

Woody Vegetation Change by Vegetation Maturity

Recent SLATS reports have reported clearing in relation to remnant vegetation. The area of remnant vegetation cleared in the 1988-1991 period cannot be calculated since the earliest version of remnant mapping available is 1995.

However, a visual analysis done by SLATS scientists using satellite imagery indicates that approximately 34 percent of the total area cleared during the 1988-1991 period was young or immature vegetation. The balance of clearing area (66 percent) was clearing of mature growth. These proportions are similar to the non-remnant clearing proportions for the periods between 1995 and 2000, which ranged between 32 and 33 percent.

Woody Vegetation Change by Land Tenure and Land Use

The 1988-1991 woody vegetation change rates have been grouped by land cover and tenure in Table 2. Figure 6 is a map of the four broad tenure classes used in Table 2. Leasehold tenure is the dominant tenure by area in Queensland. Table 3 shows the clearing rate by tenure for the 1988-1991, 1991-1995, 1995-1997, 1997-1999 and 1999-2001 periods. Figure 7 shows the trend in clearing by tenure type over all SLATS measurement periods. The information in these tables was derived by combining the woody vegetation change data with the State's Digital Cadastral Data Base and Tenures Administration System data. The area of predominantly freehold tenure is also shown previously in Figure 2 using hatching.

Table 2: 1988-1991 woody vegetation change by tenure type and land cover (See compilation notes on page 10)

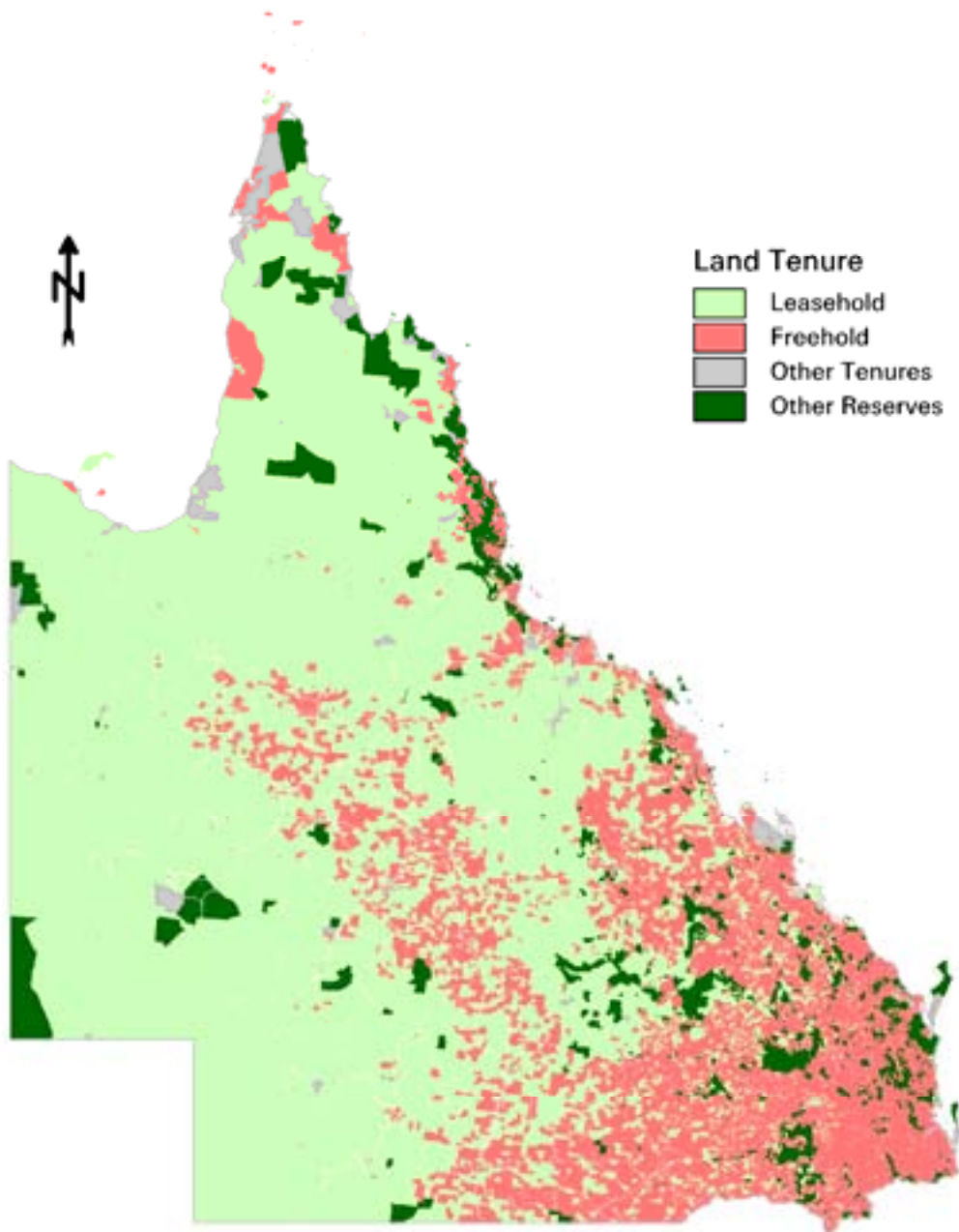
Tenure		Rate of woody vegetation change (,000ha/year)								1988 Wooded Vegetation Cover	% of total cl in Qld
Type	Land Area (,000ha)	New Woody Regrowth	Clearing by Replacement Landcover						Total Cleared		
			Pasture	Crop	Forest	Mining	Infrastructure	Settlement			
Freehold	39205	7.044	278.456	46.865	0.243	0.341	4.580	2.719	333.204	17253.587	45.7
Leasehold	119452	5.390	363.904	8.691	0.220	1.493	9.665	0.306	384.279	58820.842	52.7
Other Tenures ²	1888	0.020	3.700	0.156	0.012	0.584	1.276	0.017	5.746	1177.523	0.8
Other Reserves ³	10869	1.169	0.828	0.022	5.097	0.001	0.488	0.004	6.440	8499.451	0.9
State Totals	171414	13.623	646.888	55.735	5.572	2.419	16.009	3.045	729.668	85751.403	100.0

