motleyi, *Shorea acuminata*, *Shorea leprosula*, and *Shorea parvifolia*, were compared. Survival rate, height growth, diameter growth, H/D ratio, BPU are shown in Tables S41, S42, S43, S44, and S45, respectively. Comparing the values between EW and NS, larger values were colored in light blue.

Among species planted both in EW and in NS, specific difference of growth of trees was not observed. As the spacing of *Acacia mangium* was differed in EW direction and NS direction, which was 3.7 m and 3.0 m respectively, the widths of planting strip were differed in EW and NS. Thus the precise comparison between EW and NS was difficult. One reason might be that the illuminance under *Acacia mangium* was rather brighter than 5 % of RAI which acts as a limiting factor to the seedling growth. Then the other limiting factor such as soil moisture and genetic origin, etc., might affect the growth of seedling much more than light condition.

5.1.2.5.1.3. Conclusion

The survival rates were generally better in r rrower planting strip width. Optimum openness for height growth or diameter growth was different by species. Most of the species; i.e. *Shorea leprosula*, *Shorea parvifolia*, etc., showed their optimum growth between B type to C type, where the planting strip width was equivalent to 1 - 1.5 times the surrounding tree height, and the RAIs were 30 - 70 %. Some species; i.e. *Hopea pubescens*, did not showed different growth to the different type of strip width. The reason for this phenomenon has not been clarified whether it derives from difference of species character responding to light condition, or it derives from other site factors, such as soil moisture, genetic origin, etc.

The growth difference to the planting direction (East-West, and North-South) was not so obvious. While canopy closures were observed in A- and B-type after 1 - 2 years of opening, declinations of growth in the sites were not observed. This resulted from that RAI in the *Acacia mangium* plantation was rather high even under the non-felling condition, and that RAI gets higher in accordance with the height in the plantation. This may suggest the possibility of the management without felling of *Acacia mangium* overstory.

Ferns and herbs were dominant in A-, B-, C-type, while grasses were dominant in D- and E-type. Grasses especially Ekor kuching, and climber especially *Mikania micrantha* need more time of weeding. In terms of weeding, wider planting strips are not favorable. At the initial stage of planting, height growth is the main evaluation factor in terms of the competition between other vegetation.

The retained rows and the felled rows of overstory were set in same width in this experiment. The microclimate condition in planting strip can be changed with the condition of retained overstory; i.e. height, width of retained row, canopy development, etc. The wider retained row might be preferable in future in terms of smooth operation for overstory felling. Attention should be paid not only on the width of planting strips but also on the width of retained overstory forest.

Dipterocarp species planted under *Acacia mangium* from A- to E-type showed less self pruning, and they still kept thicker branches on the lower part of their stems 3 years after planting. On the contrary, naturally regenerated dipterocarp seedlings under secondary forest showed slender tree shape with self pruning (Photo 49). The change of tree shape is one of the most important

Table S41 Comparison of EW and NS Planting by Survival Rate

Actual Value

Species	Month	Direction	A	B	C	D	E
Dryobalanops aromatica	1	EW	92.7%	86.4%	100.0%	95.6%	56.8%
		NS	59.8%	81.9%	84.8%	52.8%	40.8%
	6	EW	75.0%	47.3%	35.9%	35.3%	32.4%
		NS	45.5%	63.0%	68.8%	40.3%	31.3%
	12	EW	53.2%	24.1%	32.0%	30.9%	23.9%
		NS	37.1%	52.9%	52.7%	28.5%	7.1%
	18	EW	41.9%	19.0%	27.3%	22.1%	15.3%
		NS	33.3%	39.9%	47.3%	17.4%	4.2%
Neobalanocarpus heimii	8	EW	96.6%	46.2%	70.2%	64.1%	59.6%
		NS	78.1%	86.5%	82.5%	69.2%	68.3%
	12	EW	96.6%	41.3%	71.2%	59.2%	55.3%
		NS	79.0%	86.5%	80.7%	64.2%	65.1%
	18	EW	95.7%	42.3%	70.2%	52.4%	42.6%
		NS	76.2%	84.6%	78.9%	60.8%	59.0%
	24	EW	88.9%	38.5%	62.5%	44.7%	23.4%
		NS	74.3%	84.6%	75.4%	51.7%	52.2%
	30	EW	90.6%	33.7%	61.5%	33.0%	13.2%
		NS	67.6%	80.8%	64.0%	34.2%	39.0%
	36	EW	87.2%	no data	59.6%	30.1%	11.9%
		NS	64.8%	79.8%	62.3%	34.2%	42.2%
Pentaspadon motleyi	1	EW	99.1%	89.2%	99.2%	93.4%	38.1%
		NS	38.3%	41.3%	48.2%	42.4%	21.3%
	6	EW	73.0%	74.2%	62.5%	45.6%	20.5%
		NS	21.1%	19.6%	39.3%	31.9%	8.3%
	12	EW	49.5%	67.5%	53.9%	36.0%	9.7%
		NS	3.8%	13.0%	30.4%	14.6%	0.0%
	18	EW	36.9%	60.0%	49.2%	27.9%	6.8%
		NS	6.0%	x	25.0%	7.6%	0.0%
Shorea acuminata	1	EW	98.3%	100.0%	99.1%	91.0%	52.3%
		NS	66.9%	89.9%	83.0%	48.6%	60.8%
	6	EW	91.6%	83.3%	81.3%	38.2%	43.9%
		NS	50.4%	80.4%	75.0%	31.3%	43.8%
	12	EW	72.3%	59.2%	58.9%	34.0%	33.1%
		NS	19.5%	32.6%	68.8%	27.8%	30.8%
	18	EW	72.3%	53.3%	58.9%	31.9%	20.1%
		NS	16.5%	34.1%	51.8%	15.3%	24.2%
Shorea leprosula	8	EW	87.5%	91.2%	75.5%	71.1%	59.2%
		NS	84.5%	99.0%	91.9%	82.7%	57.6%
	12	EW	87.5%	90.2%	74.5%	70.1%	67.5%
		NS	85.4%	99.0%	91.9%	81.8%	52.5%
	18	EW	87.5%	87.3%	71.6%	69.1%	55.8%
		NS	84.5%	94.9%	81.8%	80.9%	35.7%
	24	EW	87.5%	86.3%	69.6%	66.0%	47.2%
		NS	79.6%	81.6%	47.5%	72.7%	25.2%
	30	EW	85.7%	81.4%	67.6%	62.9%	45.1%
		NS	77.7%	76.5%	39.4%	70.9%	20.2%
	36	EW	85.7%	83.3%	67.6%	61.9%	44.2%
		NS	75.7%	75.5%	39.4%	70.0%	19.3%
Shorea parvifolia	8	EW	91.5%	70.3%	74.0%	57.8%	41.7%
		NS	88.2%	85.6%	67.9%	55.2%	59.9%
	12	EW	88.0%	65.3%	75.0%	52.9%	38.3%
		NS	86.0%	84.6%	66.0%	51.2%	54.3%
	18	EW	84.6%	64.4%	71.2%	49.0%	33.8%
		NS	82.8%	82.7%	64.2%	42.4%	50.4%
	24	EW	75.2%	39.6%	64.4%	15.7%	19.6%
		NS	79.6%	74.0%	59.4%	40.0%	37.5%
	30	EW	72.6%	38.6%	63.5%	14.7%	14.2%
		NS	79.6%	66.3%	56.6%	33.6%	26.7%
	36	EW	73.5%	37.6%	63.5%	12.7%	14.6%
		NS	78.5%	66.3%	58.5%	32.8%	26.0%

Table S42 Comparison of EW and NS Planting by Height Growth

Species	Month	Direction	Actual Value A	B	C	D	E
Dryobalanops aromatica	1	EW	0.46	0.32	0.43	0.43	0.47
		NS	0.45	0.52	0.50	0.51	0.46
	6	EW	0.68	0.41	0.59	0.58	0.56
		NS	0.54	0.59	0.57	0.60	0.61
	12	EW	0.99	0.68	1.02	0.84	0.80
		NS	0.80	0.83	0.96	0.78	0.75
	18	EW	1.56	0.99	1.60	1.67	1.02
		NS	1.37	1.38	1.63	1.26	1.21
Neobalanocarpus heimii	8	EW	0.52	0.47	0.50	0.45	0.48
		NS	0.51	0.52	0.46	0.39	0.48
	12	EW	0.62	0.63	0.59	0.49	0.56
		NS	0.64	0.67	0.65	0.57	0.56
	18	EW	0.84	0.84	0.89	0.55	0.72
		NS	0.82	0.99	0.95	0.78	0.85
	24	EW	0.99	1.01	1.16	0.74	0.96
		NS	1.03	1.23	1.20	0.87	1.14
	30	EW	1.24	1.3.	1.49	0.83	1.50
		NS	1.27	1.54	1.69	1.58	1.61
	36	EW	1.50	no data	1.79	0.94	1.87
		NS	1.53	1.89	1.96	1.76	1.95
Pentaspadon motleyi	1	EW	0.30	0.34	0.39	0.28	0.26
		NS	0.20	0.16	0.36	0.31	0.27
	6	EW	0.44	0.47	0.55	0.44	0.34
		NS	0.25	0.21	0.36	0.39	0.28
	12	EW	0.81	0.96	1.14	0.88	0.62
		NS	0.41	0.53	0.69	0.77	x
	18	EW	1.46	2.07	2.05	1.78	1.43
		NS	0.93	x	1.32	1.48	x
Shorea acuminata	1	EW	0.61	0.62	0.69	0.64	0.62
		NS	0.44	0.42	0.44	0.40	0.39
	6	EW	0.75	0.71	0.76	0.65	0.68
		NS	0.53	0.57	0.53	0.46	0.47
	12	EW	1.23	1.24	1.18	1.14	0.90
		NS	0.63	0.76	0.74	0.71	0.77
	18	EW	1.95	2.17	1.66	1.86	1.55
		NS	0.98	1.29	1.24	1.27	1.27
Shorea leprosula	8	EW	1.04	1.16	1.01	0.84	0.75
		NS	1.03	1.10	0.89	0.93	0.65
	12	EW	1.43	1.68	1.31	1.03	0.92
		NS	1.47	1.55	1.14	1.23	0.76
	18	EW	2.37	3.04	2.33	1.85	1.60
		NS	2.47	2.61	1.30	1.92	1.04
	24	EW	3.26	3.92	3.44	2.54	2.11
		NS	3.13	2.93	1.52	2.59	1.52
	30	EW	4.36	5.48	5.13	3.91	3.19
		NS	4.24	4.26	2.71	4.22	2.70
	36	EW	5.35	6.88	6.53	5.18	4.27
		NS	5.63	5.59	3.51	5.26	3.41
Shorea parvifolia	8	EW	0.87	0.84	0.78	0.79	0.68
		NS	0.82	0.88	0.82	0.66	0.67
	12	EW	1.17	1.19	0.98	0.89	0.86
		NS	1.15	1.21	1.17	0.86	0.84
	18	EW	1.80	1.81	1.51	1.30	1.30
		NS	1.91	2.02	1.79	1.32	1.16
	24	EW	2.41	2.12	2.05	2.03	1.74
		NS	2.41	2.52	2.24	1.78	1.61
	30	EW	3.24	2.89	2.93	2.78	2.72
		NS	3.21	3.60	3.31	2.57	2.49
	36	EW	3.85	4.15	3.94	3.57	3.10
		NS	3.84	4.13	3.97	3.09	2.95

Table S43 Comparison of EW and NS Planting by Diameter Growth

Species	Month	Direction	Actual Value A	B	C	D	E
Dryobalanops aromatica	1	EW	0.43	0.38	0.39	0.41	0.48
		NS	0.40	0.38	0.45	0.46	0.45
	6	EW	0.49	0.45	0.57	0.55	0.66
		NS	0.47	0.45	0.48	0.55	0.54
	12	EW	0.70	0.63	0.79	0.73	0.68
		NS	0.55	0.50	0.68	0.66	0.72
	18	EW	1.03	0.73	1.14	1.23	0.96
		NS	0.89	0.82	1.03	0.91	1.22
Neobalanocarpus heimii	8	EW	0.61	0.52	0.61	0.64	0.66
		NS	0.61	0.64	0.62	0.61	0.65
	12	EW	0.74	0.74	0.75	0.73	0.77
		NS	0.78	0.77	0.81	0.76	0.77
	18	EW	0.90	0.90	0.98	0.85	0.99
		NS	0.95	1.09	1.17	1.14	1.10
	24	EW	1.01	1.01	1.23	0.98	1.22
		NS	1.08	1.27	1.35	1.40	1.36
	30	EW	1.17	1.22	1.63	1.19	1.71
		NS	1.23	1.61	1.85	1.97	1.94
	36	EW	1.37	no data	1.77	1.34	2.03
		NS	1.50	1.88	2.14	2.46	2.39
Pentaspadon motleyi	1	EW	0.36	0.35	0.37	0.30	0.28
		NS	0.13	0.12	0.29	0.30	0.19
	6	EW	0.43	0.46	0.57	0.47	0.38
		NS	0.23	0.19	0.40	0.39	0.25
	12	EW	0.67	0.81	1.01	0.79	0.58
		NS	0.30	0.26	0.56	0.66	x
	18	EW	1.19	1.46	1.71	1.51	1.19
		NS	0.73	x	1.02	1.30	x
Shorea acuminata	1	EW	0.62	0.52	0.54	0.57	0.63
		NS	0.45	0.42	0.47	0.41	0.42
	6	EW	0.71	0.66	0.64	0.71	0.68
		NS	0.60	0.55	0.52	0.54	0.50
	12	EW	1.00	0.99	1.04	1.13	0.91
		NS	0.60	0.61	0.73	0.69	0.70
	18	EW	1.45	1.67	1.52	1.64	1.38
		NS	0.84	0.98	1.12	1.18	1.15
Shorea leprosula	8	EW	0.92	0.94	1.01	0.93	0.87
		NS	0.88	1.00	0.97	0.97	0.78
	12	EW	1.32	1.53	1.54	1.25	1.19
		NS	1.43	1.57	1.44	1.49	1.06
	18	EW	2.18	2.79	2.82	2.29	2.18
		NS	2.31	2.79	2.19	2.62	1.66
	24	EW	2.92	3.80	3.91	3.15	2.85
		NS	3.28	3.77	2.78	3.75	2.33
	30	EW	3.80	5.25	5.54	4.80	4.34
		NS	4.43	4.77	3.65	5.31	3.65
	36	EW	4.80	6.30	6.72	6.50	6.19
		NS	5.56	5.96	4.42	6.85	5.17
Shorea parvifolia	8	EW	0.73	0.67	0.73	0.76	0.68
		NS	0.72	0.79	0.83	0.70	0.64
	12	EW	1.01	0.99	0.87	0.98	0.90
		NS	0.94	1.04	1.14	0.92	0.99
	18	EW	1.68	1.59	1.47	1.39	1.52
		NS	1.56	1.73	2.05	1.49	1.53
	24	EW	2.36	1.94	2.07	2.09	1.97
		NS	2.14	2.38	2.72	1.91	2.09
	30	EW	3.06	2.66	2.79	2.84	3.13
		NS	2.77	3.32	3.53	2.83	3.31
	36	EW	3.70	3.25	3.82	4.12	4.08
		NS	3.44	3.98	4.53	4.10	4.81

Table S44 Comparison of EW and NS Planting by H/D Ratio

Species	Month	Direction	Actual Value A	B	C	D	E
Dryobalanops aromatica	1	EW	109.9	85.8	113.0	105.8	109.1
		NS	114.4	140.1	112.4	113.8	104.5
	6	EW	122.5	92.8	102.9	107.0	98.5
		NS	117.3	134.3	118.5	110.7	112.6
	12	EW	142.3	108.3	128.5	117.9	120.6
		NS	149.9	169.8	141.5	118.3	104.8
	18	EW	156.2	136.6	141.9	140.0	109.8
		NS	154.3	172.2	162.0	140.2	101.5
Neobalanocarpus heimii	8	EW	87.1	88.8	81.4	69.1	73.1
		NS	83.5	82.7	73.4	61.9	75.1
	12	EW	83.2	83.7	77.9	66.1	71.9
		NS	82.8	86.6	79.6	73.2	73.0
	18	EW	91.6	90.7	90.1	62.4	71.3
		NS	87.4	90.3	80.6	66.5	77.4
	24	EW	97.2	98.5	94.0	74.5	77.3
		NS	95.2	97.6	88.5	61.7	85.4
	30	EW	105.0	110.4	94.9	68.0	85.2
		NS	103.4	96.2	91.2	79.1	84.8
	36	EW	108.4	no data	100.4	64.9	92.3
		NS	100.0	102.6	92.2	71.0	82.3
Pentaspadon motleyi	1	EW	83.5	97.1	107.8	93.3	96.5
		NS	160.2	139.5	126.2	107.1	149.3
	6	EW	103.9	102.2	98.7	94.8	89.7
		NS	126.7	123.8	91.3	103.9	122.0
	12	EW	117.9	118.1	115.7	114.0	104.7
		NS	137.2	199.6	126.3	116.8	x
	18	EW	118.1	143.6	121.7	117.7	118.6
		NS	124.8	x	130.6	115.4	x
Shorea acuminata	1	EW	98.9	120.9	128.2	114.1	95.9
		NS	99.7	101.0	95.8	99.2	96.4
	6	EW	106.9	107.7	118.6	91.9	98.5
		NS	89.4	104.2	102.6	85.8	95.8
	12	EW	123.8	124.1	113.7	104.0	97.6
		NS	108.3	125.1	102.3	102.1	108.8
	18	EW	133.0	131.4	107.3	122.1	116.0
		NS	115.8	131.9	113.1	108.0	118.3
Shorea leprosula	8	EW	112.9	126.0	100.7	91.0	91.3
		NS	118.5	111.3	94.3	100.3	86.2
	12	EW	110.2	110.8	88.6	83.6	79.1
		NS	102.8	99.6	80.4	86.2	75.6
	18	EW	110.5	110.4	86.0	81.0	74.4
		NS	108.1	94.8	60.0	76.8	66.9
	24	EW	112.9	104.6	91.4	81.7	77.3
		NS	95.9	77.7	52.4	73.2	71.3
	30	EW	116.9	106.1	96.8	83.4	75.9
		NS	95.5	89.1	72.3	82.4	80.5
	36	EW	113.7	110.7	101.5	81.6	71.5
		NS	101.6	93.5	77.5	79.8	71.7
Shorea parvifolia	8	EW	117.2	126.4	108.1	104.5	99.6
		NS	115.0	112.4	100.7	97.7	109.2
	12	EW	113.9	119.2	111.8	88.2	94.5
		NS	120.4	113.6	103.4	95.4	85.3
	18	EW	106.2	113.1	102.4	88.4	83.4
		NS	122.1	117.2	88.6	88.8	74.5
	24	EW	103.3	108.3	104.2	100.7	89.0
		NS	114.2	105.8	84.5	98.0	77.7
	30	EW	106.3	109.0	109.5	102.0	88.8
		NS	117.9	107.3	97.4	95.5	78.3
	36	EW	107.7	131.9	106.9	91.7	75.7
		NS	113.7	102.0	88.4	76.7	63.9

