DEPARTMENT OF CONSERVATION
AND LAND MANAGEMENT

SILVICULTURE SPECIFICATION 2/90

KARRI THINNING

PREAMBLE

Substantial areas of even aged karri regrowth are becoming due for first thinning. This specification is particularly directed at those above-average quality stands that were regenerated after 1965, but it is also applicable to older stands up to 55m in top height. Although few stands are ready for second thinning at the present time the specification also indicates thinning intensities that are appropriate to second and subsequent thinnings. Above-average quality stands are defined as those that have reached a top height of 26m by age 20 years. This specification will be amended to incorporate lower quality stands as further data becomes available.

SILVICULTURAL OBJECTIVE

1. Maintain stands unthinned until the maximum possible bole length to a 3.5 cm branch diameter has been achieved.

2. Thin to intensities that will maintain volume increment per hectare consistent with maximising value increment.

3. Provide an economic thinning yield.

4. Rethin at intervals that will maintain stand volume increment and provide economic thinning yields.

5. Maintain species and visual diversity.

6. Maintain wildlife habitat.

STRATEGY

1. Delay first thinning until stands have acquired a Top Height of 30 metres. This will allow for the maximum possible 18m clean bole to develop. Thinning may occur sooner where the branch size on all crop trees has already exceeded 3.5 cm.

2. Thin to the minimum density which will maintain stand basal area increment. This is reflected in the schedule given in Table 1. The preferred method of control for first thinnings up to 35m Top Height is by stem numbers. For taller stands and for all second thinnings, basal area is the preferred method of control.

3. Thin more conservatively in a second thinning in order to maintain stand basal area increment.

4. Rethin before the stand has reached the maximum basal area appropriate to its Top Height but after it is possible to obtain an economic thinning.

5. Thin to favour the long term production of high value products.

6. Maintain the productive potential of the site by minimising soil damage and delaying prescribed burning for three years after thinning to give sufficient time for the breakdown of leaves in the thinning tops.

THINNING OPERATION

Selection of areas

Areas of even aged regrowth will be surveyed by Inventory Branch at about age fifteen. Top Height class maps will be produced from which stands taller than 30m Top Height and of sufficient stocking will be selected for thinning. The date when shorter stands will reach 30m will also be predicted and programmed for future operations.Field inspection will be required for confirmation and for the preparation of detailed logging plans.

Treemarking

In unburnt stands due for first thinnings, high scrub density makes initial marking by a treemarker impractical.The initial selection will therefore be made by the harvesting machine operator, retaining 25% more stocking than specified in Table 1. Marking to the final density will be carried out by the treemarker. Table 1 provides a guide to expected thinning intensity. Intensity is based on the retention of a density equivalent to dominants and codominants.

Crop trees should have the following characteristics:

- Vigorous trees in the dominant and codominant class
- Trees with small branches
- Trees free of gum exudation

Preference for retention :

- Select with regard to spacing
- Where a choice exists retain a smaller codominant tree in preference to a larger limby 'wolf' tree if the codominant has at least a 10m bole to 3.5 cm branch diameter and is greater than two thirds of the diameter of the 'wolf' tree.
- Where a 'wolf' tree has less than a 5m bole to a 3.5cm branch then retain any alternative codominant tree with a bole length greater than 10m regardless of relative size.
- Retain all trees where the density does not meet the minimum specification.
- Trees adjacent to large logs may be retained provided that the retention of other trees is such that they may be removed at the next thinning.

TABLE 1. THINNING INTENSITY FOR HIGH QUALITY KARRI REGROWTH STANDS

	Retained Crop Tree Density			
	After 1st Thinning			After 2nd Thinning
Top Height**	m^2/ha	Stems/ha	Spacing guide for machines	m^2/ha
30m	14	300*	5m	N/A
35m	17	240*	6m	20
40m	18*	180	-	22
45m	20*	140	-	24
50m	21*	110	-	26
5 5m	22*	90	-	27

* Preferred method of density control.
** For this purpose Top Height is defined as the mean of the height of the two tallest crop trees within a radius of 16m.

Maintenance of Diversity.

Retain all groups and where practicable,individuals of Allocasuarina. In mixed stands, retain marri to ensure that a mixture is maintained. Retain wildlife habitat trees. Up to 10% of the retained trees may be 'non-crop' tree-marri in addition to other species which provide visual diversity or habitat.