The replacement landcover following clearing for the periods 1988-1991, 1991-1995, 1995-1997 1997-99 and 1999-2001 is summarised in Table 4. It shows that the majority of clearing is for conversion to pasture for grazing with conversion to crop the second largest in area. The trend in clearing rate by replacement land cover class for all SLATS measurement periods is shown in Figure 8.

² Includes Commonwealth lands, mining, railways, ports, action pending etc.

³ Includes State forest, timber reserves and national parks

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Figure 6: Land tenures in Queensland (1997)

Table 3: 1988-2001 Woody vegetation change by land tenure (See compilation notes on page 10)

Tenure	Clearing rate 1988-1991		Clearing rate 1991-1995		Clearing rate 1995-1997		Clearing rate 1997-1999		Clearing rate 1999-2000		Clearing rate 2000-2001	
	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total
Freehold	333.25	45.67	127.72	44.07	197.97	58.04	254.39	59.81	497.29	65.62	169.95	44.70
Leasehold	384.22	52.66	155.72	53.73	134.03	39.53	161.40	37.95	254.00	33.52	202.65	53.31
Other Tenures	5.74	0.79	1.57	0.54	3.10	0.91	3.06	0.72	0.78	0.10	0.74	0.20
Other Reserves	6.46	0.88	4.83	1.67	5.18	1.52	6.50	1.53	5.71	0.75	6.82	1.79
Total	729.66	100.00	289.84	100.00	340.28	100.00	425.35	100.00	757.79	100.0	380.16	100.00

Table 4: 1988-2001 Woody vegetation change by replacement land cover (See compilation notes on page 10)

Replacement cover	Clearing rate 1988-1991		Clearing rate 1991-1995		Clearing rate 1995-1997		Clearing Rate 1997-1999		Clearing Rate 1999-2000		Clearing Rate 2000-2001	
	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total	Rate (,000ha/year)	% of State clearing total
Pasture	649.12	88.96	266.12	91.81	292.74	86.03	363.75	85.52	716.40	94.54	355.31	93.46
Crop	55.79	7.65	12.59	4.34	29.40	8.64	40.77	9.58	19.98	2.64	4.36	1.15
Forest	3.27	0.45	4.78	1.65	4.70	1.38	7.37	1.73	6.50	0.86	8.24	2.17
Mining	2.43	0.33	1.56	0.54	2.68	0.79	2.08	0.49	1.44	0.19	1.93	0.51
Infrastructure	16.01	2.19	2.45	0.85	8.25	2.42	9.90	2.33	11.49	1.52	8.84	2.33
Settlement	3.05	0.42	2.34	0.81	2.51	0.74	1.48	0.35	1.98	0.26	1.48	0.39
Total	729.66	100.00	289.84	100.00	340.28	100.00	425.35	100.00	757.79	100.00	380.16	100.00