Table S45 Comparison of EW and NS Planting by BPU

Species	Month	Direction	Actual Value A	B	C	D	E
Dryobalanops aromatica	1	EW	0.09	0.06	0.07	0.08	0.15
		NS	0.05	0.07	0.09	0.06	0.04
	6	EW	0.11	0.05	0.07	0.07	0.18
		NS	0.06	0.08	0.10	0.08	0.06
	12	EW	0.30	0.08	0.25	0.17	0.11
		NS	0.11	0.13	0.30	0.12	0.03
	18	EW	0.87	0.13	0.65	0.72	0.20
		NS	0.46	0.47	1.19	0.27	0.11
Neobalanocarpus heimii	8	EW	0.22	0.09	0.15	0.14	0.16
		NS	0.17	0.23	0.18	0.13	0.17
	12	EW	0.37	0.18	0.29	0.18	0.23
		NS	0.34	0.41	0.46	0.29	0.28
	18	EW	0.76	0.42	0.78	0.29	0.43
		NS	0.64	1.16	1.36	0.87	0.80
	24	EW	1.04	0.55	1.39	0.42	0.53
		NS	1.02	1.91	2.09	1.16	1.45
	30	EW	1.86	0.92	3.09	0.58	0.85
		NS	1.50	3.61	4.54	2.69	2.90
	36	EW	2.89	no data	4.40	1.01	1.27
		NS	2.67	6.34	6.91	4.59	5.98
Pentaspadon motleyi	1	EW	0.04	0.05	0.07	0.03	0.01
		NS	0.00	0.00	0.02	0.02	0.00
	6	EW	0.07	0.10	0.14	0.05	0.01
		NS	0.00	0.00	0.03	0.03	0.00
	12	EW	0.24	0.57	0.86	0.27	0.03
		NS	0.00	0.01	0.08	0.07	0.00
	18	EW	1.13	3.26	4.03	1.54	0.18
		NS	0.04	0.00	0.45	0.25	0.00
Shorea acuminata	1	EW	0.25	0.19	0.23	0.21	0.15
		NS	0.07	0.08	0.09	0.04	0.05
	6	EW	0.37	0.29	0.29	0.14	0.16
		NS	0.11	0.16	0.12	0.05	0.06
	12	EW	0.98	0.90	0.88	0.54	0.33
		NS	0.05	0.11	0.32	0.13	0.15
	18	EW	3.52	3.84	2.90	1.63	0.91
		NS	0.15	0.57	1.03	0.42	0.65
Shorea leprosula	8	EW	0.89	1.08	0.97	0.63	0.46
		NS	0.83	1.22	0.89	0.95	0.33
	12	EW	2.66	4.06	3.14	1.59	1.07
		NS	3.11	4.25	2.72	3.08	0.75
	18	EW	12.41	23.90	18.10	9.32	6.75
		NS	13.97	21.74	7.34	16.67	2.11
	24	EW	30.33	56.44	46.78	24.37	11.09
		NS	34.94	38.99	11.20	41.53	4.05
	30	EW	64.71	140.38	130.16	74.25	35.16
		NS	85.61	92.22	28.68	123.90	12.19
	36	EW	127.26	275.01	242.03	173.47	93.19
		NS	169.33	175.55	54.12	239.64	27.84
Shorea parvifolia	8	EW	0.57	0.33	0.36	0.37	0.17
		NS	0.48	0.59	0.44	0.22	0.22
	12	EW	1.49	1.03	0.76	0.71	0.35
		NS	1.10	1.40	1.23	0.50	0.61
	18	EW	6.23	4.72	3.41	2.31	1.51
		NS	5.42	6.68	6.66	1.89	2.17
	24	EW	13.71	6.11	8.12	2.27	1.73
		NS	11.43	14.42	13.38	4.00	4.04
	30	EW	30.11	13.55	23.21	5.53	4.79
		NS	27.23	34.96	32.40	10.03	9.89
	36	EW	52.62	26.51	54.95	10.51	10.24
		NS	49.00	65.01	69.20	24.77	24.73

Photo S49 Naturally regenerated *Shorea leprosula* in Block-A(1994) with the slender tree shape and self pruning

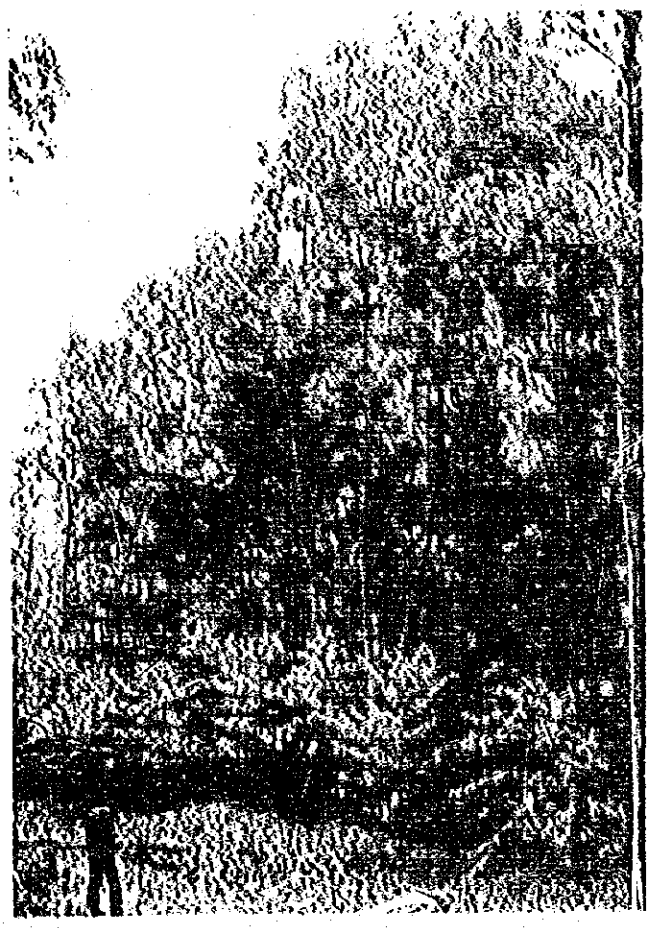


Photo S50 Overstory-felling experiment plot

factors for the growth of trees, so that observation should be kept. If less self pruning is observed for a long time, manual pruning or high density planting should be considered in the future.

Roughly speaking, the survival and growth in underplanting method in *Acacia mangium* plantation is fairly good under the proper opening such as A- to D-type. Next step to be clarified is to evaluate from the economic point of view. And also overstory felling experiment is important. During follow-up period of the project, these topics must be clarified to conclude an optimum management system.

5.1.2.5.2. Underplanting in Belukar

5.1.2.5.2.1. Planting Design (F-H type) and Growth of Trees

Survival rate, height growth, RGR-H, diameter growth, H/D ratio, BPU are shown in Tables S46, S47, S48, S49, S50, and S51, respectively. Relative value was calculated at each measurement time with setting the standard value of F type as 1. *Neobalanocarpus heimii*, *Shorea leprosula*, *Shorea ovalis*, *Shorea ovata*, *Shorea parvifolia*, were planted in 3 types; F-, G-, and H-type. *Dialium* sp., *Gonystylus* sp., *Shorea acuminata*, *Shorea bracteolata*, *Shorea gibbosa*, *Shorea glauca*, *Shorea talura*, *Shorea multiflora*, *Shorea pauciflora*, *Sindora* sp., were planted in 2 types; F- and G-type.

Survival of Trees

Table S46 shows the survival rate in each planting design. *Shorea talura* showed the notable survival; 100 % in F type and 97.3 % in G type at 12 months after planting, while *Shorea ovata* showed the worst survival; 24.5 % in F type, 17.9 % in G type, 21.7 % in H type at 12 months after planting. Comparing with the relative value, the difference among 3 types of planting width were not so obvious in terms of survival rate so far. Further observation is needed.

Height Growth

Table S47 shows the mean height in each planting design. *Shorea leprosula* in F type showed the highest growth of 1.62 m at 12 months after planting. Table S48 shows the RGR-H in each planting design. For the actual value of height, more than 2 of numerical value are colored in light blue.*Shorea talura* in G type showed the highest growth rate of 3.87 at 12 months after planting. Comparing with the relative value, the difference among 3 types of planting width were not so obvious in terms of height growth and growth rate so far. Further observation is needed.

Diameter Growth

Table S49 shows the mean diameter in each planting design. *Shorea leprosula* in F type showed the highest growth of 1.90 cm at 12 months after planting. Comparing with the relative value, the difference among 3 types of planting width were not so obvious in terms of diameter growth and growth rate so far. Further observation is needed.

Table S46 Survival Rate of Each Planting Design in Underplanting in Belukar Plots

Species	Month	Direction	Actual Value Type F	Actual Value Type G	Actual Value Type H	Relative Value Type F	Relative Value Type G	Relative Value Type H
Dialium sp.	1	EW	85.4%	96.4%	x	1.00	1.13	x
	6	EW	85.4%	87.5%	x	1.00	1.02	x
	12	EW	76.0%	79.0%	x	1.00	1.04	x
Gonystylus sp.	1	EW	93.8%	73.7%	x	1.00	0.79	x
	6	EW	85.4%	68.3%	x	1.00	0.80	x
	12	EW	81.3%	59.8%	x	1.00	0.74	x
Neobalanocarpus heimii	1	EW	89.1%	81.7%	82.5%	1.00	0.92	0.93
	6	EW	85.4%	74.1%	80.0%	1.00	0.87	0.94
	12	EW	77.1%	64.3%	70.0%	1.00	0.83	0.91
Shorea acuminata	1	EW	68.8%	55.8%	x	1.00	0.81	x
	6	EW	62.5%	44.6%	x	1.00	0.71	x
	12	EW	44.8%	27.2%	x	1.00	0.61	x
Shorea bracteolata	1	EW	92.7%	95.1%	x	1.00	1.03	x
	6	EW	93.8%	88.8%	x	1.00	0.95	x
	12	EW	90.6%	76.3%	x	1.00	0.84	x
Shorea gibbosa	1	EW	92.7%	79.9%	x	1.00	0.86	x
	6	EW	88.5%	75.0%	x	1.00	0.85	x
	12	EW	76.0%	67.0%	x	1.00	0.88	x
Shorea glauca	1	EW	84.4%	62.5%	x	1.00	0.74	x
	6	EW	82.3%	59.8%	x	1.00	0.73	x
	12	EW	71.9%	55.8%	x	1.00	0.78	x
Shorea talura	1	EW	99.0%	98.7%	x	1.00	1.00	x
	6	EW	99.0%	99.1%	x	1.00	1.00	x
	12	EW	100.0%	97.3%	x	1.00	0.97	x
Shorea leprosula	1	EW	77.6%	84.8%	85.0%	1.00	1.09	1.10
	6	EW	71.9%	70.1%	74.2%	1.00	0.98	1.03
	12	EW	57.8%	60.7%	69.2%	1.00	1.05	1.20
Shorea mulitiflora	1	EW	71.9%	73.7%	x	1.00	1.02	x
	6	EW	68.8%	68.8%	x	1.00	1.00	x
	12	EW	60.4%	59.8%	x	1.00	0.99	x
Shorea ovalis	1	EW	87.5%	90.2%	93.3%	1.00	1.03	1.07
	6	EW	83.3%	83.5%	87.5%	1.00	1.00	1.05
	12	EW	72.9%	76.3%	85.0%	1.00	1.05	1.17
Shorea ovata	1	EW	72.9%	76.3%	88.3%	1.00	1.05	1.21
	6	EW	58.3%	46.0%	55.0%	1.00	0.79	0.94
	12	EW	24.5%	17.9%	21.7%	1.00	0.73	0.89
Shorea parvifolia	1	EW	89.1%	73.7%	71.7%	1.00	0.83	0.80
	6	EW	83.9%	68.3%	60.0%	1.00	0.81	0.72
	12	EW	65.1%	50.9%	38.3%	1.00	0.78	0.59
Shorea pauciflora	1	EW	87.5%	87.1%	83.3%	1.00	0.99	0.95
	6	EW	81.8%	74.6%	63.3%	1.00	0.91	0.77
	12	EW	67.7%	57.6%	53.3%	1.00	0.85	0.79
Sindora sp.	1	EW	91.7%	91.1%	x	1.00	0.99	x
	6	EW	84.4%	79.0%	x	1.00	0.94	x
	12	EW	69.8%	59.4%	x	1.00	0.85	x

Table S47 Height Growth of Each Planting Design in Underplanting in Belukar Plots

Species	Month	Direction	Actual Value Type F	Actual Value Type G	Actual Value Type H	Relative Value Type F	Relative Value Type G	Relative Value Type H
Dialium sp.	1	EW	0.38	0.29	x	1.00	0.75	x
	6	EW	0.44	0.40	x	1.00	0.92	x
	12	EW	0.69	0.75	x	1.00	1.09	x
Gonystylus sp.	1	EW	0.47	0.43	x	1.00	0.92	x
	6	EW	0.60	0.53	x	1.00	0.88	x
	12	EW	0.85	0.79	x	1.00	0.92	x
Neobalanocarpus heimii	1	EW	0.46	0.62	0.61	1.00	1.35	1.34
	6	EW	0.55	0.62	0.63	1.00	1.14	1.16
	12	EW	0.86	0.86	0.85	1.00	0.99	0.99
Shorea acuminata	1	EW	0.48	0.40	x	1.00	0.84	x
	6	EW	0.49	0.46	x	1.00	0.93	x
	12	EW	0.88	0.78	x	1.00	0.89	x
Shorea bracteolata	1	EW	0.47	0.36	x	1.00	0.77	x
	6	EW	0.51	0.40	x	1.00	0.77	x
	12	EW	0.63	0.54	x	1.00	0.86	x
Shorea gibbosa	1	EW	0.28	0.29	x	1.00	1.04	x
	6	EW	0.39	0.39	x	1.00	0.98	x
	12	EW	0.76	0.76	x	1.00	1.00	x
Shorea glauca	1	EW	0.52	0.65	x	1.00	1.27	x
	6	EW	0.73	0.71	x	1.00	0.97	x
	12	EW	1.48	1.24	x	1.00	0.84	x
Shorea talura	1	EW	0.48	0.40	x	1.00	0.84	x
	6	EW	0.60	0.64	x	1.00	1.05	x
	12	EW	1.07	1.34	x	1.00	1.25	x
Shorea leprosula	1	EW	0.55	0.52	0.59	1.00	0.95	1.07
	6	EW	0.81	0.74	0.76	1.00	0.91	0.93
	12	EW	1.62	1.37	1.44	1.00	0.84	0.89
Shorea mulitiflora	1	EW	0.70	0.37	x	1.00	0.53	x
	6	EW	0.69	0.47	x	1.00	0.67	x
	12	EW	1.14	0.87	x	1.00	0.76	x
Shorea ovalis	1	EW	0.48	0.45	0.59	1.00	0.93	1.24
	6	EW	0.66	0.56	0.68	1.00	0.85	1.04
	12	EW	1.48	1.23	1.34	1.00	0.83	0.90
Shorea ovata	1	EW	0.47	0.49	0.42	1.00	1.04	0.90
	6	EW	0.50	0.53	0.50	1.00	1.07	1.00
	12	EW	0.94	0.93	0.68	1.00	0.99	0.72
Shorea parvifolia	1	EW	0.43	0.41	0.35	1.00	0.96	0.82
	6	EW	0.59	0.59	0.42	1.00	1.01	0.71
	12	EW	1.24	1.17	1.06	1.00	0.94	0.85
Shorea pauciflora	1	EW	0.50	0.53	0.40	1.00	1.06	0.81
	6	EW	0.73	0.66	0.56	1.00	0.91	0.76
	12	EW	1.21	1.17	1.07	1.00	0.96	0.88
Sindora sp.	1	EW	0.39	0.37	x	1.00	0.96	x
	6	EW	0.39	0.41	x	1.00	1.06	x
	12	EW	0.53	0.59	x	1.00	1.11	x

Table S48 RGR-H of Each Planting Design in Underplanting in Belukar Plots

Species	Month	Direction	Actual Value Type F	Actual Value Type G	Actual Value Type H	Relative Value Type F	Relative Value Type G	Relative Value Type H
Dialium sp.	6	EW	1.16	1.40	x	1.00	1.21	x
	12	EW	1.84	2.65	x	1.00	1.44	x
Gonystylus sp.	6	EW	1.28	1.25	x	1.00	0.98	x
	12	EW	1.82	1.81	x	1.00	0.99	x
Neobalanocarpus heimii	6	EW	1.25	1.02	1.04	1.00	0.82	0.83
	12	EW	1.98	1.40	1.39	1.00	0.71	0.70
Shorea acuminata	6	EW	1.03	1.15	x	1.00	1.11	x
	12	EW	1.83	1.94	x	1.00	1.06	x
Shorea bracteolata	6	EW	1.10	1.11	x	1.00	1.01	x
	12	EW	1.36	1.50	x	1.00	1.10	x
Shorea gibbosa	6	EW	1.50	1.42	x	1.00	0.95	x
	12	EW	2.80	2.78	x	1.00	0.99	x
Shorea glauca	6	EW	1.42	1.08	x	1.00	0.76	x
	12	EW	2.99	1.86	x	1.00	0.62	x
Shorea talura	6	EW	1.29	1.75	x	1.00	1.36	x
	12	EW	2.30	3.87	x	1.00	1.68	x
Shorea leprosula	6	EW	1.52	1.40	1.27	1.00	0.92	0.83
	12	EW	2.92	2.58	2.45	1.00	0.88	0.84
Shorea mulitiflora	6	EW	1.01	1.29	x	1.00	1.27	x
	12	EW	1.69	2.44	x	1.00	1.45	x
Shorea ovalis	6	EW	1.45	1.29	1.18	1.00	0.89	0.81
	12	EW	3.22	2.79	2.32	1.00	0.87	0.72
Shorea ovata	6	EW	1.01	1.03	1.12	1.00	1.02	1.11
	12	EW	1.81	1.77	1.46	1.00	0.98	0.81
Shorea parvifolia	6	EW	1.33	1.42	1.19	1.00	1.07	0.89
	12	EW	2.69	2.80	2.95	1.00	1.04	1.09
Shorea pauciflora	6	EW	1.45	1.26	1.34	1.00	0.87	0.92
	12	EW	2.41	2.17	2.62	1.00	0.90	1.09
Sindora sp.	6	EW	1.00	1.12	x	1.00	1.12	x
	12	EW	1.40	1.50	x	1.00	1.07	x

Table S49 Diameter Growth of Each Planting Design in Underplanting in Belukar Plots