Maintenance of Thinning Intensity Standards.

Regular stand sampling is essential to maintain standards and provide feedback for the refinement of silvicultural specifications. The importance of maintaining thinning intensity standards should not be underestimated. At full production, one day's thinning results in a density which is 20% below specification will cost $2000 in lost growth which cannot be recovered. It is preferable to retain a crop tree of minimum standard (5m of potential sawlog) than to thin below specification.
The sampling procedure to be followed is given in Appendix 1.

Protection of crop trees

Damage to crop trees must be kept to a minimum during the logging operation. Limits of acceptability and the assessment method are given in the Manual of Hardwood Logging Specifications. Tops and debris from the current operation which are larger than 75mm must be moved more than 1m from the base of all crop trees.

Protection of Soil

Frequent and repeated logging operations present a risk of accumulated soil damage.It is therefore imperative that the impact of each operation be kept to a minimum.All relevant techniques should be applied. i.e.maximising summer logging, careful selection of sites, the use of tops and scrub to reduce ground pressures and the selection and repeated use of major snig tracks. The limits and assessment method is given in the Manual of Hardwood Logging Specifications.

Except in areas of strategic importance, tops should not be burnt for at least three years after thinning, in order to allow time for the leaching of nutrients from the leaf component of the tops.

SUBSEQUENT THINNINGS

Figure 1 gives the proposed density limits of first and subsequent thinnings at different Top Heights. It is based on the presumption of more conservative second and subsequent thinnings to maintain maximum basal area increment and maximum sawlog increment.

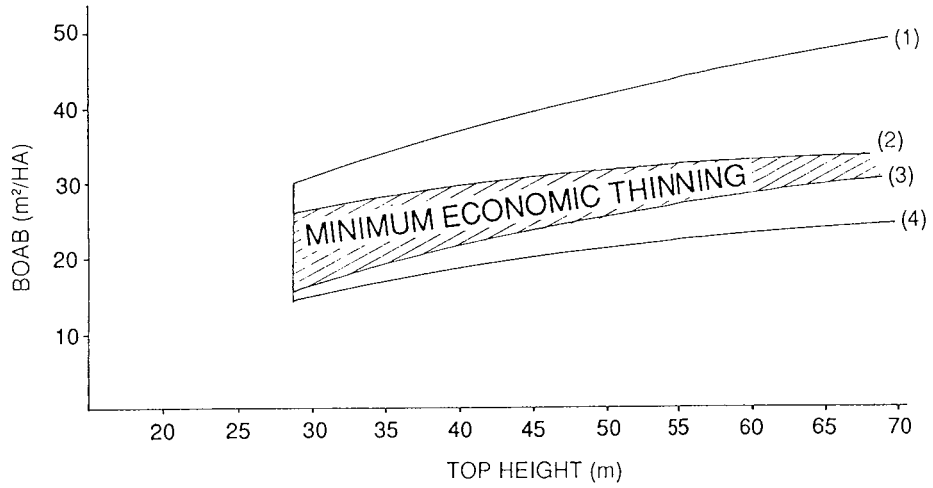

Figure 1. **THINNING LIMITS FOR ABOVE-AVERAGE QUALITY KARRI REGROWTH**

(1) = MAXIMUM STAND DENSITY
(2) = MINIMUM DENSITY BEFORE THINNING
(3) = RETAINED DENSITY AFTER 2ND TNINNING
(4) = RETAINED DENSITY AFTER 1ST THINNING

Following first thinning to the appropriate density (4), the stand is allowed to grow on until its density exceeds that required for an economic thinning (2) but before it reaches maximum density (1). It is then rethinned to the more conservative second thinning limit (3) and the process repeated.The minimum time between thinnings on this basis is about 15 years in high quality stands.

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APPENDIX 1

PROCEDURE FOR MONITORING THE APPLICATION OF THINNING SPECIFICATIONS.

1. Frequency of sampling- at the completion of each two hectares of thinning.

2. Number of samples- five sample points per two hectares.

3. Selection of sample points-on each two hectares, select :-

3.1 One point representative of the densest patch of forest.

3.2 One point representative of the least dense patch (not on a landing or road but it may in clude a snig track).

3.3 Three points near the middle of the two hectare thinned area. Select the first point at random, the second at 50m from the first and the third at 50m from the second to form more or less an equilateral triangle.