Clearing Rate by Tenure Type

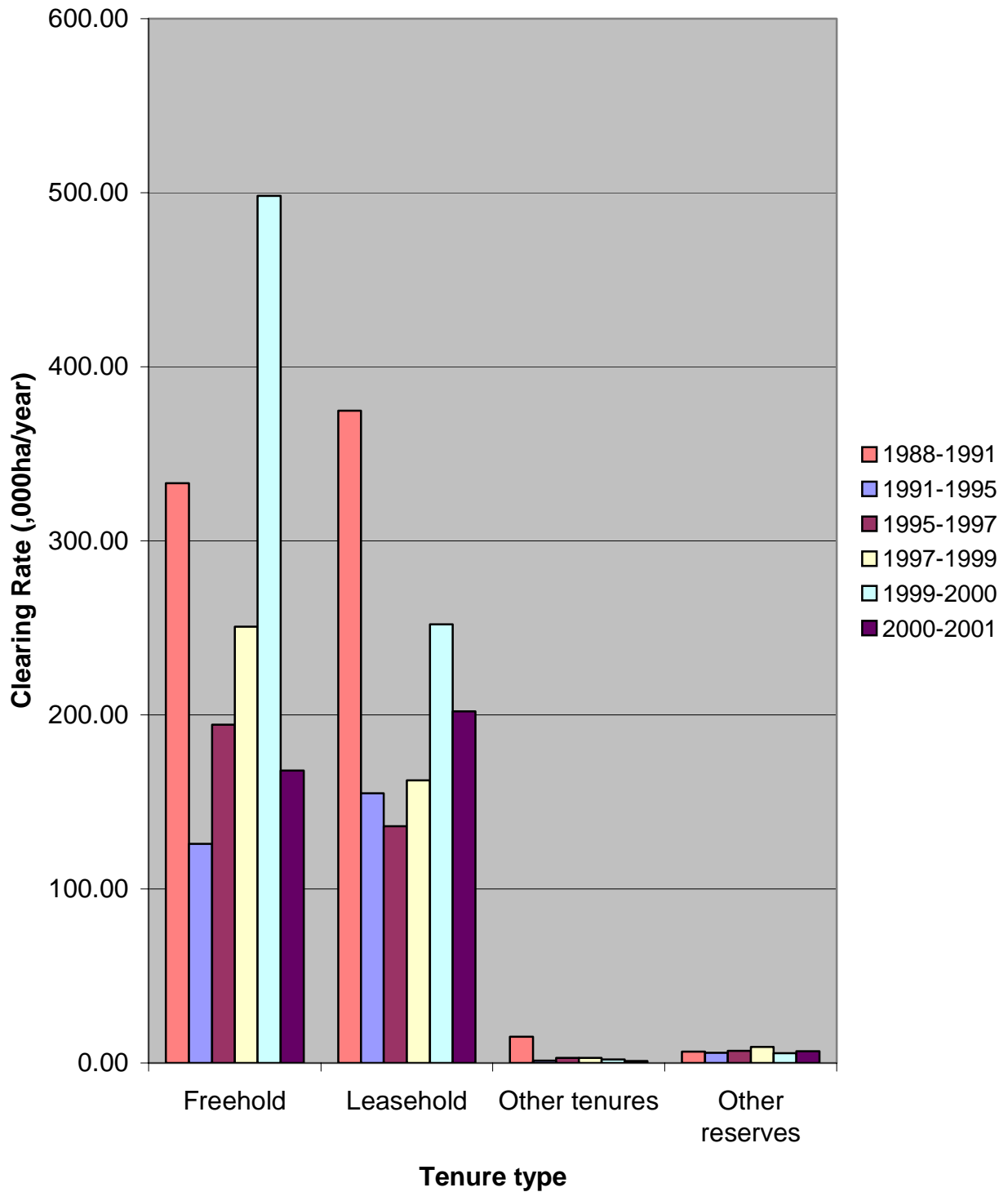


Figure 7: Trend in clearing rate by tenure type (1988-2001)