Species	Month	Direction	Actual Value Type F	Actual Value Type G	Actual Value Type H	Relative Value Type F	Relative Value Type G	Relative Value Type H
Dialium sp.	1	EW	0.73	0.49	x	1.00	0.68	x
	6	EW	0.76	0.62	x	1.00	0.81	x
	12	EW	0.97	0.96	x	1.00	0.98	x
Gonystylus sp.	1	EW	0.70	0.64	x	1.00	0.91	x
	6	EW	0.82	0.75	x	1.00	0.92	x
	12	EW	1.10	1.03	x	1.00	0.93	x
Neobalanocarpus heimii	1	EW	0.73	0.74	0.82	1.00	1.01	1.11
	6	EW	0.81	0.86	0.96	1.00	1.06	1.19
	12	EW	1.06	1.04	1.22	1.00	0.98	1.15
Shorea acuminata	1	EW	0.57	0.43	x	1.00	0.75	x
	6	EW	0.65	0.56	x	1.00	0.85	x
	12	EW	0.90	0.82	x	1.00	0.92	x
Shorea bracteolata	1	EW	0.66	0.51	x	1.00	0.77	x
	6	EW	0.77	0.68	x	1.00	0.89	x
	12	EW	1.06	1.02	x	1.00	0.96	x
Shorea gibbosa	1	EW	0.45	0.34	x	1.00	0.76	x
	6	EW	0.52	0.57	x	1.00	1.09	x
	12	EW	0.80	0.92	x	1.00	1.15	x
Shorea glauca	1	EW	0.50	0.62	x	1.00	1.25	x
	6	EW	0.69	0.78	x	1.00	1.12	x
	12	EW	1.22	1.34	x	1.00	1.09	x
Shorea talura	1	EW	0.79	0.57	x	1.00	0.72	x
	6	EW	0.98	0.99	x	1.00	1.01	x
	12	EW	1.79	1.95	x	1.00	1.09	x
Shorea leprosula	1	EW	0.72	0.58	0.70	1.00	0.81	0.97
	6	EW	1.08	1.04	1.17	1.00	0.96	1.08
	12	EW	1.90	1.88	1.85	1.00	0.99	0.97
Shorea mulitiflora	1	EW	0.83	0.44	x	1.00	0.53	x
	6	EW	0.90	0.61	x	1.00	0.67	x
	12	EW	1.38	0.93	x	1.00	0.68	x
Shorea ovalis	1	EW	0.67	0.56	0.76	1.00	0.83	1.14
	6	EW	0.91	0.89	0.99	1.00	0.97	1.08
	12	EW	1.55	1.55	1.74	1.00	1.00	1.13
Shorea ovata	1	EW	0.65	0.59	0.51	1.00	0.91	0.78
	6	EW	0.71	0.68	0.66	1.00	0.97	0.94
	12	EW	1.15	1.14	0.78	1.00	0.99	0.68
Shorea parvifolia	1	EW	0.58	0.53	0.53	1.00	0.91	0.92
	6	EW	0.75	0.79	0.62	1.00	1.05	0.82
	12	EW	1.17	1.21	1.20	1.00	1.03	1.03
Shorea pauciflora	1	EW	0.68	0.62	0.49	1.00	0.91	0.71
	6	EW	0.95	1.00	0.85	1.00	1.05	0.89
	12	EW	1.46	1.38	1.47	1.00	0.95	1.01
Sindora sp.	1	EW	0.67	0.55	x	1.00	0.82	x
	6	EW	0.72	0.64	x	1.00	0.89	x
	12	EW	0.96	1.03	x	1.00	1.07	x

H/D Ratio

Table S50 shows the mean diameter in each planting design. Most of the species showed the thicker shape with less than 80 of H/D ratio, while *Shorea glauca* showed the highest value of 123.6 in F type at 12 month. Comparing with the relative value, the difference among 3 types of planting width were not so obvious in terms of H/D ratio so far. Further observation is needed.

Biomass

Table S51 shows BPU in each planting design. *Shorea ovalis* showed the largest value of 4.82 in H type at 12 months after planting. Comparing with the relative value, the difference among 3 types of planting width were not so obvious in terms of BPU so far. Further observation is needed.

5.1.2.5.2.2. Comparison with the Underplanting in *Acacia mangium* Plantation Plots

In order to clarify the difference between the underplanting in *Acacia mangium* and the underplanting in Belukar, same species planted in both under *Acacia mangium* in EW planting direction and under Belukar were compared. *Neobalanocarpus heimii*, *Shorea acuminata*, *Shorea glauca*, *Shorea leprosula*, *Shorea ovalis*, *Shorea ovata*, *Shorea parvifolia*, *Shorea pauciflora*, were compared. Due to the difference of stand age, both sites were compared with the data at 12 months after planting.

The strip width of underplanting in *Acacia mangium* was 6 m in EW-A, 9 m in EW-B, 15 m in EW-C, 27 m in EW-D, 51 m in EW-E, and those of underplanting in Belukar was 10 m in F, 20 m in G, 40 m in H. Thus F type in Belukar was correspond to EW-B in *Acacia mangium*, G type was correspond to between EW-B to EW-C, H type was correspond to between EW-D to EW-E.

Survival rate, height growth, diameter growth, H/D ratio, BPU are shown in Tables S51,S52, S53, S54, and S55, respectively. Relative value was calculated at each measurement time with setting the standard value of EW-E type in *Acacia mangium* plantation as 1. These two sites were planted in different year with different seedlings with different provenance and nurturing history. Thus precise comparison was difficult. Further study is required.

Survival of Trees

Table S52 shows the survival rate in each planting design. While 4 plots in underplanting in *Acacia mangium*, such as *Neobalanocarpus heimii* in A, *Shorea leprosula* in A and B, *Shorea parvifolia* in A, showed more than 80 % of survival, only *Shorea ovalis* in H in Belukar showed

Table S50 H/D Ratio of Each Planting Design in Underplanting in Belukar Plots

Species	Month	Direction	Actual Value Type F	Actual Value Type G	Actual Value Type H	Relative Value Type F	Relative Value Type G	Relative Value Type H
Dialium sp.	1	EW	53.4	60.1	x	1.00	1.13	x
	6	EW	58.4	66.5	x	1.00	1.14	x
	12	EW	71.0	74.9	x	1.00	1.06	x
Gonystylus sp.	1	EW	67.2	66.9	x	1.00	0.99	x
	6	EW	74.2	70.5	x	1.00	0.95	x
	12	EW	77.7	76.8	x	1.00	0.99	x
Neobalanocarpus heimii	1	EW	63.0	85.3	75.9	1.00	1.36	1.21
	6	EW	67.5	73.6	66.5	1.00	1.09	0.98
	12	EW	80.2	83.3	71.0	1.00	1.04	0.89
Shorea acuminata	1	EW	85.2	96.2	x	1.00	1.13	x
	6	EW	77.4	83.2	x	1.00	1.07	x
	12	EW	99.5	95.1	x	1.00	0.96	x
Shorea bracteolata	1	EW	72.0	72.3	x	1.00	1.00	x
	6	EW	67.5	58.5	x	1.00	0.87	x
	12	EW	59.4	53.4	x	1.00	0.90	x
Shorea gibbosa	1	EW	63.2	88.6	x	1.00	1.40	x
	6	EW	77.1	68.7	x	1.00	0.89	x
	12	EW	96.2	80.2	x	1.00	0.83	x
Shorea glauca	1	EW	106.1	108.9	x	1.00	1.03	x
	6	EW	105.6	93.1	x	1.00	0.88	x
	12	EW	123.6	93.3	x	1.00	0.75	x
Shorea talura	1	EW	62.2	72.2	x	1.00	1.16	x
	6	EW	62.6	66.2	x	1.00	1.06	x
	12	EW	60.9	71.5	x	1.00	1.17	x
Shorea leprosula	1	EW	80.7	94.8	87.8	1.00	1.17	1.09
	6	EW	78.6	74.2	67.8	1.00	0.94	0.86
	12	EW	87.1	75.1	80.6	1.00	0.86	0.93
Shorea mulitiflora	1	EW	85.0	86.4	x	1.00	1.02	x
	6	EW	78.1	77.7	x	1.00	1.00	x
	12	EW	86.4	94.2	x	1.00	1.09	x
Shorea ovalis	1	EW	72.3	85.7	80.2	1.00	1.19	1.11
	6	EW	72.9	64.6	70.9	1.00	0.89	0.97
	12	EW	95.8	77.8	77.6	1.00	0.81	0.81
Shorea ovata	1	EW	74.0	85.7	85.4	1.00	1.16	1.15
	6	EW	72.0	80.7	75.9	1.00	1.12	1.05
	12	EW	80.6	82.7	86.2	1.00	1.03	1.07
Shorea parvifolia	1	EW	76.1	90.1	68.2	1.00	1.18	0.90
	6	EW	77.8	76.0	67.8	1.00	0.98	0.87
	12	EW	104.1	95.9	88.3	1.00	0.92	0.85
Shorea pauciflora	1	EW	75.6	89.4	84.1	1.00	1.18	1.11
	6	EW	78.3	67.7	66.3	1.00	0.87	0.85
	12	EW	81.8	85.0	74.8	1.00	1.04	0.91
Sindora sp.	1	EW	58.1	69.6	x	1.00	1.20	x
	6	EW	53.5	64.5	x	1.00	1.20	x
	12	EW	54.7	55.3	x	1.00	1.01	x

Table S51 BPU of Each Planting Design in Underplanting in Belukar Plots

Species	Month	Direction	Actual Value Type F	Actual Value Type G	Actual Value Type H	Relative Value Type F	Relative Value Type G	Relative Value Type H
Dialium sp.	1	EW	0.19	0.07	x	1.00	0.39	x
	6	EW	0.24	0.16	x	1.00	0.66	x
	12	EW	0.59	0.72	x	1.00	1.22	x
Gonystylus sp.	1	EW	0.23	0.15	x	1.00	0.63	x
	6	EW	0.37	0.23	x	1.00	0.61	x
	12	EW	1.01	0.63	x	1.00	0.62	x
Neobalanocarpus heimii	1	EW	0.25	0.30	0.37	1.00	1.21	1.50
	6	EW	0.36	0.36	0.53	1.00	1.03	1.49
	12	EW	0.96	0.68	1.11	1.00	0.71	1.15
Shorea acuminata	1	EW	0.12	0.05	x	1.00	0.40	x
	6	EW	0.16	0.08	x	1.00	0.52	x
	12	EW	0.41	0.22	x	1.00	0.52	x
Shorea bracteolata	1	EW	0.21	0.10	x	1.00	0.47	x
	6	EW	0.34	0.20	x	1.00	0.59	x
	12	EW	0.79	0.53	x	1.00	0.67	x
Shorea gibbosa	1	EW	0.06	0.03	x	1.00	0.55	x
	6	EW	0.11	0.11	x	1.00	1.03	x
	12	EW	0.49	0.58	x	1.00	1.20	x
Shorea glauca	1	EW	0.12	0.17	x	1.00	1.46	x
	6	EW	0.36	0.31	x	1.00	0.86	x
	12	EW	1.93	1.69	x	1.00	0.88	x
Shorea talura	1	EW	0.32	0.18	x	1.00	0.56	x
	6	EW	0.67	0.80	x	1.00	1.20	x
	12	EW	4.55	6.97	x	1.00	1.53	x
Shorea leprosula	1	EW	0.27	0.18	0.29	1.00	0.66	1.07
	6	EW	0.89	0.71	0.98	1.00	0.80	1.10
	12	EW	4.69	4.24	4.40	1.00	0.90	0.94
Shorea mulitiflora	1	EW	0.37	0.06	x	1.00	0.17	x
	6	EW	0.43	0.14	x	1.00	0.33	x
	12	EW	1.71	0.63	x	1.00	0.37	x
Shorea ovalis	1	EW	0.23	0.15	0.35	1.00	0.66	1.52
	6	EW	0.62	0.46	0.68	1.00	0.73	1.10
	12	EW	3.39	3.18	4.82	1.00	0.94	1.42
Shorea ovata.	1	EW	0.18	0.16	0.11	1.00	0.89	0.65
	6	EW	0.22	0.16	0.16	1.00	0.76	0.73
	12	EW	0.49	0.34	0.13	1.00	0.70	0.26
Shorea parvifolia	1	EW	0.15	0.11	0.08	1.00	0.73	0.54
	6	EW	0.37	0.31	0.13	1.00	0.85	0.36
	12	EW	1.66	1.30	0.77	1.00	0.78	0.46
Shorea pauciflora	1	EW	0.25	0.21	0.10	1.00	0.84	0.38
	6	EW	0.78	0.65	0.37	1.00	0.83	0.47
	12	EW	2.62	1.76	1.84	1.00	0.67	0.70
Sindora sp.	1	EW	0.19	0.14	x	1.00	0.70	x
	6	EW	0.22	0.21	x	1.00	0.94	x
	12	EW	0.46	0.64	x	1.00	1.41	x

Table S52 Comparison of Survival Rate between the Underplanting in Acacia mangium and the Underplanting in Belukar at 12 Months after Planting

	Actual Value Acacia					Belukar			Relative Value Acacia					Belukar		
Species	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H
Neobalano	96.6%	41.3%	71.2%	59.2%	55.3%	77.1%	64.3%	70.0%	1.75	0.75	1.29	1.07	1.00	1.39	1.16	1.27
Shorea ac	72.3%	59.2%	58.9%	34.0%	33.1%	44.8%	27.2%	x	2.19	1.79	1.78	1.03	1.00	1.36	0.82	X
Shorea gla	52.1%	x	51.5%	21.2%	14.6%	71.9%	55.8%	x	3.57	X	0.79	1.45	1.00	4.93	3.83	X
Shorea leg	87.5%	90.2%	74.5%	70.1%	57.5%	57.8%	60.7%	69.2%	1.52	1.57	1.30	1.22	1.00	1.01	1.06	1.20
Shorea ov	74.4%	75.4%	40.6%	44.9%	57.9%	72.9%	76.3%	85.0%	1.28	1.30	0.70	0.77	1.00	1.26	1.32	1.47
Shorea ov	45.3%	42.4%	13.3%	19.1%	10.8%	24.5%	17.9%	21.7%	4.18	3.91	1.23	1.76	1.00	2.26	1.65	2.00
Shorea pa	68.0%	65.3%	75.0%	52.9%	38.3%	65.1%	50.9%	38.3%	2.30	1.70	1.96	1.38	1.00	1.70	1.33	1.00
Shorea pa	71.6%	58.3%	35.2%	24.3%	36.3%	67.7%	57.6%	53.3%	1.98	1.61	0.97	0.67	1.00	1.87	1.59	1.47

Table S53 Comparison of Height Growth between the Underplanting in Acacia mangium and the Underplanting in Belukar at 12 Months after Planting

	Actual Value Acacia					Belukar			Relative Value Acacia					Belukar		
Species	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H
Neobalano	0.62	0.63	0.59	0.49	0.56	0.86	0.86	0.85	1.11	1.13	1.06	0.88	1.00	1.55	1.54	1.53
Shorea ac	1.23	1.24	1.18	1.14	0.90	0.88	0.78	x	1.37	1.38	1.31	1.28	1.00	0.98	0.87	X
Shorea gla	0.60	0.00	0.66	0.42	0.43	1.48	1.24	x	1.42	x	1.56	0.98	1.00	3.47	2.92	X
Shorea leg	1.43	1.68	1.31	1.03	0.92	1.62	1.37	1.44	1.55	1.82	1.42	1.11	1.00	1.76	1.48	1.56
Shorea ov	1.00	1.01	0.99	1.01	0.89	1.48	1.23	1.34	1.13	1.14	1.11	1.14	1.00	1.68	1.39	1.51
Shorea ov	1.05	0.83	0.71	0.80	0.48	0.94	0.93	0.68	2.19	1.84	1.47	1.67	1.00	1.95	1.93	1.41
Shorea pa	1.17	1.19	0.98	0.89	0.86	1.24	1.17	1.06	1.36	1.39	1.14	1.04	1.00	1.44	1.36	1.23
Shorea pa	0.85	1.03	0.71	0.71	0.79	1.21	1.17	1.07	1.07	1.31	0.90	0.90	1.00	1.53	1.48	1.35

Table S54 Comparison of Diameter Growth between the Underplanting in Acacia mangium and the Underplanting in Belukar at 12 Months after Planting

	Actual Value Acacia					Belukar			Relative Value Acacia					Belukar		
Species	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H
Neobalano	0.74	0.74	0.75	0.73	0.77	1.06	1.04	1.22	0.96	0.96	0.98	0.94	1.00	1.38	1.35	1.58
Shorea ac	1.00	0.99	1.04	1.13	0.91	0.90	0.82	x	1.10	1.08	1.14	1.24	1.00	0.98	0.90	X
Shorea gla	0.58	x	0.59	0.53	0.50	1.22	1.34	x	1.17	X	1.19	1.07	1.00	2.46	2.69	X
Shorea leg	1.32	1.53	1.54	1.25	1.19	1.90	1.88	1.85	1.11	1.29	1.30	1.05	1.00	1.60	1.58	1.55
Shorea ov	0.99	1.08	1.17	1.26	1.03	1.55	1.55	1.74	0.97	1.05	1.14	1.22	1.00	1.50	1.51	1.69
Shorea ov	0.99	0.80	0.84	0.79	0.63	1.15	1.14	0.78	1.59	1.28	1.34	1.26	1.00	1.83	1.81	1.24
Shorea pa	1.01	0.99	0.87	0.98	0.90	1.17	1.21	1.20	1.13	1.10	0.97	1.09	1.00	1.30	1.35	1.34
Shorea pa	0.86	1.06	0.96	0.86	0.88	1.45	1.38	1.47	0.98	1.21	1.09	0.98	1.00	1.66	1.57	1.68

Table S55 Comparison of H/D ratio between the Underplanting in Acacia mangium and the Underplanting in Belukar at 12 Months after Planting

	Actual Value Acacia					Belukar			Relative Value Acacia					Belukar		
Species	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H
Neobalano	83.2	83.7	77.9	65.1	71.9	80.2	83.3	71.0	1.16	1.16	1.08	0.92	1.00	1.12	1.16	0.99
Shorea ac	123.8	124.1	113.7	104.0	97.6	99.5	95.1	x	1.27	1.27	1.16	1.07	1.00	1.02	0.97	X
Shorea gla	104.6	x	113.8	78.9	88.6	123.6	93.3	x	1.18	X	1.28	0.89	1.00	1.39	1.05	X
Shorea leg	110.2	110.8	88.6	83.6	79.1	87.1	75.1	80.6	1.39	1.40	1.12	1.06	1.00	1.10	0.95	1.02
Shorea ov	97.9	90.3	82.6	79.7	65.5	95.8	77.6	77.6	1.15	1.06	0.97	0.93	1.00	1.12	0.91	0.91
Shorea ov	105.0	108.9	83.0	98.5	79.8	80.6	82.7	86.2	1.32	1.37	1.04	1.24	1.00	1.01	1.04	1.08
Shorea pa	113.9	119.2	111.8	88.2	94.5	104.1	95.9	88.3	1.20	1.26	1.18	0.93	1.00	1.10	1.01	0.93
Shorea pa	95.6	93.0	73.3	82.9	88.8	81.8	85.0	74.8	1.09	1.05	0.83	0.94	1.00	0.92	0.96	0.84

Table S56 Comparison of BPU between the Underplanting in Acacia mangium and the Underplanting in Belukar at 12 Months after Planting

	Actual Value Acacia					Belukar			Relative Value Acacia					Belukar		
Species	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H
Neobalano	0.37	0.18	0.29	0.18	0.23	0.96	0.68	1.11	1.65	0.80	1.28	0.81	1.00	4.24	3.00	4.89
Shorea ac	0.98	0.90	0.88	0.54	0.33	0.41	0.22	x	2.95	2.71	2.66	1.63	1.00	1.24	0.65	X
Shorea gla	0.12	x	0.03	0.03	0.02	1.93	1.69	x	6.67	x	1.67	1.61	1.00	107.00	93.94	X
Shorea leg	2.66	4.06	3.14	1.59	1.07	4.69	4.24	4.40	2.48	3.80	2.93	1.49	1.00	4.38	3.96	4.12
Shorea ov	1.01	1.30	0.76	1.08	0.89	3.39	3.18	4.82	1.13	1.45	0.85	1.21	1.00	3.79	3.56	5.39
Shorea ov	0.73	0.42	0.08	0.15	0.03	0.49	0.34	0.13	26.00	15.04	2.75	5.29	1.00	17.46	12.18	4.61
Shorea pa	1.49	1.03	0.76	0.71	0.35	1.68	1.30	0.77	4.26	2.94	2.17	2.03	1.00	4.77	3.71	2.20
Shorea pa	0.55	1.08	0.59	0.15	0.38	2.62	1.76	1.84	1.43	2.83	1.56	0.39	1.00	6.88	4.64	4.84

more than 80 % of survival at 12 months after planting. On the contrary, *Shorea glauca* in C and D, *Shorea ovata* in C, D, E, in Acacia showed less than 20 % of survival, only *Shorea ovata* in H in Belukar showed less than 20 % of survival at 12 months after planting. Comparing with the relative value to the standard (EW-E in Acacia), all Belukar plots except for *Shorea acuminata* in G showed the higher value to the standard. Though the survival in Bleaker plots showed better results than that in EW-E in Acacia, the difference between narrower plots in *Acacia mangium* plots was difficult to be concluded. Further study is needed.