4.Measurements to be taken at each sample point.

4.1 Measure the height of the two tallest crop trees within 16m of the point and calculate the mean. For stands over 40m Top Height it is only necessary to make one set of Top Height measurements for the five plot sample unless a height difference is evident.

4.2 Take a basal area sweep of crop trees using a two factor prism. Where a veteran tree exists, take a 'half' sweep away from the veteran and double the result.

4.3 Select three trees which form the most compact triangle around the point and pace the distance between each crop tree (do not include whips in the selection). Determine density using Table 2. Omit this sample of stocking where the sample point is influenced by veteran trees.

5.Recording of Results.

Record the results on the Post Thinning Stand Density Report form. Record with a '+' those plots within which no thinning has occurred because of low initial stocking. Plot each point for which thinning was done (i.e. omit '+') on the Thinning Standards Report Form. Use these results to adjust future thinning intensity according to the preferred method of control (Table 1) Note that the correct application on the basis of say stems will not always appear to be correct for basal area due to the variation created by past stocking levels. Use the same form and graphs to accumulate all data for the same compartment.

6.Reporting of Results.

Forward a copy of Thinning Standards Report to the Regional Operations Officer at the end of each month. Forward a copy of both reports to the Inventory Office at the completion of each compartment or at the end of each year for final analysis of results and inclusion in HOCS records.

POST THINNING STAND DENSITY REPORT

Block__________________ Cmpt________ 1st/2nd Thinning

Date of Meast.	Sample Point	Top Ht. (m)	BOAB m^2/HA	Density spha	Not Thinned '+'	Treemarker
	D					
	LD					
	1					
	2					
	3					
	D					
	LD					
	1					
	2					
	3					
	D					
	LD					
	1					
	2					
	3					
	D					
	LD					
	1					
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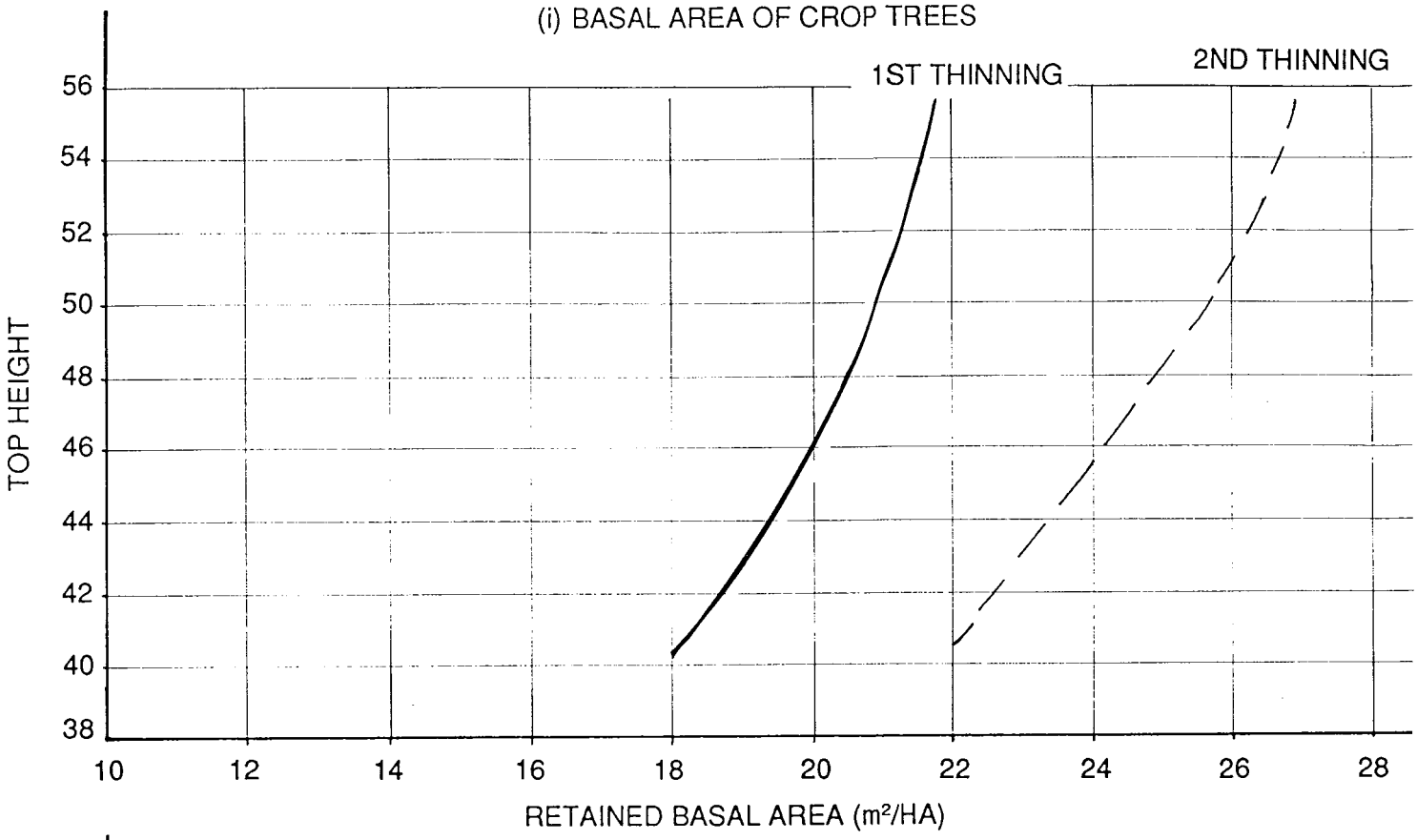
	3					
	D					
	LD					
	1					
	2					
	3					
	D					
	LD					
	1					
	2					
	3					