Clearing Rate by Replacement Cover

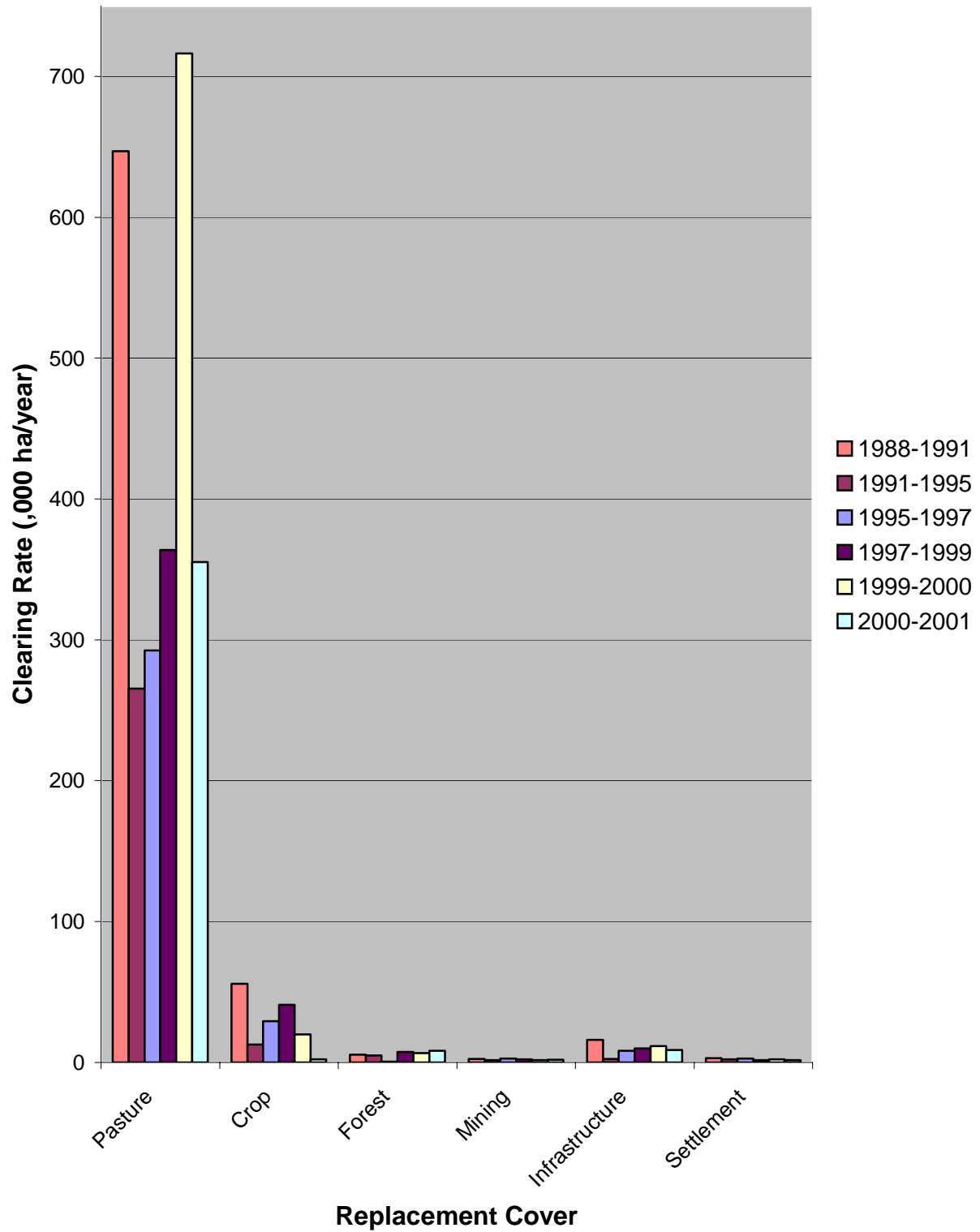


Figure 8: Trend in clearing rate by replacement land cover (1988-2001)

Woody Vegetation Change by Foliage Cover and Basal Area

The woody vegetation change data for all SLATS measurement periods were cross-tabulated with mapping of woody vegetation cover (overstorey and shrub FPC) generated from the Landsat TM imagery. For the 1988-1991 period, the woody FPC mapping used was based on mapping developed using the Multiple Regression Vegetation Index (MRVI) described by Goulevitch *et al.* 2002. 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 both 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.

Figure 9 shows the frequency distribution of clearing in relation to woody vegetation cover. The highest frequency of clearing occurs at a FPC value of 24 percent for 1988-1991, at 24 percent for 1991-1995, at 28 percent for 1995-1997, at 29 percent for the 1997-1999 and at 23 percent for the 1999-2001 period.