Height Growth

Table S53 shows the mean height in each planting design. Comparing with the relative value to the standard (EW-E in *Acacia mangium* plots), even the widest planting strip of H type in Belukar showed the higher value to the standard. Roughly speaking all Belukar plots except for *Shorea acuminata* showed the higher height growth to that in *Acacia mangium* plantation. Because of short period for 12 months and the difference of initial size, the conclusion is difficult. Further study is needed.

Diameter Growth

Table S54 shows the mean diameter in each planting design. Comparing with the relative value to the standard (EW-E in *Acacia mangium* plots), all Belukar plots except for *Shorea acuminata* showed the higher diameter growth to that in *Acacia mangium* plantation. Because of short period for 12 months and the difference of initial size, the conclusion is difficult. Further study is needed.

H/D Ratio

Table S55 shows the mean diameter in each planting design. Comparing with the relative value to the standard (EW-E in *Acacia mangium* plots), all Belukar plots except for *Shorea glauca* in F showed the almost equal value to the standard. The narrower planting width in Acacia plots showed higher H/D ratio, which means the slender tree shape. Because of short period for 12 months and the difference of initial size, the conclusion is difficult. Further study is needed.

Biomass

Table S56 shows BPU in each planting design. Comparing with the relative value to the standard (EW-E in *Acacia mangium* plots), all Belukar plots except for *Shorea acuminata* showed the higher BPU value to that in *Acacia mangium* plantation. Because of short period for 12 months and the difference of initial size, the conclusion is difficult. Further study is needed.

5.1.2.5.2.3. Conclusion

Planting method in bare land was changed from mix and coexistent planting both with fast growing species and indigenous species into underplanting in secondary forest. The result at one year after planting showed better than in openplanting in terms of survival and growth. This suggested that the secondary forest which regenerated after clear cutting of natural forest should not be clear cut again. This forest can be utilized as nurse trees of indigenous species.

Comparing with the underplanting in *Acacia mangium* plantation and the underplanting in Belukar, the results were better in Belukar in terms of survival, height, diameter, and BPU. The results are the comparison just 12 months after planting, and initial size of seedlings might have been differed, thus the conclusion is difficult.

The differences among three types of designs; F, G, H, in Belukar was no so obvious. This might be caused by the similar light condition among these three designs.

Since *Acacia mangium* is a legume with nitrogen fixing ability, the soil in the underplanting in Acacia plots is supposed to contain high nitrogen contents. If the site in Acacia contains the high nitrogen, the growth of the seedlings planted there must have been increased. The results of the comparison between Acacia plots and Belukar plots did not meet this hypothesis. The chemical analysis of the soil is now in the progress. The result is awaited.

5.1.2.6. Relationship between the Light Condition and the Growth of Trees

In this study, the light condition was considered as one of the most important factors on the growth of planted seedlings. Several planting designs were taken to manipulate the light condition. The relationship between the planting strip widths and the light condition was discussed in former section, and also the relationship between the planting strip widths and the growth of planted trees was discussed in former section. Then the relationship between the light condition and the growth of planted trees is discussed in this section. Fig. S34 show the spatial distribution pattern of the seedlings of *Shorea leprosula* in E-type at 30 months after planting. If the survival rate or the height growth correlated with the RAI, the distribution pattern of the seedlings must have shown characteristic arrangement in proportion to the distribution pattern of RAI. But dead trees distributed randomly, and height of alive trees were heterogeneous. This may suggest that there are a lot of factors influencing the survival and growth of dipterocarp species beside light condition, e.g. temperature, humidity, soil condition, vegetation, etc. Therefore further study is required to clarify the limiting factors on the survival and the growth of dipterocarp species.

Fig. S35 shows the relationship between the RAI and the survival rate for each planting row in each planting type. Although each data varied widely, survival rates decreased with the increment of RAI.

Relationship between the RAI and the height growth increment is shown in Fig. S36. The height growth increment was taken before and after 6 months of measurement of the RAI; totaling 12 months from April 1994 to April 1995. Each data varied widely. But under close monitoring of maximum data, height growth increment seemed to have been suppressed under higher RAI. The growth rate of dipterocarp seed-

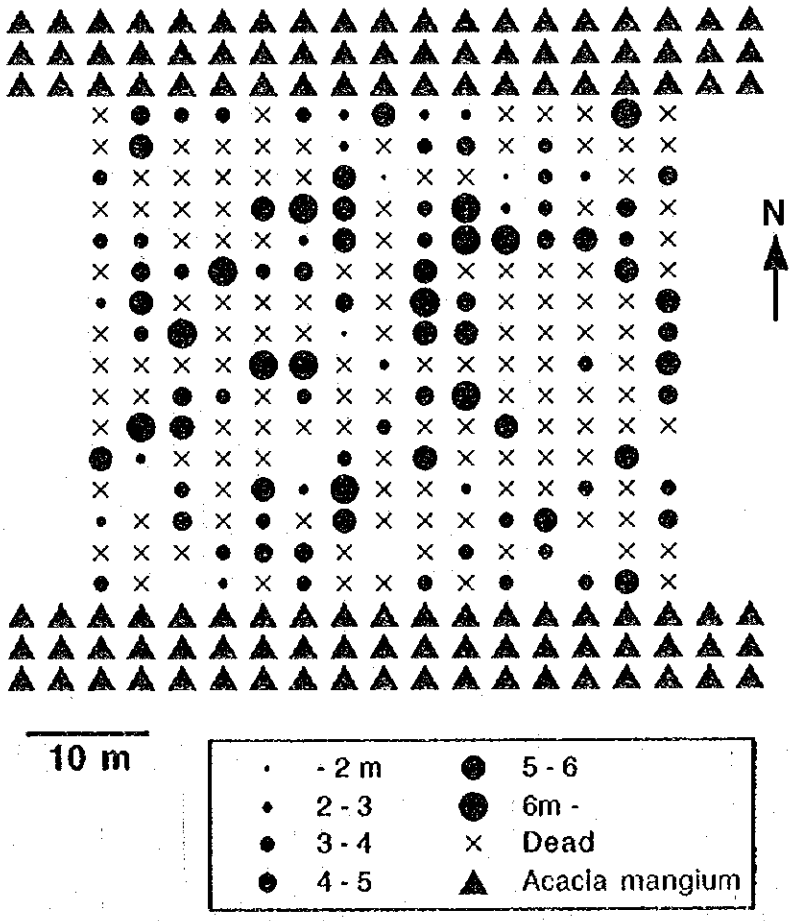


Fig. S34 Spatial distribution pttern of seedlings of *Shorea leprosula* in EW-E type at 30 months after planting

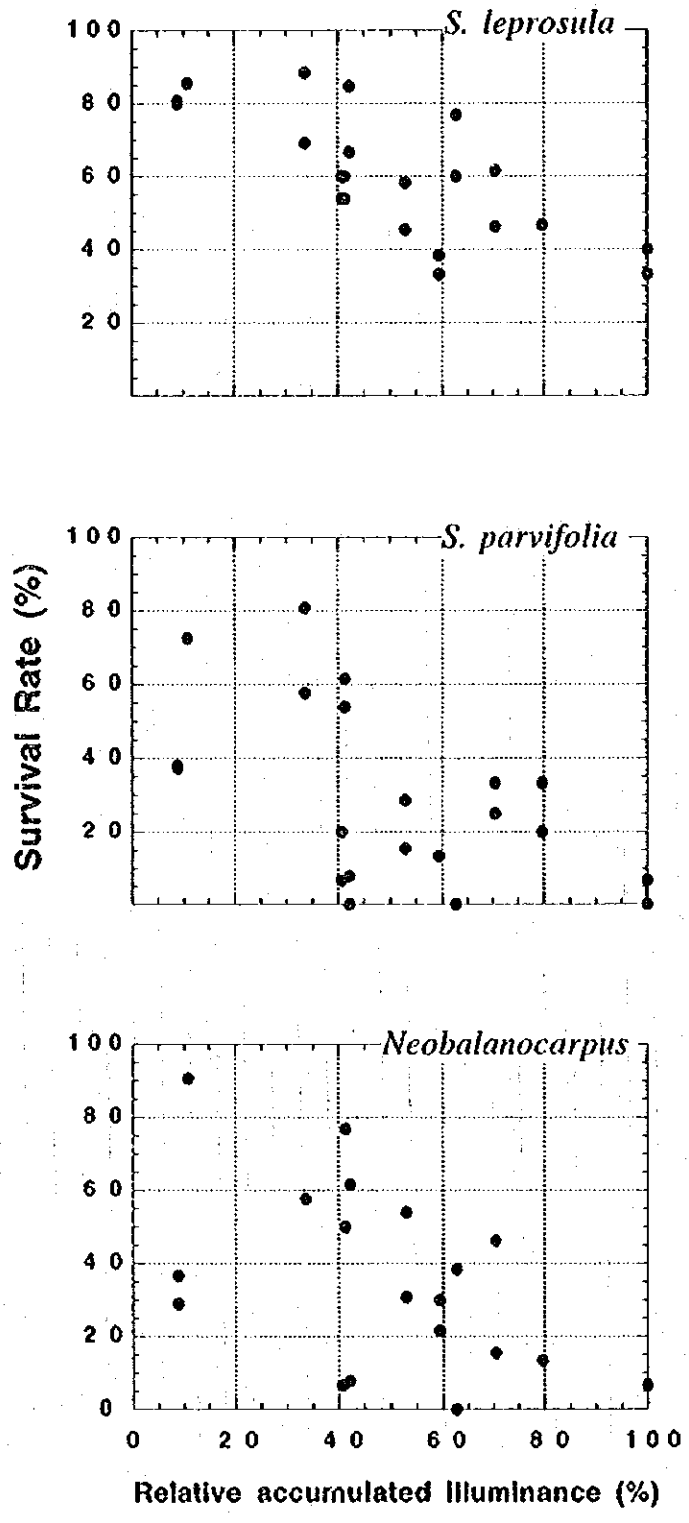


Fig. S35 Relationship between RAI and survival rate

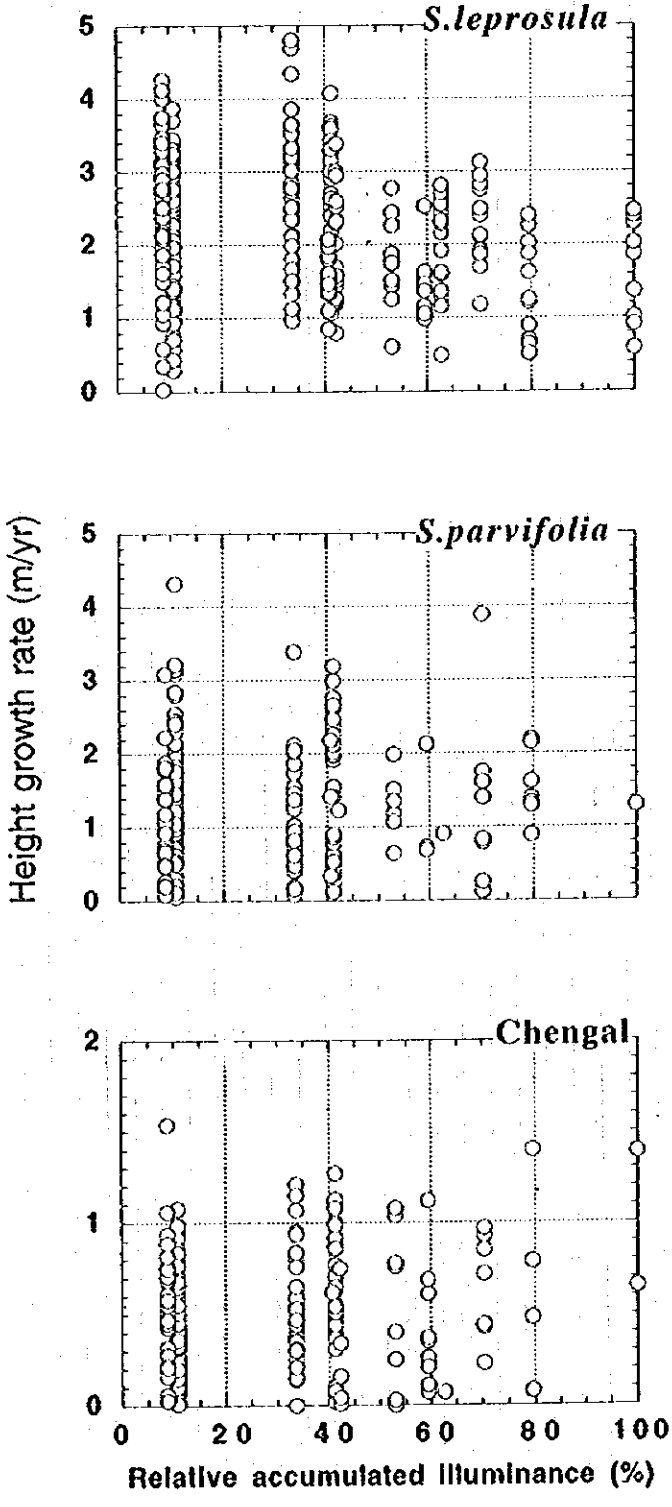


Fig. S36 Relationship between RAI and height growth increment

lings was reported to increase at 30 to 50 % of the full sunlight (Sasaki and Mori 1981), but the optimum RAI for the height growth was not so obvious in this study. In this study RAIs were measured in each planting row, not on each seedling, so that the relationship between RAI and growth may have been unclear. In the initial stage, the competition between the planted seedlings and other vegetation on the forest floor is a serious problem. Thus it is required to find out the optimum light condition to enhance the growth of planted seedlings with controlling the other vegetation. On the other hand, some dipterocarp species is said to be suffered from brittle heart if it grows too fast in early stage (Appanah & Weinland 1993). In this point of view, it is also important to manipulate the light condition to keep the optimum growth speed. Therefore the further study of the light condition is indispensable.

Fig. S37 shows the changes of RAI measured by the diazo method after the felling of *Acacia mangium*. RAI in the felled row was increased from 11 - 14 % to 35 - 56 % after felling. The heights and diameters of *Shorea leprosula* in and out of the felled rows were measured in November 1995 when fell on 1 month after felling, and in April 1996 when fell on 6 months after felling. Increment of height and diameter between 1 month and 6 months after planting were compared. Table S57 shows the mean height increment and mean diameter increment during the period. Significant differences among planting rows were not observed both in height increment and in diameter increment (ANOVA test, $p<0.05$). The influence of canopy opening on height increment and diameter increment was not clarified after 6 months of canopy opening. Continuous measurement and analysis are required.

5.1.3. Conclusion

In this project, light condition was considered the main factor on the growth of seedling, so that manipulation of light condition was the main design of this project. However the relationship between the light condition and the growth of seedlings was not so obvious. Light might not be the main factor on the growth of seedling in the underplanting site.

In the planting strips in underplanting site, the environmental factors, such as light, temperature, humidity, soil condition, vegetation, etc., change in accordance with the openness of upper canopy. Each factor correlating each other. Hence it is very difficult which factor is the main limiting factor on the growth of trees. Especially in wider planting strip in underplanting as well as in openplanting, less soil moisture and high temperature caused by harsh sunlight seems to seriously affect the initial survival of the seedlings. As discussed in section 5.1.2.1., the light condition under non-felling *Acacia mangium* plantation was rather bright with the RAI of about 10 %. Under this light environment, the light might not be a limiting factor on the growth of seedlings.

The effect of several factors other than light condition, such soil condition (type, moisture, hardness, etc.), topography, etc., should be studied.

It is important for establishing the Multi-Storied Forest Management System with underplanting in *Acacia mangium* plantation to clarify the planting design, such as forest type of overstory, height of overstory, width of planting strips, width of retained forest, etc., other than depending only on RAI. For the practical indicator for establishing Multi-Storied Forest by

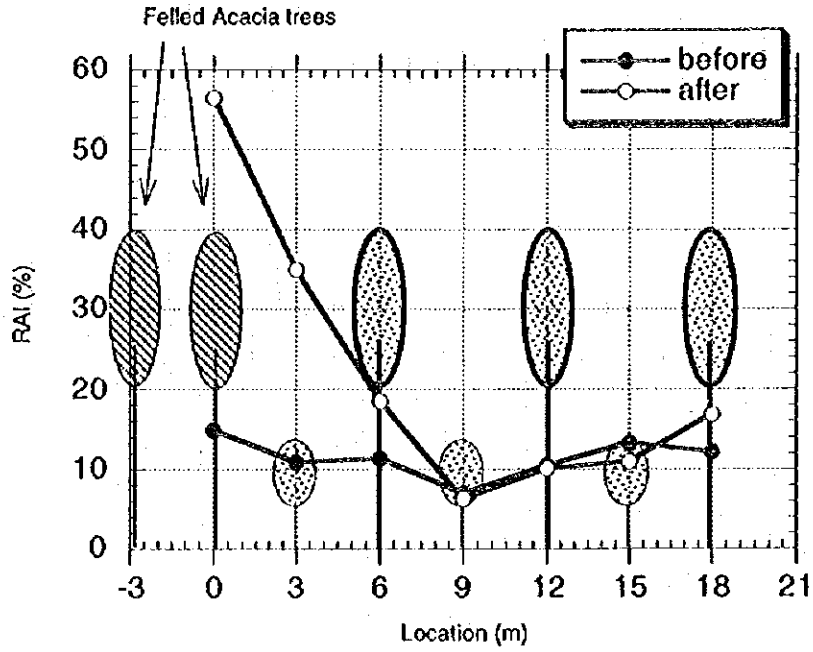


Fig. S37 Changes of RAI after the felling of Acacia mangium

underplanting in *Acacia mangium* plantation can be the planting design. Light condition, especially RAI, can be a useful indicator for the openness of planting strips or an useful evaluation factor of the planting design.