D = densest patch
LD = least dense patch
1,2,3 = other sample points

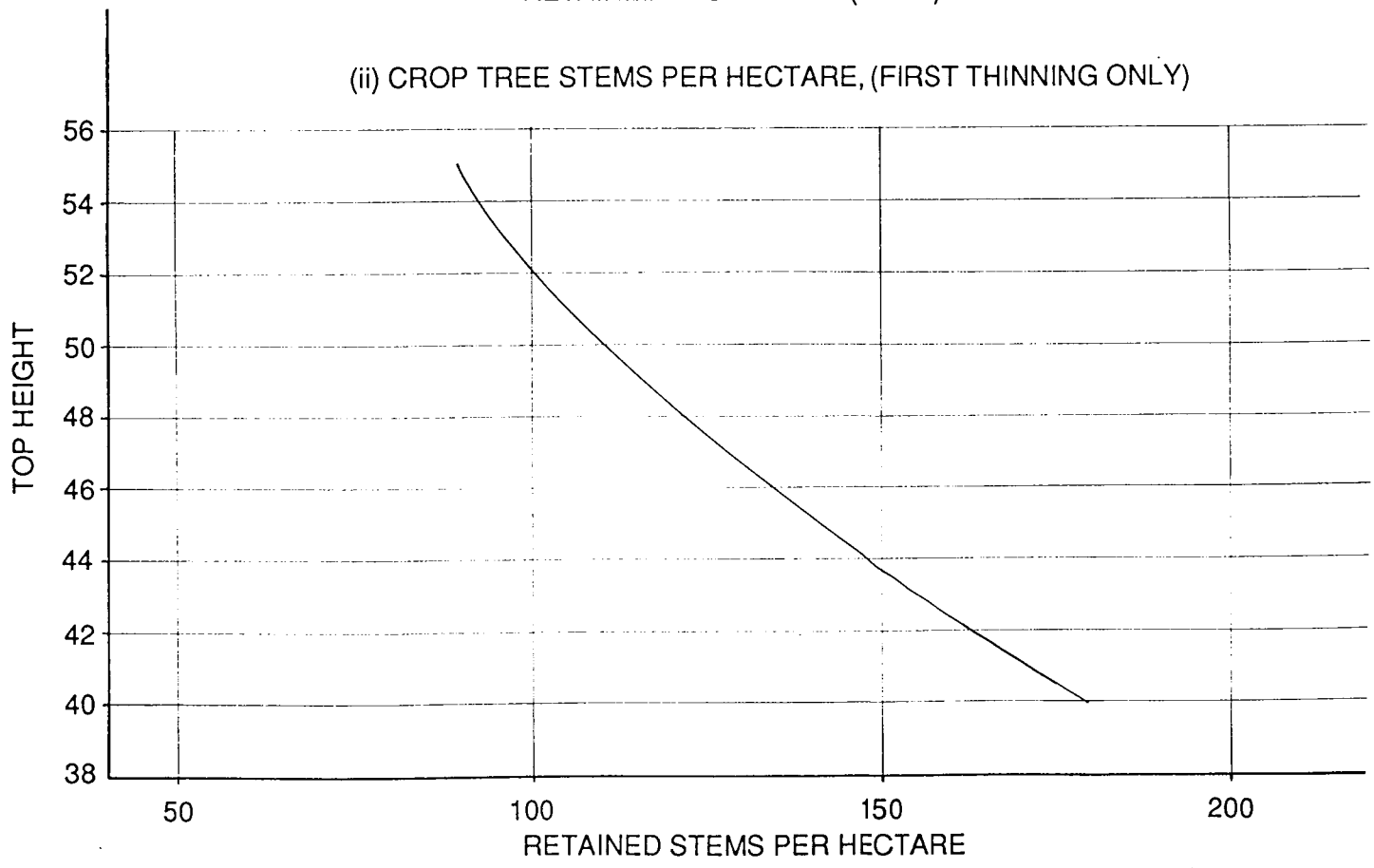
THINNING STANDARDS REPORT