There are areas of young regrowth which were cleared in the 1995-2001 period but not mapped as woody vegetation in the 1991 vegetation cover mapping. These areas could not be represented in the histogram as their FPC value was unknown. These rates of re-clearing are shown in Table 5. They show an increasing trend from 1995 to 2001. This is expected as when vegetation matures it has greater impact on pasture production than young regrowth, so there is a greater need to clear. 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 vegetation greater than 12 percent foliage cover and more affected by seasonal conditions. Table 5 also shows rates for the clearing of vegetation considered to be greater than or equal to 12 percent foliage cover.

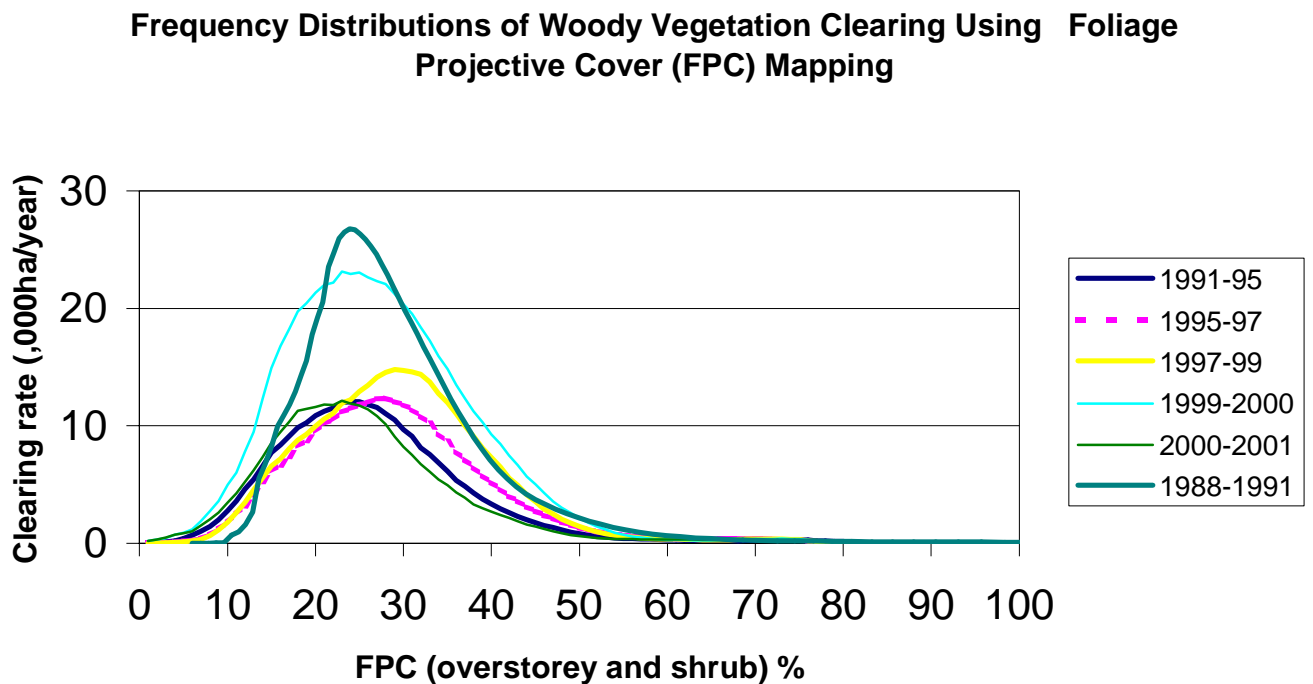


Figure 9: Clearing by woody vegetation cover (FPC) (1988-2001)

The SLATS woody vegetation cover data were divided into the four foliage cover classes used by Carnahan (1988) and intersected with the 1988-1991 clearing rate data. These clearing rates by woody vegetation cover data are given in Table 6.