Table S57 Comparison of Height and Diameter Increment in and out of the Felled Rows from 1 month to 6 months after Felling

Plot	Count	Height Increment(m)	Standard Deviation(m)
Felled Row (0)	18	1.01	0.42
1st Row (1)	19	0.82 (2)	0.64
2nd Row (2)	14	1.23 (1)	0.42
3rd Row (3)	14	0.87	0.69

Plot	Count	Diameter Increment(cm)	Standard Deviation(cm)
Felled Row (0)	18	1.45	0.42
1st Row (1)	19	1.25	0.65
2nd Row (2)	14	1.09	0.67
3rd Row (3)	14	1.08	0.75

Note: Shared letters indicate the significant differences (Fisher's PLSD test, $p<0.05$)

5.2. Bukit Kinta site

5.2.1 Methods

5.2.1.1. Setting up of permanent plots

Setting up of experimental plots started from third year in 5-year plan. Planting work were carried out 1994- 1996. First planting was carried out in Feb. 1994.

Experimental plots were set up with adding replication experimental plots to have replication data and made effort to secure sample numbers sufficiently so as to get endorsed data statistically. Measurment plots were set so as to collect data around 100 in GP-1, LP. In GP-2 all the data of trees would be collected.

5.2.1.2. Tree measurement

Measurements (survival rate, height, diameter, and number of leaves) were done at 1 month or 2 months after planting. Aftrer the second measurements at 6 months, they were done every 6 months. Actual measuring dates are shown in Table S58. Height of tree was measured from the ground to the top of trunk with measuring pole to the accuracy of 1 cm. Diameter at ground height was measured at the point of 5cm above ground level using caliper to the accuracy of 1 mm. Number of leaves was measured all leaves belonging tree by counter. Measurement is usually done by silviculture assistant employed by JICA and 2 or 3 workers employed by Kinta-Manjung District Forest Office having jurisdiction over Bukit Kinta Forest Reserve.

5.2.1.3. Meteorological data

Automatic meteorological data recorder (OTAC-2000) was installed at the house which is set up as an evacuation house built in case of emergency such as unexpected bad weather in front of D Block in Bukit Kinta. It records temperature, moisture, rainfall, wind velocity, wind direction, solar radiation, solar duration. It started collecting data from Sep. 1994.

5.2.1.4. Light condition

The light conditions were measured by 2 methods. One is Diazo method and another is hemispherical photo method. See 5.1.1.5. for the basic idea of diazo method.

5.2.1.4.1. Diazo method

Lingt conditions were measured using diazo method in D and J blocks. The former is focused on relationship between light condition and growth, and the latter is focused on grasping the light conditions in different sized canopy openings.

In a gap plot in D block, with opening area of about 1 ha, light conditions were measured above the spots of 102 planted seedlings which have been observed for monitoring of growth and

Table S58 Dates of measurements for each planting plots/types in Bukit Kinta site

Table-11.Measurement dates

Block	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
A	28/7/94	24/11/94	5/6/95	27/11/96	21/5/96				
B	17/11/94	16/1/95	30/5/95	9/11/95	22/5/96				
C	17/7/94	23/11/94	30/5/95	11/11/95	23/5/96				
D	6/4/94	24/5/94	29/8/94	6/12/94	13/2/95	7/6/95	23/8/95	2/4/96	21/8/96
E	27/7/94	29/11/94	6/6/95	28/11/96	27/5/96				
F	5/5/94	5/10/94	18/1/95	8/4/95	4/10/95	3/4/96			
G	6/5/94	4/10/94	21/1/95	5/4/95	5/9/96	4/4/96			
H	13/5/95	3/10/95	11/4/96						
I	22/5/95	2/10/95	6/4/96						
J GP-2 05	16/5/95	26/9/95	20/4/96						
10	17/5/95	26/9/95	23/4/96						
20	18/5/95	27/9/95	24/4/96						
C20	18/5/95	28/9/95	24/4/96						
30	17/5/95	28/9/95	23/4/96						
LP-02	17/5/95	27/9/95	20/4/96						
LP-10	16/5/95	30/9/95	22/4/96						
LP-20	11/5/95	30/9/95	22/4/96						
K GP-1	18/4/95	18/9/95	15/4/96						
GP-2 10	4/5/95	20/9/95	20/4/96						
20	6/5/95	19/9/95	18/4/96						
30	8/5/95	25/9/95	18/4/96						
LP-02	26/4/95	19/9/95	13/4/96						
LP-10	22/4/95	20/9/95	20/4/96						
LP-20	22/4/96	20/9/96	18/4/96						

survival. Beside the planted seedlings, pvc pipes of ca. 1.2 m hight were put up and two diazo plates were placed at a time on each of the pipes. The measurements were carried out 4 times; on 9th-10th and 10th-11th of Nov. 1994 and on 14th-16th and 16th-17th of Oct.1995.

In J block, light conditions were measured at gap plots of nineteen 5m x 5m, seventeen 10m x 10m, three 20m x 20m, one 30m x 30m, and two control (20m x 20m) and at two line planting plots of 2m width. In each gap, measurements were done for one point in 5mx5m and 10mx10m gaps, four points in 20m x 20m and control, and five points in 30m x 30m gaps. In each of the two line planting plots, measurements were done at 10 points along the line with 6m apart each other. Diazo plates were placed on pvc pipes in the same manner as in D block. The measurements were carried out on 18th-19th and 19th-20th of October, 1995. The total number of measruing point is 86.

5.2.1.4.2. Hemispherical photo method

We analyzed the ratio of hemisphere opening (hemisphere openness) using a program to analyze light condition from digitized hemispherical photographs (HEMIPHOT, Tropenbos Foun-

dation). The hemisphere opening indicates the value which is the ratio of canopy opening and ground opening. Fish eye lens can be used for taking all hemispherical photographs. The top of the photograph was oriented north. The camera was kept at 1m height in taking photo.

Over 50 points were sampled for taking hemisphere photo to grasp the light condition of trees, or gaps mainly in D block and J block.

5.2.2 Results and discussion

5.2.2.1. Stand environment

5.2.2.1.1. Weather condition

The weather data is available from Sep. 1994 at Bukit Kinta. The annual rainfall recorded from Nov. 1994 to Oct. 1995 was 2,864 mm. Within this period the monthly lowest rainfall was 57 mm (Feb.1995), and the highest was 500 mm (Oct.95). The monthly average temperature of 24.5°C and the average max. of 33.7°C, average min. of 19.3°C were recorded. The lowest temperature was 16.8°C and the highest temperature was 35.7°C. The average relative humidity was 90.9% and the average max. 99.9% and the average min.46.4%. The lowest humidity was 36.5% and the highest humidity was 100% . Monthly maximum, mean, and minimum temperature and monthly rainfall are shown in Fig. S38. The rainfall data of Dec.95 to Jan.96 were not available as the equipment was out of order.

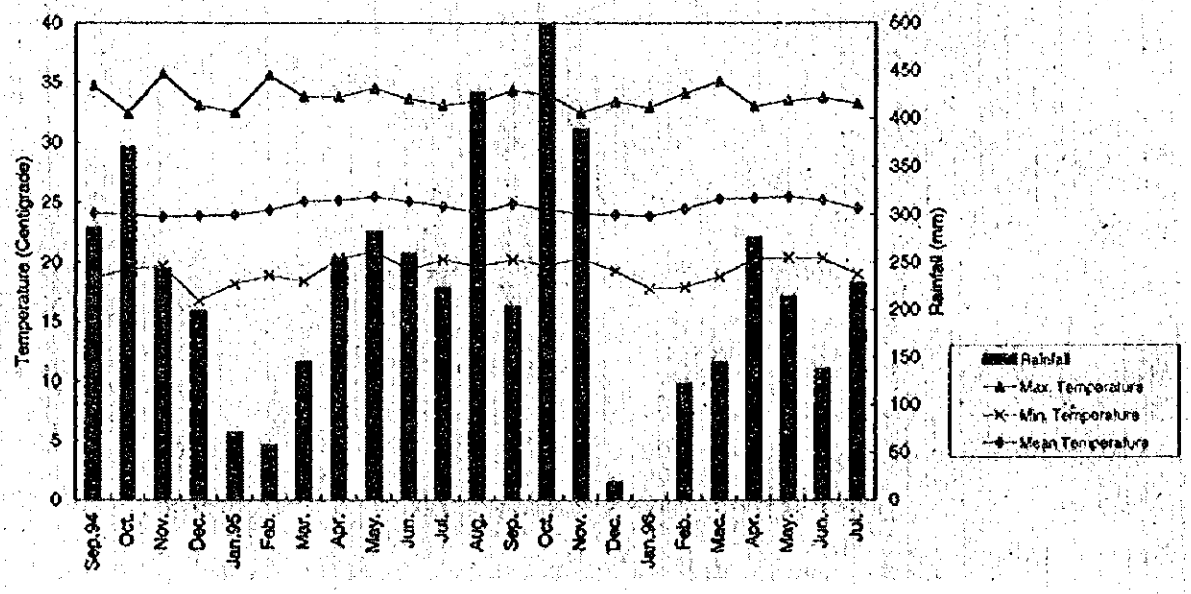


Fig. S38 Monthly rainfall at Bukit Kinta meteological station

5.2.2.1.2. Spatial distribution of RAI

Spatial distribution of RAI in D block measured in 1994 and 1995 are shown in Fig. S39. Since the gap has a diameter of more than 40 m, distribution of high RAI values, such as RAIs of more than 50 %, are restricted to the central area. This is partly because the slope faces to the north and the measuring dates were Oct.-Nov., when the sun incline to the south about 20 degrees.

There is only a small difference between the two measurements carried out in Nov.1994 and Oct. 1995 in terms of the spatial distribution of RAIs (Fig.S40). However, RAI drop from more than 30% into less than 5% is ovserved where young bamboo overgrow the measuring height. These results show that less influence of remained trees on light condition in big gap within one

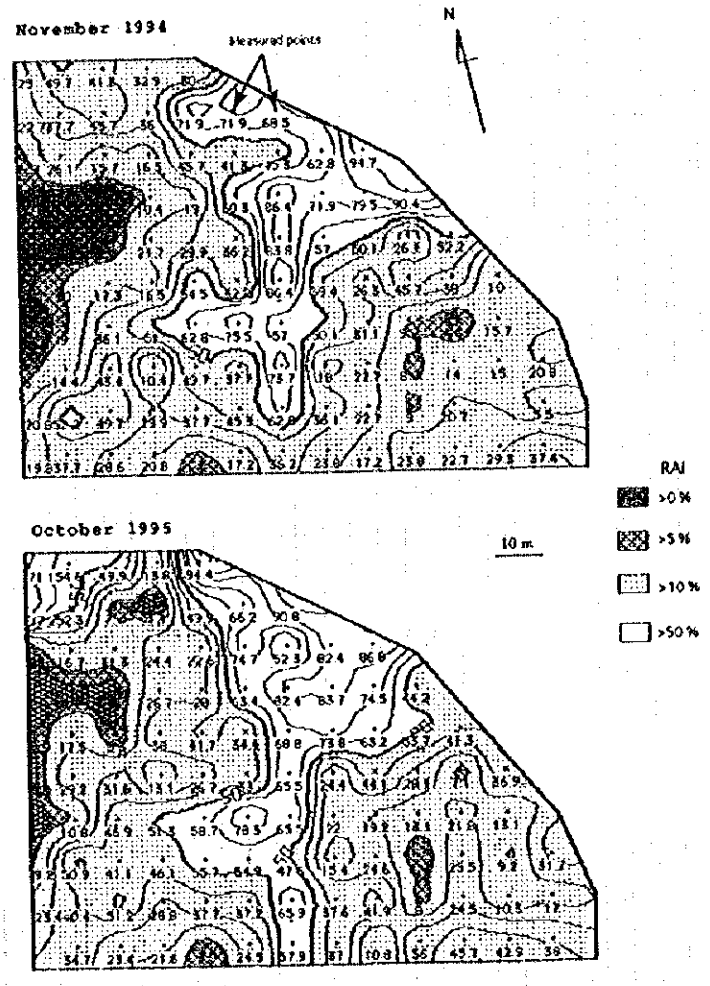


Fig. S39 Spatial distribution of RAI in D blockmeasured in 1994 and 1995

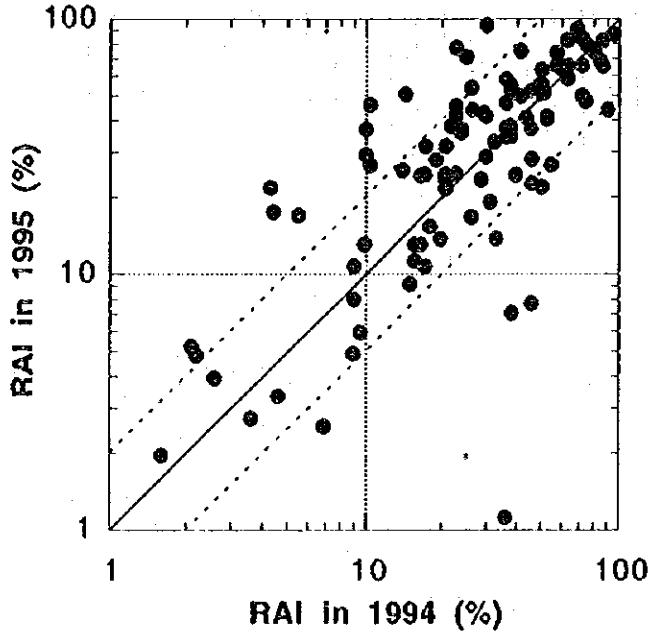


Fig. S40 Relationship between RAIs in 1994 and 1995 at 104 measuring points in the gap of D block

year. And show that the RAI value can be maintained by controlling the shrubs with the regular weeding and easily fail into dark condition if the treatment is not done properly in first stage.

5.2.2.1.3. Gap and light condition

Frequency distribution of RAIs in each gap is shown in Fig.S41. In a GP1 plot, RAI distributes widely from less than 5 % to almost 100 %, but average value is higher than those of the other plot types. Since planting area of GP1 plots extend outside of the gaps, the points under surrounding canopy trees would show low RAI values. RAIs of the other planting type roughly correlate with their canopy opening size (Table S59). Many of the points in LP2 and control plots shows RAIs of less than 5 %, while in the rest of the planting types, lower RAI values than 5 % are rare. RAIs of 30 m square gaps are lower than those of 20 m square gaps, probaly due to some remaining trees in the plots.

GP-1 D Block can be thought which is under brighter condition compared with other GP-1 plot by field observation, however, frequency of more than 80% of RAI is less. The method of site preparation is same in GP-1and it depends on site which consists of secondary forest or not.

Canopy openness can be thought to be one of the most inportant factor on growth of planted seedlings. Openness is also considered to affect other environments such as micro climate, soil temperature, soil water tension which affect on seedlings. Furthermore, if we want to manipulate surrounding environments arround trees, manipulating canopy openness through changing the methods of site preparation can be considered as easy and reasonable way. Hence, manipulating canopy openness would be considered as reasonable parameter if we could measure canopy openness and make it adopt to practical silvicultural opearation. After measuring Relative Accumulated Illumi-