FOR STANDS 38-55M TOP HEIGHT

(i) BASAL AREA OF CROP TREES

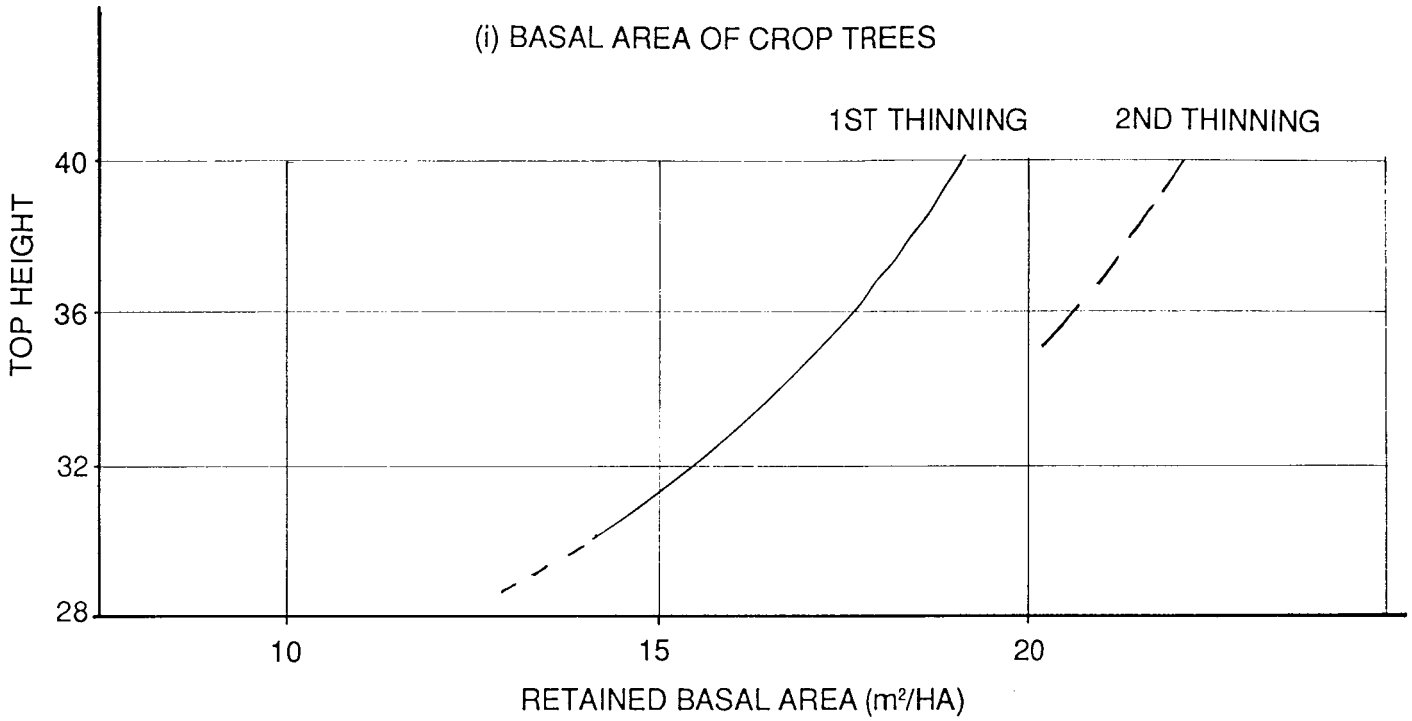


(ii) CROP TREE STEMS PER HECTARE, (FIRST THINNING ONLY)

