees (10–30m) 30–70% foliage cover	44.70	6.15	25.02	8.68	23.38	6.84
M4	Medium trees (10–30m) >70% foliage cover	0.96	0.13	0.79	0.27	0.69	0.20
S1	Tall shrubs (>2m) <10% foliage cover	1.46	0.20	0.84	0.29	1.29	0.38
S2	Tall shrubs(>2m) 10–30% foliage cover	0.48	0.07	0.48	0.17	0.28	0.08
T3	Tall trees (>30m) 30–70% foliage cover	0.00	0.00	0.00	0.00	0.00	0.00
Z1	Low shrubs (<2m) <10% foliage cover	1.16	0.16	0.07	0.02	0.03	0.01
Z3	Low shrubs (<2m) 30–70% foliage cover	0.04	0.01	0.00	0.00	0.00	0.00
Total		727.16	100.00	288.18	100.00	341.72	100.00