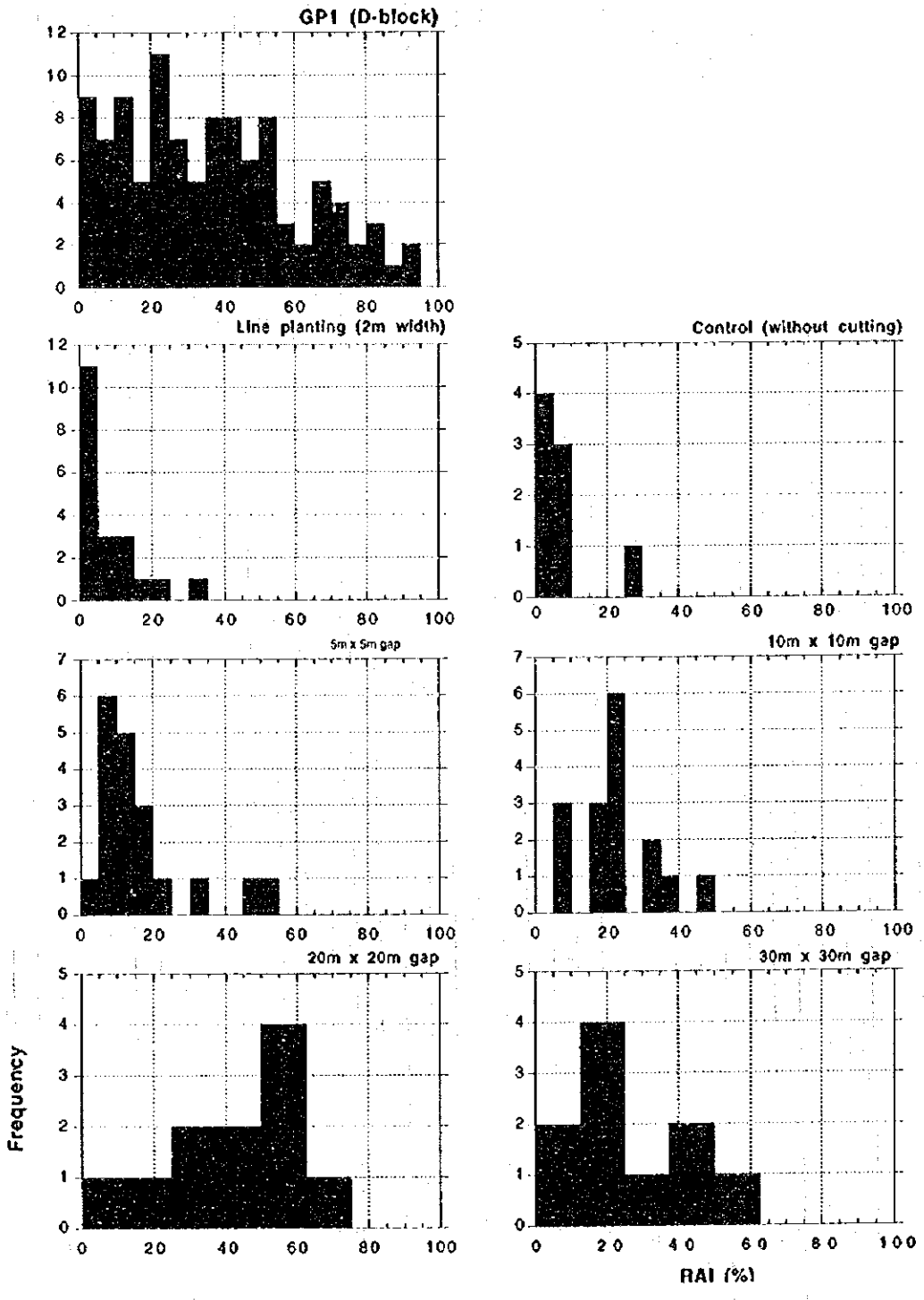
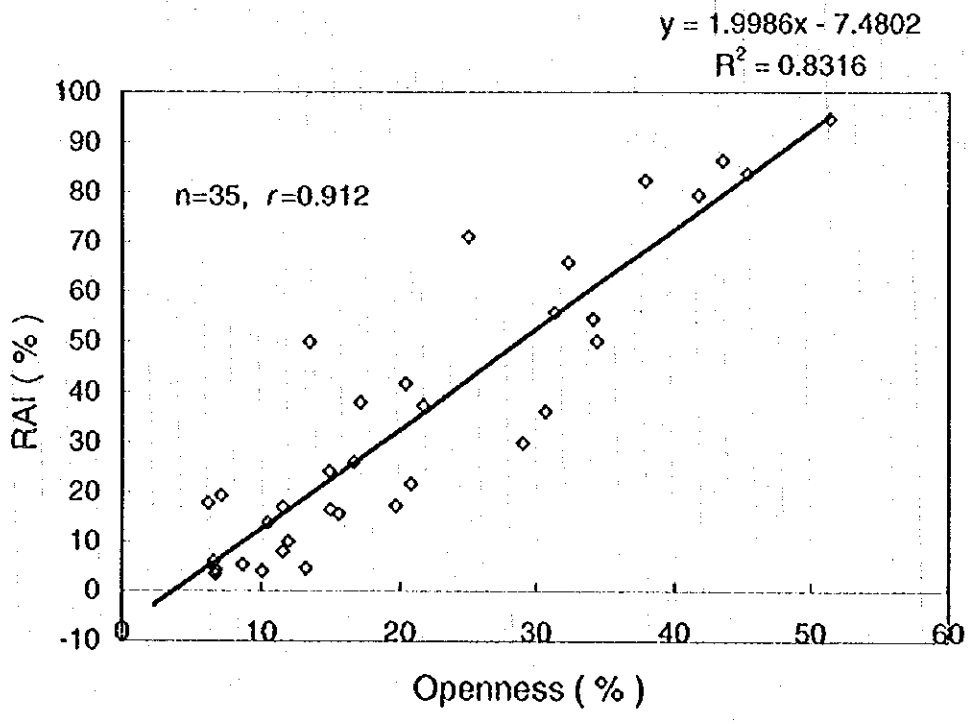


Fig. S41 Frequency distribution of RAIs in each opening type in block J of Bukit Kinta site

Table-S59 RAI in each plot

PLOT	RAI	PLOT	RAI	PLOT	RAI	PLOT	RAI	PLOT	RAI	PLOT	RAI
5-1	7.7	10-1	38.7	20-1	32.1	C20-1	5.4	30-1	20.9	LP2-1	11.2
5-2	33.2	10-2	25.0	(20)	—	(10.7)	28.9	(12.5)	13.1	(9.2)	8.5
5-3	11.5	10-3	—		16.2		7.2		6.9		2.5
5-4	2.5	10-4	15.7		11.8		1.2		3.1		3.8
5-5	10.2	10-5	16.6	20-2	35.1	C20-2	1.7		18.4		2.7
5-6	8.5	10-6	9.4	(50)	72.4	(4.0)	8.5	30-2	35.1		2.5
5-7	6.3	10-7	22.0		54.2		4.5	(40.6)	50.6		3.7
5-8	50.6	10-8	5.7		38.7		1.3		47.8		13.3
5-9	22.8	10-9	22.1	20-3	54.2				21.9		32.4
5-10	19.5	10-10	21.8	(53.5)	61.7				47.8		11.3
5-11	6.0	10-11	17.8		42.3					LP2-4	1.7
5-12	5.7	10-12	7.8		55.5					(7.19)	3.1
5-13	15.1	10-13	19.3								1.7
5-14	9.8	10-14	22.0								3.7
5-15	19.2	10-15	31.0								7.8
5-16	14.4	10-16	23.0								4.1
5-17	11.1	10-17	47.8								16.4
5-18	47.8										23.4
5-19	11.8										6.9
											3.1
average	16.5		21.6		43.1		7.4		26.6		8.3
Parenthesis indicates average value in plot											

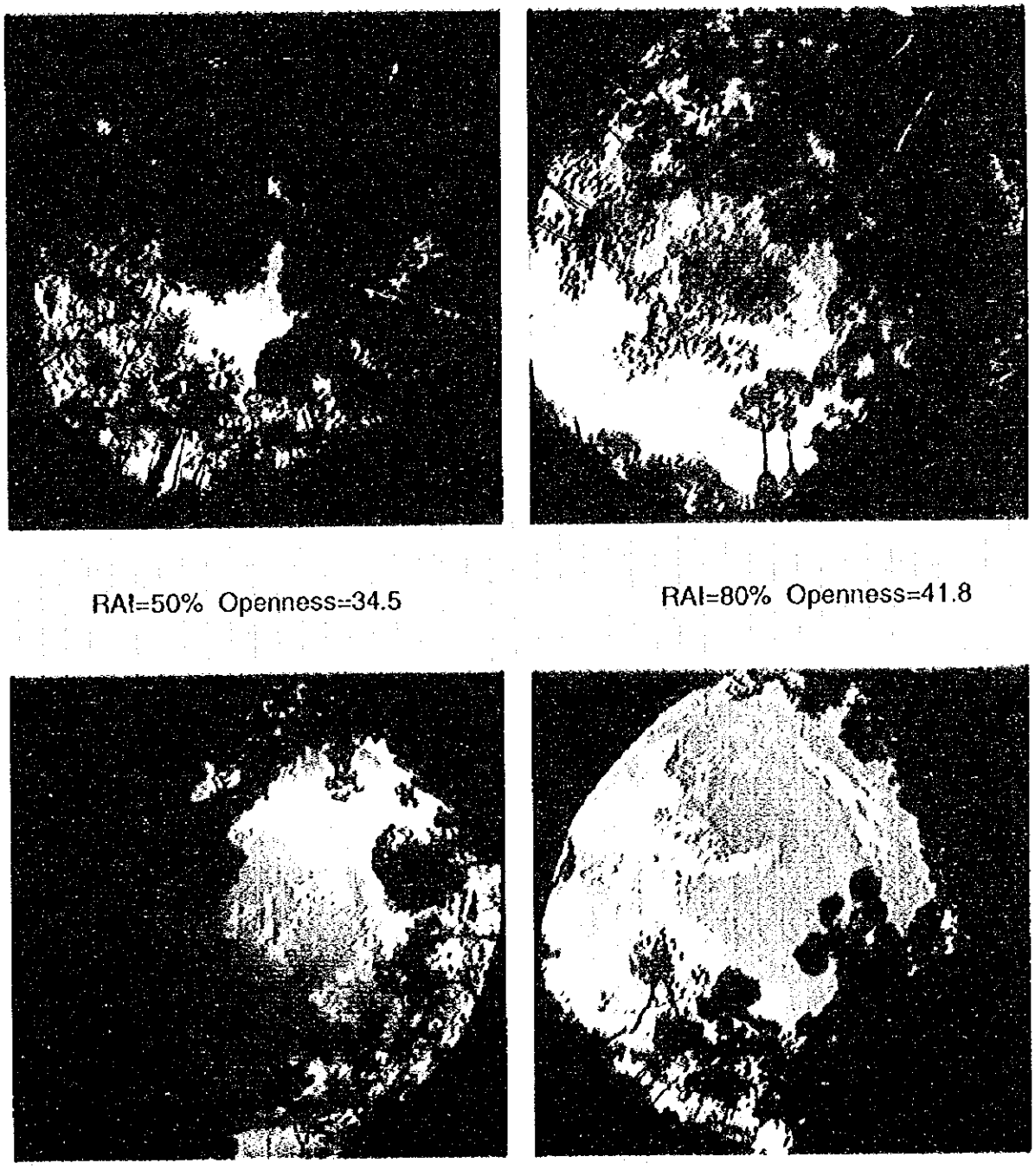
Figure-42 Openness and RAI



nance (RAI) by a short-term expert in Nov.1994, twenty hemispherical photographs were taken at the measured points in D Block. We analyzed relationship between canopy openness and light condition (RAI value). Consequentry, it could be recognized that relationship between canopy openness and light condition has a good correlation (Fig.S42). This result suggests that the hemisphere openness can be expected as rough indicator for estimating the light condition at the point (Fig. 43).

RAI=10% Openness=11.9

RAI=30% Openness=29.0



RAI=50% Openness=34.5

RAI=80% Openness=41.8

Fig. S43 RAI values and hemisphere openness

5.2.2.2. Survival and growth of planted trees

GP1 plots planted in 1994

Survival rate suddenly dropped in the early stage was observed (Fig. S44). It seems to be due to the serious dry period from June and July in 1994. B, D and G block showed good performance in height growth. B is located on the top of the main ridge, and burnt in June 1994. After the fire, the ash of the litter and leaves of the bertum pelm covered the ground with more than 30cm thick. The seedlings of *S. parvifolia* were replanted in Nov.1994, and grow well as you see, remarkably, without any treatment work after the fire.

On the other hand, D and G are situated in lower part of the slope which have moist and rich top soil. C Block is on the ridge, is covered with mainly fern, bertum and partly regenerated S.curtisii. In terms of diameter, the tendency is the same as height growth. C is the worst, the reason seems to be the lack of top soil due to logging operation. In fact, some part of the plot was used as decking site, and also, even on the slope, after chopping the fern, no plant can grow up because chopped fern is hardly decomposed. This occurrence is found in A block as well. Chopped fern for the site preparation was still covered the ground densely.

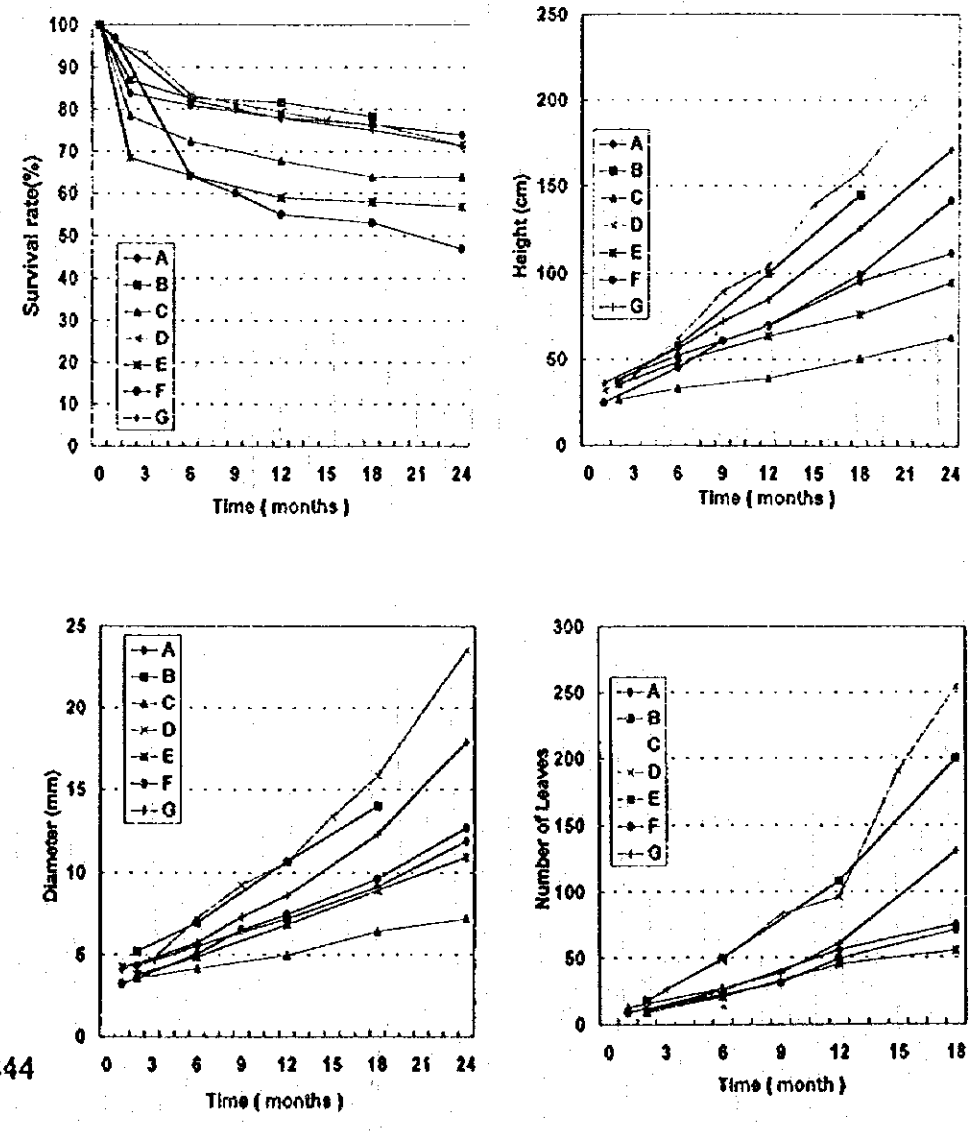


Fig. S44

preparation was still covered the ground densely.

Block B and D, the number of leaves increased rapidly. The light conditions in B Block were almost full. And D has a big gap in the center. On the other hand, in A, C, E and F, saplings increased very slowly. Saplings for A and E Block were wildings purchased from private nursery. The potting soil consisted of clay which was too hard to develop their root system quickly, and supposed to difficult to endure the water stress in the dry period. F Block, clearly the light is not enough, upper canopy covers all over the plot.

Generally plots which is set up on ridge and upper slope shows poor growth performance (low survival and low growth compared with plots which is set up on lower slope. However, it could not be compared by topographical character in this experimental plot. Main reason is that quality of seedlings were not unified. Concretely, seedlings in some parts were wildings purchased from private nursery. In B Block located on ridge which had forest fire and replanted in Nov.1994 shows good performance as well as D Block. Therefore, the quality of seedlings and planting time could be considered to be influenced on growth of seedlings. Further study will be needed between topography and growth.

GP1, GP2, and LP plots planted in 1995

In Bukit Kinta to select a suitable method of afforestation planting of various sizes were established. In the year 1995 14ha of artificial planting was established to compare both methods of gap planting and Line planting with planting *S. macroptera* and *S. pauciflora*. Survival rate and height growth of every species for 1 year after planting by various planting methods are summarized below.

Species except *S. curtisii* show high survival rate. *S.curtisii* show low survival rate 48.3%. Many reasons can be thought for that such as soil, water flow due to steep area, elevation, too open, however, the reason why such low survival is not clear. *D. baudii* shows higher survival 84.5% than other species. Seeds of *D.baudii* were collected in Bukit Kinta and that place is adjacent planted area. That's why It can be thought as reason *D. baudii* shows higher survival. *S.leprosura* also shows low survival rate in GP-2(30). However, this reason is cleared, area(GP-2 30 in K Block) planted *S. leprosura* is often covered with water in rainy season as mentioned above. In GP-2 plots a significant difference between sizes can't be seen, however, *S. pauciflora* shows less survival rate than *S. macroptera* in all GP-2 plots especially *control plots* and 5x5. It seems to show sensitive character of *S.pauciflora* compared with *S. macroptera*. *S.macroptera* shows a higher survival rate than *S. pauciflora* in LP plots too. No significant difference can be seen between 3 line widths. But each LP plot shows high survival compared with other GP-1,GP-2 plots in *S. pauciflora*.

Adopted planting methods in Bukit Kinta are 9 types in total. Tables S60 and S61 summarize all trees data in H,I,J and K. In GP-1 plot *S.leprosura* shows higher growth and *S. curtisii* shows lower growth. However, planted seedlings have deviations on size, and conditions of all the planted area could not be grasped surrounding conditions, therefore it is difficult to compare until differences come up in height growth by this table. Height increment were shown in Table S61. It makes no difference between gap sizes except control plots. In other words, almost all planting methods

Table S60 Survival rate (%) of seedlings at one year

Species	Planting methods								
	GP-1	GP-2					LP		
		co.20	5x5	10x10	20x20	30x30	2m	10m	20m
D. baudii	84.5								
S. curtisii	48.3								
S. leprosura	76.3					50.0(-)			
S. macroptera	76.5	84.8	87.5	84.8	85.6	74.7(88.9)	84.2	86.7	84.8
S. pauciflora	66.1	69.4	65.9	75.8	75.6	66.7(78.6)	77.1	77.5	88.4

Note: GP-2 30x30 has 4 plots. However, 1 plot planted 3species(*S. leprosura*, *S. macroptera*, and *S. pauciflora*) is often covered with water in rainy season. ( ) indicates value excluded that plot.

Table S61 Height increment (cm) of seedlings between2 month and 12 month

Species	Planting methods								
	GP-1	GP-2					LP		
		co.20	5x5	10x10	20x20	30x30	2m	10m	20m
D. baudii	69.1								
S. curtisii	42.4								
S. leprosura	72.9					52.6			
S. macroptera	60.4	12.7	45.8	44.3	54.1	49.9	42.3	41.7	43.9
S. pauciflora	47.3	6.1	28.7	53.0	42.1	46.6	35.3	53.7	46.6

excluding *control plot* showed satisfactory performance.

5.2.2.3. Relationship between survival/growth and canopy opening

Survival ratio and height growth of seedlings in J Block are summarized in Talbes S62 and S63. No clear differences can be seen between gap sizes and survival ratio while only co. 20 and GP2(5) shows low survival in *S. pauciflora*.

The growth of average height in both species are shown in Table S62. From this table co.20 is worst closely followed LP2 in both species. Conspicuous differences can not be seen between other plots-GP-2(5), (10), (20), (30), LP10 and LP20 and those plots show higher growth in first year (Fig. S45). This result is almost corresponding to the average value of RAI (Relative Accumulated illuminance) measured in each plots data.

Light condition of each gaps were not unified so that it seems to be effective way to take each light conditions rather than mere to take gap sizes into consideration as a factor to grasp conditions of each gaps. As mentioned above Co.20 and LP2 showed low growth performance its main reason was under darker light condition. It can be said both plots were under conditions closed by dying branches, climber and leaves of vegetation rather than canopy closing. With its height is low as 2m-3m.