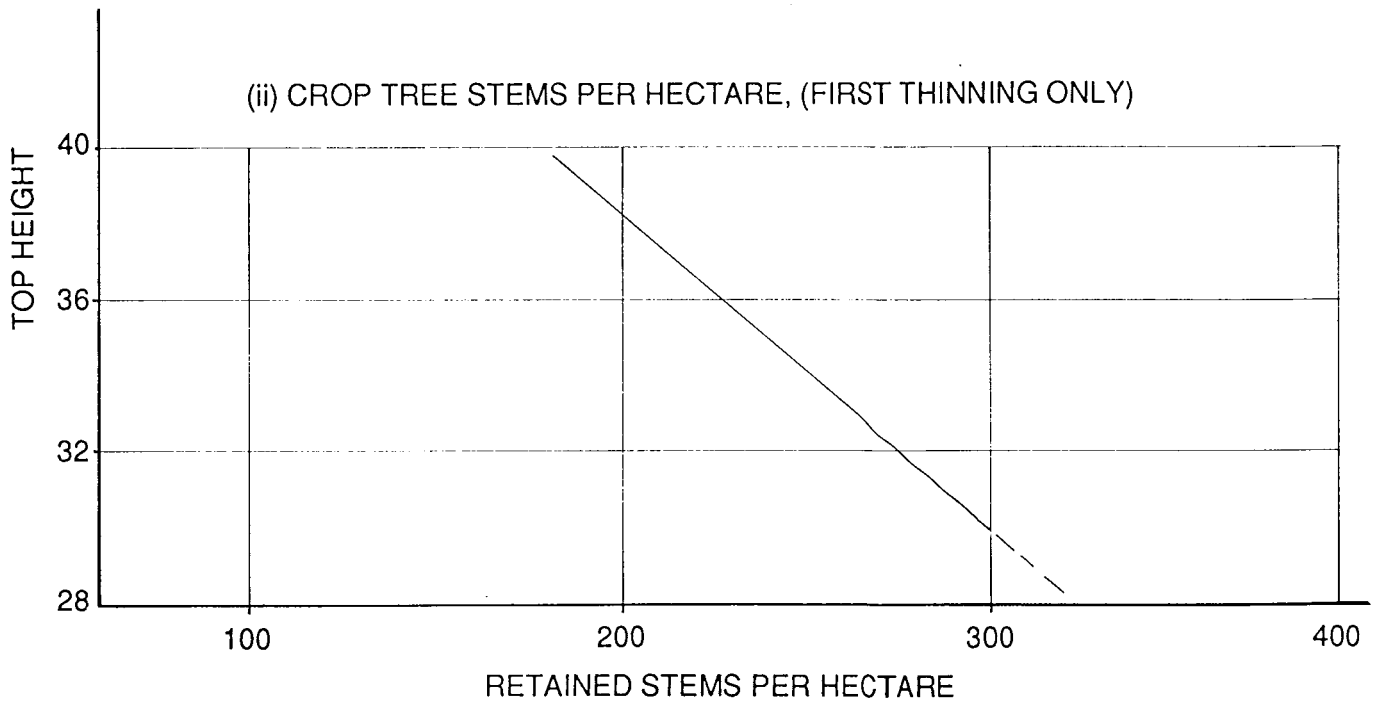


FOR STANDS UP TO 40 METRES TOP HEIGHT

(i) BASAL AREA OF CROP TREES

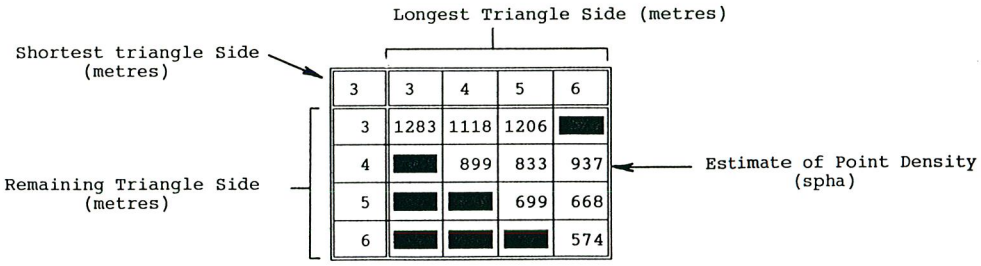


(ii) CROP TREE STEMS PER HECTARE, (FIRST THINNING ONLY)



ESTIMATION OF POINT DENSITY USING TRIANGLES
KARRI THINNINGS

Example: 3 metres x 4 metres x 6 metres = Density of 937 spha.