Table 5: 1988-2001 woody vegetation change (,000 ha/year) using a 12 percent FPC definition
(See compilation notes on page 10)

Foliage Projective Cover (FPC)	1988-91	1991-95	1995-97	1997-99	1999-2000	2000-2001
Not mapped as woody in 1991	n/a	0.0	34.5	64.1	166.4	99.0
FPC <12% and mapped as woody in 1988/1991	3.9	13.0	6.5	6.9	23.0	17.6
FPC >12%	726.8	276.0	299.0	354.0	568.3	261.4
Total	730.7	289.0	340.0	425.0	757.7	378.0

Table 2: 1988-1991 woody vegetation change (,000 ha/year) by FPC (See compilation notes on page 10)

Woody vegetation cover % (overstorey and shrub FPC)	1988-1991 Clearing rate (,000ha/year)	% of State clearing total
<10	2.3	0.3
10-29	505.1	69.1
30-69	220.9	30.2
70-100	2.5	0.4
Total	730.8	100.0

A tree basal area layer was derived from the woody vegetation cover (FPC) layer using relationships between FPC and basal area based on site measurements. This relationship only holds for mature vegetation. Hence, areas which were known to be young regrowth vegetation because they had been previously cleared were not included. The tree basal area layer will continue to be improved using historical Landsat TM and Multi-Spectral Scanner (MSS) analyses (possibly as far back as the 1970s) to identify previously cleared vegetation. Kuhnell *et al.* (1998) describe the development of the basal area data. Figure 10 shows the frequency distribution of clearing rate in relation to basal area. The highest frequency of clearing occurs at the values of 9 m²/ha for the 1988-91 change, 9 m²/ha for the 1991-95 change, 10 m²/ha for the 1995-97 change, 11 m²/ha for the 1997-99 change and 8.4 m²/ha for the 1999-2001 change. The photos in Figure 11 show examples of woody vegetation for the range of basal area values of cleared vegetation.

Frequency Distributions of Woody Vegetation Clearing by Basal Area

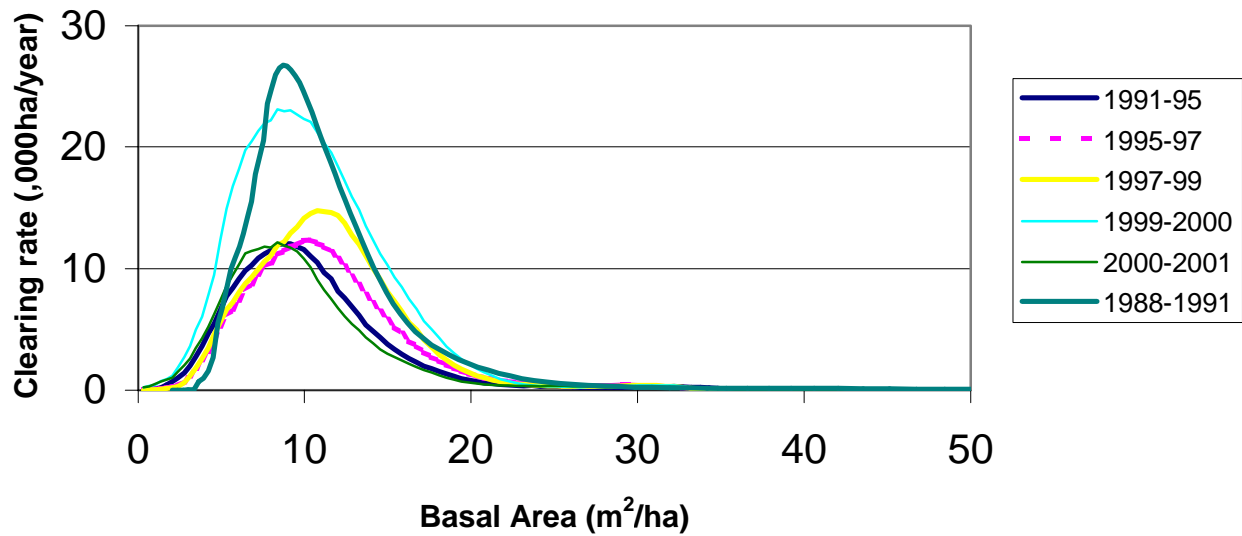


Figure 10: Clearing by tree basal area (1988-2001)

The 1988-91, 1991-95, 1995-97, 1997-99 and 1999-2001 vegetation change mosaics were intersected with the foliage cover classes from the 1:5,000,000 Carnahan Present Vegetation Map (Carnahan, 1988) to produce Table 7. All vegetation classes which included some clearing have been included in this table. In the previous National and State greenhouse gas inventories, clearing was grouped into three vegetation types which 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 woodland (M2,L2). In Queensland, the only additional classes which have significant 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 > 30m height and 70 percent foliage cover) in Queensland, are due to this reason.