Furthermore to take a look over tree growth of each gaps with refering light conditions, it can be understood that the gaps showing poor growth were under too dark light conditions especially below 10% in both *S. macroptera* and *S. pauciflora*. In these gaps almost no growth i.e. neither Height, Diameter nor Number of Leaves were observed although survival rates were stable as

Table S62 Surival rates of seedlings planted in J block

Planting methods								
	GP-2					Line planting		
Species	co.20	5x5	10x10	20x20	30x30	2m	10m	20m
S. macroptera	84.9	87.5	81.5	87.0	87.7	85.0	88.3	90.5
S. pauciflora	69.4	65.9	75.0	70.4	70.4	88.3	83.3	92.1

Table S63 Height growth of seedlings planted in J block

Planting methods								
	GP-2					Line planting		
Species	co.20	5x5	10x10	20x20	30x30	2m	10m	20m
S.macroptera	1.292	1.982	2.282	2.163	2.059	1.512	1.834	2.371
	65	100	115	109	104	76	92	119
S. pauciflora	1.290	2.179	2.380	2.547	2.651	1.917	2.304	2.857
	54	91	100	107	111	80	97	120

Note : Upper value is calculated (height at 12 month ÷ height at 2month). Lower value indicates an index in the case of setting average growth as 100.

Fig-16 Height growth by each planting design

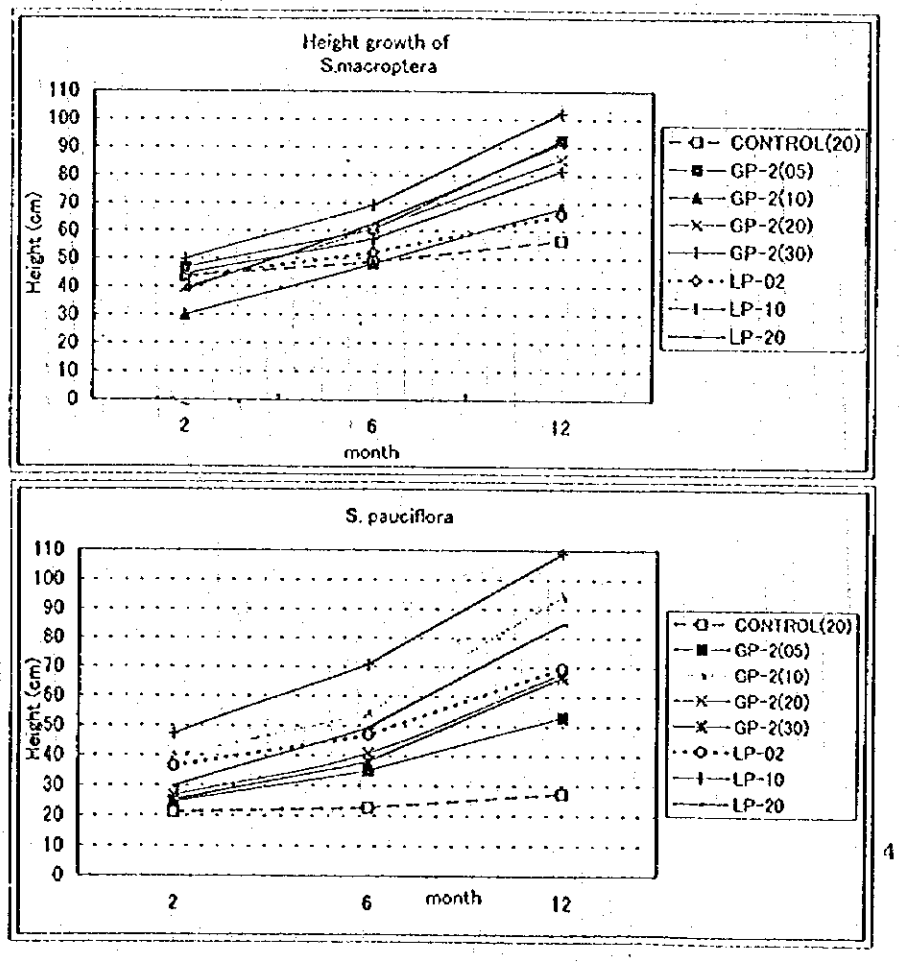


Fig. S45 Height growth of two species planted in different planting designs

shown in data. According to field observation even in such dark conditions some trees getting light by tree top can be observed height growth as exception.

On the other hand almost all the brighter plots showed better growth than darker plots shown in data. For instance plots 5-3 and 5-4 and others near 10% . Hence, it can be concluded it should be concentrated on light condition so as not to be too dark conditions about 10% for the trees as cases remaining pre-existence trees at initial stage.

Light conditions among the plots of the same opening design are not stable because of unevenly remaining trees in gaps or heterogenous structure of the surrounding forest. Fig. S46 shows relationship between RAIs at plots of diffrent opening designs and the height of trees in those plots where RAIs were measured. The tree heights in the plots of less than 10 % of RAI are clearly lower than those of higher plots

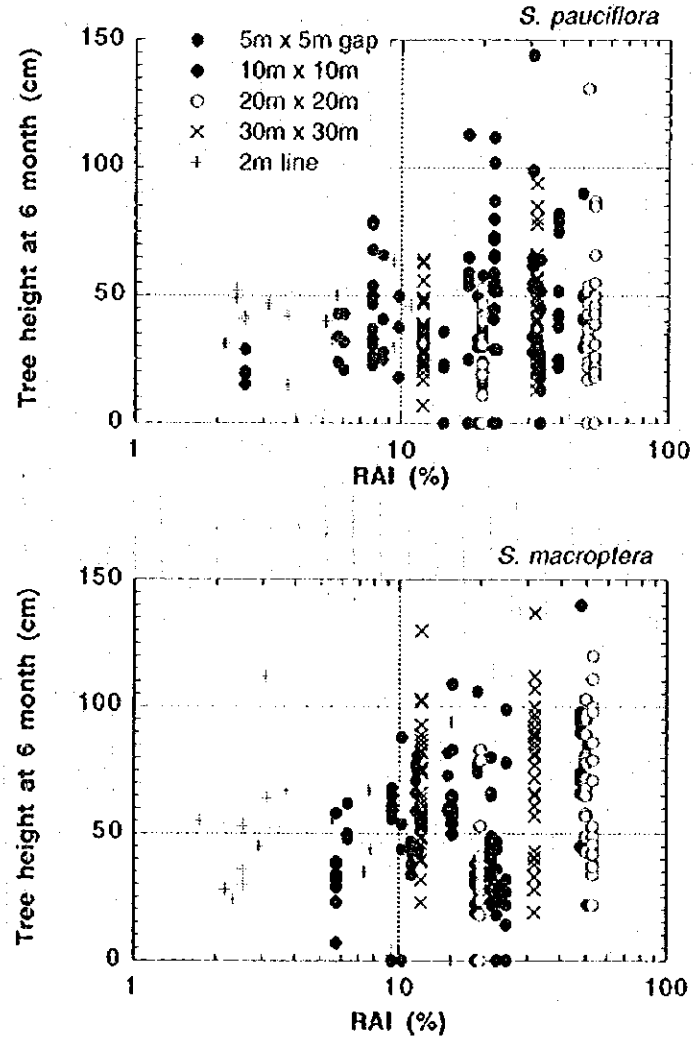


Fig. S46 Relationships between RAI and tree height at 6 month after planting in Bukit Kinta J block

5.2.2.4. Survival and growth of trees under differnt light condition within a plot.

As mentioned in former part, light conditions in GP1 type plots has a wide distribution range within a plot. In D block, RAIs were measured just above the planted seedlings. So, it is possible to examine a direct correlation between growth and survival rates of each seedling and RAI at each planting point. In this part, relationships between light conditions and survival/growth of seedlings are discussed. Part of the results are published in "Growth performance of Shorea parvifolia at 15 months after planting in a logged over hill forest" (Takai *et al.*, *in press*).

Distribution of RAI in the plot of Block D

RAI was classified into five classes based on the measurement carried out in 1994; A (5% or less), B (10% or less), C (25% or less), D (50% or less), and E (50% over). See Fig. S41 for actual distribution of RAIs in this plot. Class E made a ridge of illuminance in the centre of the block where the gap existed after clearing the bamboo jungle. However, some points showed class D of RAI near the centre of the gap because the isolated residuals provided shade.

Light condition and growth of *S. parvifolia*

The relationships between RAI at 8.5 months after planting and increment of height, number of leaves, and D^2H from 9 to 15 months after planting were shown in Figs. S47, S48, and S49 respectively. These figures indicated that the increment of each item remained constant under more than 25% of RAI, while saplings responded to the light condition sharply under less than 25% of RAI. In addition, the illuminance of less than 5% of RAI was obviously inadequate .

The relationships among items

A close relationship exists between DGH and height at 15 months irrespective of light condition ($r=0.863$, $n=67$, $p<0.0001$ Fig. S50). Correlation between leaf number at nine (9) months after planting and D^2H increment from 9 to 15 months was observed irrespective of RAI classes ($r=0.727$, $n=67$, $p<0.0001$ Fig.S51). This relationship may suggest that leaf number can be a rough indicator for its future volume increment.

Survival rate

Survival rates were 66.7% - 87.5%. There were neither significant differences among rates of the RAI classes nor any tendency according to RAI (Table.S64).

Course of height growth

Fig. S52 shows the course of the height increment of *S. parvifolia*. Classes C, D, and E grew with rapid consistency except from 9 to 12 months (November 1994 - February 1995). And there is no clear difference among these three classes up to 15 months. On the other hand, the disadvantage of class A appeared at nine months after planting and the large difference between class A and the other classes have been increasing steadily. Class B showed slower growth than classes C, D, and E at 12 months after planting and the difference increased at 15 months.

5.2.2.4. Survival and growth of trees under differnt light condition within a plot.

As mentioned in former part, light conditions in GP1 type plots has a wide distribution range within a plot. In D block, RAIs were measured just avobe the planted seedlings. So, it is possible to examine a direct correlation between growth and survival rates of each seedling and RAI at each planting point. In this part, relationships between light conditions and survival/growth of seedlings are discussed. Part of the results are published in "Growth performance of Shorea parvifolia at 15 months after planting in a logged over hill forest" (Takai *et al., in press*).

Distribution of RAI in the plot of Block D

RAI was classified into five classes based on the measurement carried out in 1994; A (5% or less), B (10% or less), C (25% or less), D (50% or less), and E (50% over). See Fig. S41 for actual distribution of RAIs in this plot. Class E made a ridge of illuminance in the centre of the block where the gap existed after clearing the bamboo jungle. However, some points showed class D of RAI near the centre of the gap because the isolated residuals provided shade.

Light condition and growth of *S. parvifolia*

The relationships between RAI at 8.5 months after planting and increment of height, number of leaves, and D^2H from 9 to 15 months after planting were shown in Figs. S47, S48, and S49 respectively. These figures indicated that the increment of each item remained constant under more than 25% of RAI, while saplings responded to the light condition sharply under less than 25% of RAI. In addition, the illuminance of less than 5% of RAI was obviously inadequate .

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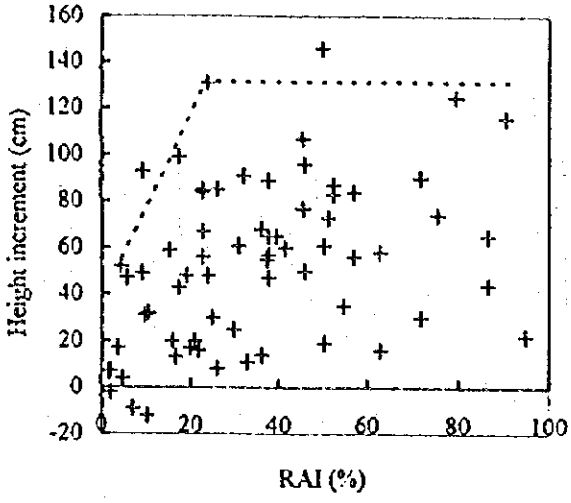

Fig. S47 Relationship between RAI and height increment (9-15 months)

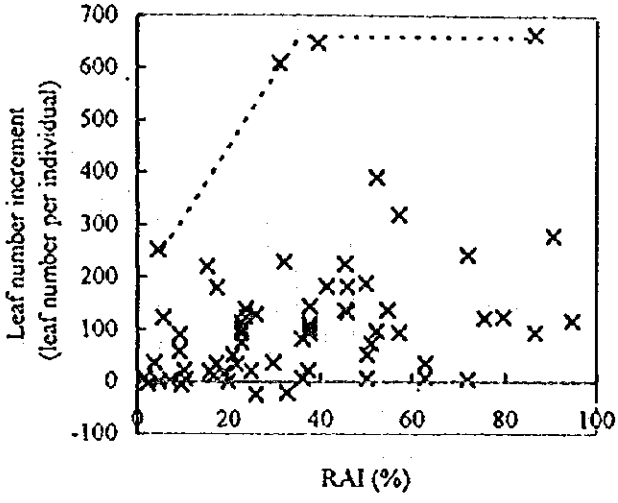

Fig. S48 Relationship between RAI and increment of number of leaves (9-15 months)

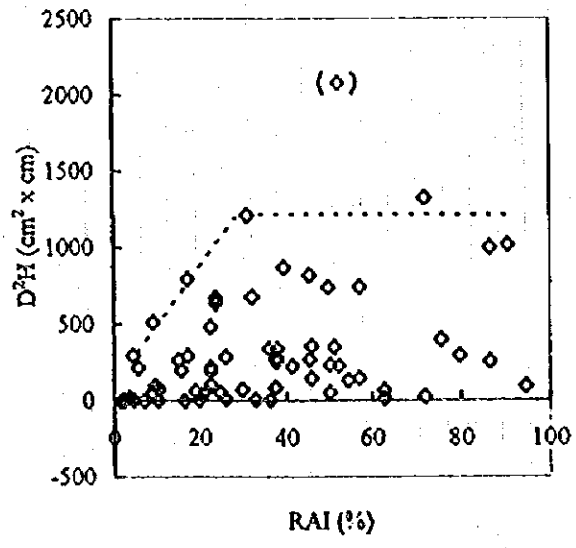

Fig. S49 Relationship between RAI and D^2H increment (9-15 months)

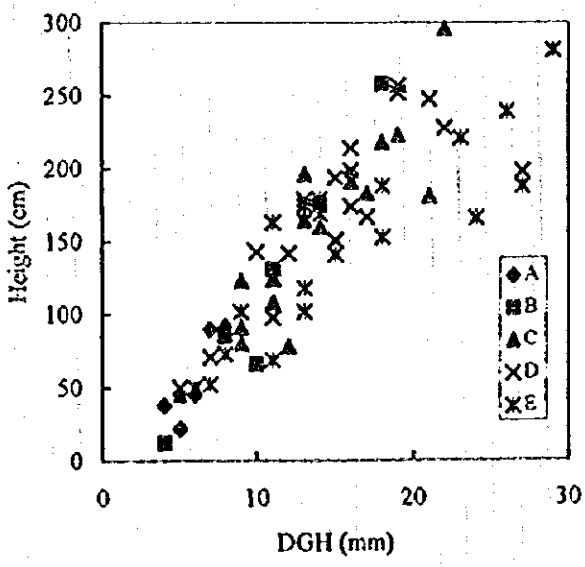

Fig. S50 Relationship between Diameter at Ground Height (DGH) and height at 15 months after planting (9-15 months)

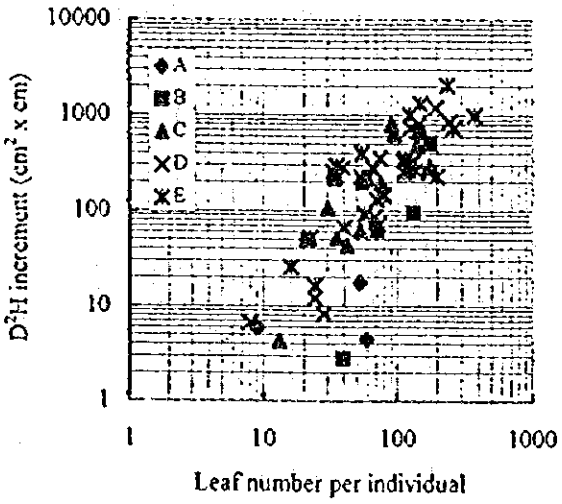

Fig. S51 Relationship between number of leaves (9 months) and D2H increment (9-15 month)

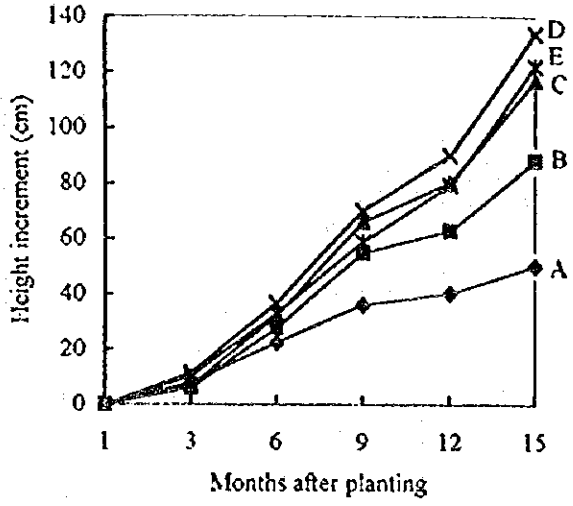

Fig. S52 Course of height increment by RAI class

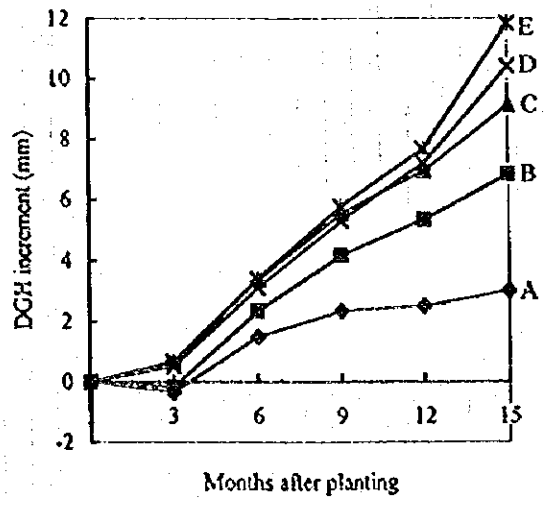

Fig. S53 Course of increment of DGH by RAI class

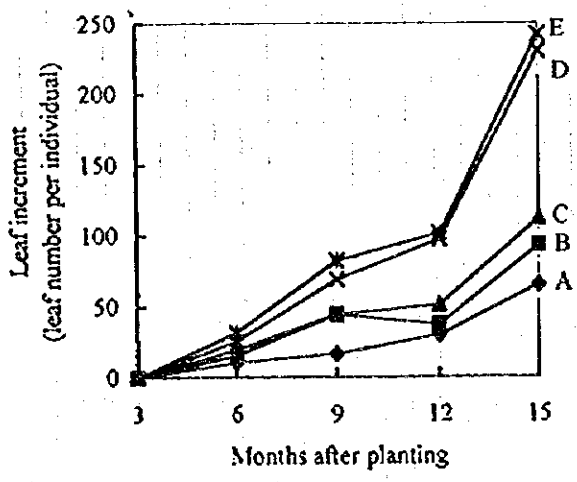

Fig. S54 Course of increment of number of leaves by RAI class

Table S64 Survival rate, mean increment of height, DGH, and number of leaves of *Shorea parvifolia* at 15 months after planting according to the RAI classes

parvifolia at 15 months after planting according to the RAI classes.