3	3	4	5	6
3	1283	1118	1206	
4		899	833	937
5			699	668
6				574

4	4	5	6	7	8
4	722	641	630	738	
5		546	504	510	611
6			442	417	430
7				373	357
8					323

5	5	6	7	8	9	10
5	462	417	400	417	510	
6		367	340	334	354	439
7			306	289	287	308
8				263	251	252
9					231	223
10						207

6	6	7	8	9	10	11	12
6	321	293	280	280	302	379	
7		264	246	238	242	264	334
8			225	213	208	214	234
9				196	188	185	191
10					175	168	167
11						157	152
12							143

7	7	8	9	10	11	12	13	14
7	236	218	207	204	210	231	296	
8		199	186	180	179	186	206	266
9			172	163	159	160	167	186
10				152	146	143	144	152
11					137	132	130	132
12						124	120	119
13							114	111
14								105

8	8	9	10	11	12	13	14	15	16
8	180	168	160	156	157	165	184	239	
9		155	146	141	139	141	149	167	218
10			136	130	126	125	128	135	153
11				122	117	114	114	117	124
12					110	106	104	105	108
13						101	98	96	97
14							93	90	89
15								86	84
16									81

9	9	10	11	12	13	14	15	16	17	18
9	143	134	128	124	124	126	134	152	199	
10		124	118	114	111	111	115	122	139	183
11			111	106	102	101	102	105	112	128
12				100	96	93	93	94	97	104
13					91	88	86	85	87	90
14						84	81	80	79	81
15							78	75	74	74
16								72	70	70
17									68	66
18										64

10	10	11	12	13	14	15	16	17	18	19	20
10	115	109	104	101	100	101	104	112	127	169	
11		102	97	94	92	91	92	96	103	118	156
12			92	88	85	84	83	85	88	95	110
13				83	80	78	77	77	79	82	89
14					76	74	72	71	72	73	77
15						71	69	67	67	67	69
16							66	64	63	63	63
17								62	60	60	59
18									58	56	56
19										55	53
20											52

11	11	12	13	14	15	16	17	18	19	20
11	95	90	87	84	83	83	84	88	95	109
12		85	81	78	77	76	76	78	81	88
13			77	74	72	70	70	70	72	76
14				71	68	66	65	65	66	67
15					65	63	62	61	61	61
16						61	59	57	57	57
17							57	55	54	53
18								53	52	51
19									50	49
20										47

12	12	13	14	15	16	17	18	19	20
12	80	76	73	71	70	69	70	72	75
13		72	69	67	65	64	64	65	67
14			66	63	61	60	60	60	60
15				61	59	57	56	56	56
16					56	54	53	52	52
17						52	51	50	49
18							49	48	47
19								46	45
20									44

13	13	14	15	16	17	18	19	20
13	68	65	63	61	60	59	59	60
14		62	60	58	56	55	55	55
15			57	55	53	52	51	51
16				53	51	50	49	48
17					49	47	46	46
18						46	45	44
19							43	42
20								41

14	14	15	16	17	18	19	20
14	59	56	54	53	52	51	51
15		54	52	50	49	48	48
16			50	48	47	46	45
17				46	45	44	43
18					43	42	41
19						40	39
20							38

15	15	16	17	18	19	20
15	51	49	48	46	45	45
16		47	45	44	43	42
17			44	42	41	40
18				41	40	39
19					38	37
20						36

16	16	17	18	19	20
16	45	43	42	41	40
17		42	40	39	38
18			39	38	37
19				36	35
20					34

17	17	18	19	20
17	40	39	37	36
18		37	36	35
19			35	34
20				32

18	18	19	20
18	36	34	33
19		33	32
20			31

19	19	20
19	32	31
20		30

20	20
20	29