RAI class	Survival rate (%)	Height (cm)	DGH (mm)	Number of leaves	n
A>0%	87.5	50.3^{abc}	3.0^{a}_{bcd}	64.8^{ab}	6
B>5%	66.7	88.2	6.8^{a}	92.8	6
C>10%	74.1	117.2^{a}	9.1_{b}	123.9^{a}	17
D>25%	76.5	133.9^{b}	10.4_{c}	230.4	20
E>50%	83.3	122.2^{c}	11.8_{d}	242.1^{b}	18

Note: The increments of height and diameter were recorded from 1 month to 15 months after planting, and the increment of mean number of leaves per individual was recorded from 3 months to 15

The best increment was recorded by class D which increased 133.9cm from the first month to fifteenth month after planting, followed by class E and C (Table.S64). However, the differences among them were rather small though class A was significantly poor compared with class C, D, or E (p=0.0251, 0.0126, and 0.0278 respectively, Mann-Whitney test). The speed of height growth decreased slightly between the ninth and the twelfth month. It can be assumed that the shortage of rainfall in this period affected the growth rate.

Course of diameter at ground height (DGH) growth

The disadvantages of class A and B were already obvious by nine months, and since then, especially the difference between class A and the other classes has been going wider continuously (Fig.53). On the other hand, class C, D, and E had grown well, and had almost the same course.

Class A was significantly thinner than the other classes at 15 months after planting (B:p=0.0496, C:p=0.0074, D:p=0.0036, E:p=0.0025 Table S64). The tendency could be pointed out : when RAI goes higher, DGH goes thicker. until 12 months, class C, D, and E followed a similar course, and the tendency appeared clearly at 15 months after planting.

Course of leaf number increment per individual

The number of leaves of class D and E increased rapidly, and they took almost the same course (Fig.S54). The other three classes A, B, and C showed a slower increment than D and E. A clearer slowdown than height increment was observed from 9 months to 12 months after planting. Class A had the fewest leaves at 15 months and the order of leaf number increment depended on RAI (Table.S64). D and E had nearly double the leaves of class C, which was ranked third.

Discussion

Significant difference in each item between class A and other classes ($p<0.05$, Mann-Whitney test) observed 12 months after planting though class A showed poorest result at 6 months through three items already (Tables S65 and S66). The disadvantages of class A became clearer at 15 months after planting. At the same time, the position of class B looked confirmed in second from the bottom at 15 months. These facts perhaps showed that *S. parvifolia* did not respond quickly to light condition, and therefore, the evaluation of response should be done not earlier than nine months, but at least later than 12 months after planting.

Table S65 Growth of S. parvifolia planted Feb. 1994

RAI class	Height* (cm)	Diameter at Ground Height* (mm)	Number of Leaves per Individual*	n
0 % < A = < 10 %	30.3	2.4	35.0	9
10 % < B = < 25 %	54.5	3.9	128.9	15
25 % < C = < 50 %	90.6	8.8	241.8	29
50 % < D	74.3	8.2	209.8	17

Note : - * Significant difference were observed in all items (Kruskal - Wallis test, p=0.0030, 0.0002, 0.0014 respectively).

- Values were increment from nine months to eighteen months after planting.

Table S66 p values tested with Mann-Whitney U test

RAI class	Item	A	B	C	D
A	Height	-	*0.0736*	**0.0024**	**0.0191**
	DGH	-	*0.2967*	**0.0006**	**0.0049**
	Leaves	-	*0.690*	**0.0006**	**0.0033**
B	Height		-	**0.0100**	0.2058
	DGH		-	**0.0011**	**0.0206**
	Leaves		-	**0.0235**	*0.1127*
C	Height			-	*0.2366*
	DGH			-	*0.5603*
	Leaves			-	*0.5166*

Note : -*Italic* letters express insignificant for 5 % level of significance.

-Normal letters express the significant difference for 5 % level.

-Bold letters express the significant difference for 1 % level.

According to the field observation, saplings under 5% or less of RAI looked not vital but stable: they had less shoots, and colour of leaves were rather dark. They managed to survive even under the light condition of class A or under 5% or less of RAI, but it might be inadequate to grow up. When it comes to class B or 5-10% of RAI, the growth of saplings was improved although the growth speed was slower than the brighter classes. Turner (1989) reported that three species include two *Dipterocarpaceae* grew significantly faster under 12% in relative Photosynthetically Active Radiation (PAR) than 1% or 6% in relative PAR. This finding fits to the result of this study because of the small difference between RAI and relative PAR (Matsumoto 1995).

Relative illuminance at the floor in natural forest is usually about 2% and often measured 1% or less (Sasaki & Mori 1981, Matsumoto 1995). In addition, plants tend to make gaps smaller. Therefore it seems to be easy to fall into less than 5% in logged over forest if clearing width is not wide enough. And it should be remembered that *S. parvifolia* would perish after a few years later under the inadequate light (Appanah & Weinland 1993).

On the other hand, there is no obvious reduction under bright condition up to nearly full sunlight (Figs.S47, S48, and S49). Class E, more than 50% of RAI, was the second in height growth, and the best in both DGH and number of leaves (Figs.S52, S53, and S54). However the reduction of growth and high mortality under strong light of some dipterocarps was reported in certain experiments both in nurseries and fields (Sasaki & Mori 1981, Ashton & De Zoysa 1989, Iwasa *et al.* 1993, Ueda *et al.* 1995). One of the reasons for this difference between the result of this study and previous works was possibly that the milder climate of this site e.g. cooler temperature and higher humidity than lowland affected the adaptability of *S. parvifolia* to the exposure. The adaptability to high RAI maybe suggests that *S. parvifolia* is able to survive and maintain its fair growth under wide openings in hill forests. It probably meant that the wide opening for planting *S. parvifolia* is less dangerous than over shading in hill forest. To achieve the target of the experiment, further information such as the relationship between RAI and opening width, its alteration, and also growth speed of weedy plants according to the opening would be required.

The light conditions of the logged over forest are varied and will alter at each planting point. Therefore the wide adaptability of the saplings to various light condition would be an important and desirable character for successful enrichment planting and it may help to broaden the choice of planting site and planting specification. *S. parvifolia* should be one of the most preferable species from this point of view: it showed the ability to grow up from 10% of RAI to nearly full sunlight in this study. Hence when *S. parvifolia* will be planted in hill forest, we should only care the opening not to fail into less than 10% of RAI at least up to 15 months after planting.

5.2.3. Conclusion

The result of 6 species at one year after planting in Bukit Kinta is summarized in Table S67. This table show all species by each planting method within one year after planting. Each column shows value (e.g. *S. parvifolia* were planted A-G Block. Value was calculated by survival trees at one year /all planted trees) Each result show satisfactory performance both survival rate and height growth of almost all species while survival rate of *S. curtisii* dropped less than 50%. And that

Table S67 Survival rates and mean height at one year after planting for all the species planted in each planting type in Bukit Kinta site

year	type	Gap planting						Line planting		
		GP-1	GP-2				control	2m	10m	20m
			(5m)	(10m)	(20m)	(30m)	(20m)			
survival rate(%)										
93	S. parvifolia	72								
94	D. baudii	85								
94	S. curtisii	48								
94	S. leprosura	76				50				
94	S. macroptera	77	88	85	86	75	85	84	87	85
94	S. pauciflora	65	66	76	76	67	66	77	78	88
Mean height(m)										
93	S. parvifolia	0.77								
94	D. baudii	1.05								
94	S. curtisii	0.97								
94	S. leprosura	1.27				1.01				
94	S. macroptera	1.13	0.92	0.85	0.91	0.98	0.56	0.95	0.92	0.86
94	S. pauciflora	0.86	0.53	0.90	0.68	0.74	0.27	0.69	0.93	0.79

almost all planting methods show satisfactory performance except *control plots* .

These results are collected only one year after planting. And in this case other factors were not measured such as soil, vegetation, canopy height and so on, however, we could conclude it as a main factor to grasp relation between gap condition and tree growth with excluding other factors.

This study suggests that gap planting methods (including strip planting) proved as effective way of planting in first stage if seedlings can get sufficient light more than 10%. Hereafter, it should be looked into optimum gap size not only on growth but also on costing to introduce MSF in Logged over Forest.

As time goes by, gap getting smaller and smaller as well as Line Planting. At that time how to influence on planted trees and its growth by such affects will be needed to be looked into. On the other hand cost analysis including weeding treatment would be a practical subject. Therefore, further long-term maintainance and observation of experimental plots will be needed.

5.2.4. Other studies

5.2.4.1. Soil condition

For planting, soil is an important element in the circumstances of the forest for it is the base on which the forest stands and it reflects the influences of many circumstantial elements. From January 1993 to February 1993 (before planting started)and from September 1993 to Novemver 1993(C, D, and G Block) soil survey was conducted by short-term expert S. Aizawa.

Slopes are so steep that soft surface soil will be easily removed and hard clay accumulated horizons will appear on the surface if the ground surface is disturbed by harvesting . there are no vegetation on naked clay horizons because they are too hard for plants to grow . Thus, for afforestation, these places should be excluded. Harvesting and site preparation should be carried out carefully as not to remove soft surface horizons.

5.2.4.2. Mycorryza

It is acknowledged that there are correlations between Mycorrhizal fungi and growth of dipterocarps . The study of mycorrhizal fungi was conducted by Dr. M. Ogawa, short-term expert, in June 1995. In block D, the infection of *Scleroderma* spp. was observed frequently. The relationship between the infection and height was shown in Fig.S55.

35 trees are measured in D block. The most of mycorryza on roots of *S. parvifolia* are Scleroderma, however, Laccaria and other mycorryza also can be found. As a result of the survey, the importance of the infection of mycorrhizal fungi in nursery should be emphasized in order to contribute to the vital growth irrespective of the soil conditions.

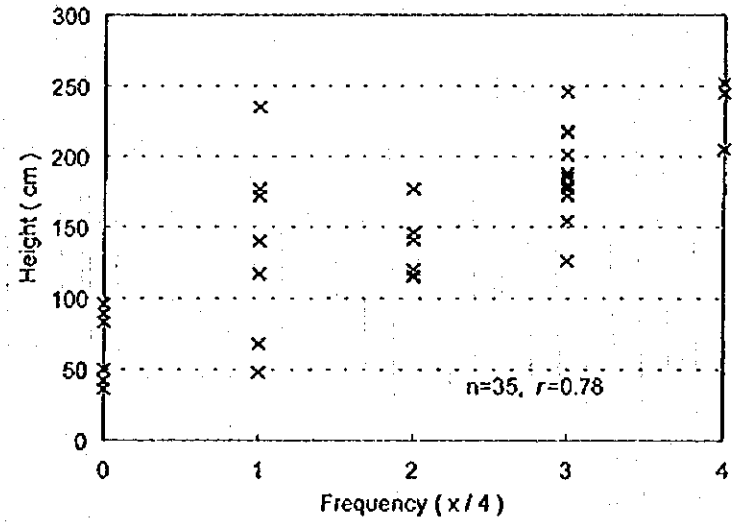

Fig. S55 Relationship between frequency of the appearance of mycorrhizal fungi and height of Shorea parvifolia at 15 months after planting

6. CONCLUSION

6.1. Recommendable Planting Design

In Chikus site, underplanting is superior to openplanting. Difference between underplanting in *Acacia mangium* plantation and underplanting in Belukar is not clear so far. Influence of planting direction (EW or NS) on the growth of trees is not clear as well. Among the design in underplanting in *Acacia mangium* plantation, B to C type, where the planting strip width was equivalent to 1 - 1.5 times the surrounding tree height, and the RAIs were 30 - 70 %, can be generally concluded as an optimum planting designs. Optimum design is different by species. Table S68 shows the evaluation of optimum planting design on underplanting in *Acacia mangium* plots at 12 months after planting.

In Bukit Kinta, *S. parvifolia* corresponds with light condition especially under 10% sharply, over 10% RAI seedlings had not correspondings with light, and that over exposure seedlings had hardly seen dead and no growth. Moreover, too dark condition affected badly on both *S. macroptera* and *S. pauciflora* were observed. Hence, it should be concentrated on so as not to be too dark condition in site preparation were suggested. Therefore light condition can be considered as main environmental factor on seedlings.

However, introducing RAI method as grasping light conditions to silvicultural operation is improper way, hemisphere openness has correlation with light condition (RAI value) as mentioned before and would be more convenient parameter, thus it is recommendable that introducing openness into silvicultural operation. Furthermore, in the case of remaining trees it is difficult to grasp gap condition and it can be considered to be one of parameters to grasp gap condition.

6.2. Recommendable Planting Species

By comparing survival and growth at one year after planting, we can evaluate the performances of each species (Tables S69 and S70). Based on the tables, following species are recommendable species for afforestation in Chikus site;

1) In terms of high survival rate (more than 80 %); *Hopea odorata, Neobalanocarpus heimii, Shorea assamica, Shorea bracteolata, Shorea leprosula, Shorea macroptera, Shorea ovalis, Shorea parvifolia, Shorea talura*

2) In terms of high height growth (more than 1 m); *Dryobalanops aromatica, Hopea odorata, Pentaspadon motleyi, Shorea acuminata, Shorea glauca, Shorea leprosula, Shorea macroptera, Shorea multiflora, Shorea ovalis, Shorea ovata, Shorea parvifolia, Shorea pauciflora, Shorea talura*

3) In terms of both Survival and Height growth; *Hopea odorata, Shorea leprosula, Shorea*

Table S68 Evaluation among Planting Designs and Species in Underplanting in Acacia mangium Plots at 12 months after Planting

	Absolute Value				Relative Value				
Species	SURVIVAI SR>80%	HEIGHT H>1.0	DIAMETEI D>1.0	BPU BPU>1	SURVIVAI RI>1.2	HEIGHT RI>1.2	DIAMETEI RI>1.2	BPU RI>1.2	TOTAL Evaluatic
Dipterocarpus cornutus			B		A	B	B	AB	AB
Dryobalanops aromatica		C			ABCD	AC		AC	ABC
Hopea odrata	ACD	ABCD	ABCDE	ABCDE		C	C	C	C
Hopea pubescens									
Intsia palembanica			C	C	ABC			BC	BC
Neobalanocarpus heimi	ABC				ABC				ABC
Palaquium gutta					ABCD			A	A
Parashorea densiflora			C		ABCD	ABCD	ABCD	ABCD	ABCD
Pentaspadon motleyi		C	C		ABCD	ABCD	BCD	ABCD	BCD
Shorea acuminata		ABCD	ACD		ABC	ABCD	D	ABC	ABC
Shorea assamica	A		ABCD		ABCD		D	ABCD	ABCD
Shorea glauca					AD	AC		A	A
Shorea leprosula	ABCD	ABCD	ABCDE	ABCDE	ABCD	ABCD	ABCD	ABCD	ABCD
Shorea macroptera					AB			AB	AB
Shorea ovalis		ABCD	BCDE	ABD	AB		D		AB
Shorea ovata		A			ABCD	ABCD	ABCD	ABCD	ABCD
Shorea parvifolia	AB	ABC	ABC	ABC	ABCD	ABC		ABCD	ABC
Shorea pauciflora		B	B	B	AB	B	B	B	B

Table S69 Evaluation on Survial Rate among Planting Designs and Species in Chikus site at 12 months after planting

			Underplanting in Acacia mangium plantation										Underplanting in Belukar			Openplanting					Arboretum
			A		B		C		D		E		F	G	H	A	B	C	D	E	x
Species	Site	Year	EW	NS	EW	NS	EW	NS	EW	NS	EW	NS	EW	EW	EW	EW	EW	EW	EW	EW	x
Agathis borneensis	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4%
Alstonia sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74%
Calophyllum sp.	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	3%	0%	7%	1%	0%	-
Cinnamomum sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72%
Dacryodes sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9%
Dialium sp.	Belukar	94	-	-	-	-	-	-	-	-	-	-	76%	79%	-	-	-	-	-	-	-
Dipterocarpus cornutus	Acacia	94	75%	-	58%	-	59%	-	49%	-	56%	-	-	-	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6%
Dryobalanops aromatica	Acacia	93	53%	37%	24%	53%	32%	53%	31%	28%	24%	7%	-	-	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	5%	0%	8%	0%	4%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13%
Durio sp.	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53%
Endospermum malaccense	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	12%	6%	28%	0%	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29%
Gonystylus sp.	Belukar	94	-	-	-	-	-	-	-	-	-	-	81%	80%	-	-	-	-	-	-	-
Horsfieldia sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25%
Hevea brasiliensis	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15%
Hopea odorata	Acacia	93	81%	-	76%	-	90%	-	85%	-	76%	-	-	-	-	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	77%	72%	69%	78%	87%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70%
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86%
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37%
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38%
Hopea pubescens	Acacia	94	44%	-	51%	-	23%	-	51%	-	50%	-	-	-	-	-	-	-	-	-	-
Intsia palembanica	Acacia	94	66%	-	79%	-	72%	-	54%	-	50%	-	-	-	-	-	-	-	-	-	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20%
Koompassia malaccensis	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1%
Neobalanocarpus heimii	Acacia	92	97%	79%	41%	87%	71%	81%	59%	64%	55%	65%	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	77%	64%	70%	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	30%	13%	25%	27%	36%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46%
Palaquium gutta	Acacia	93	78%	-	45%	-	30%	-	24%	-	10%	-	-	-	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5%
Parashorea densiflora	Acacia	93	62%	-	67%	-	47%	-	46%	-	9%	-	-	-	-	-	-	-	-	-	-
Parkia sp.	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22%
Pentaspadon motleyi	Acacia	93	50%	4%	68%	13%	54%	30%	36%	15%	10%	-	-	-	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	2%	0%	0%	11%	6%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10%
Pouteria malaccensis	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	2%	0%	0%	-
Scaphium macropodum	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	4%	12%	3%	0%	17%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32%
Shorea acuminata	Acacia	93	72%	20%	59%	33%	55%	69%	34%	28%	33%	31%	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	45%	22%	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	9%	0%	0%	0%	7%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8%
Shorea assamica	Acacia	94	80%	-	70%	-	63%	-	54%	-	40%	-	-	-	-	-	-	-	-	-	-
Shorea bracteolata	Belukar	94	-	-	-	-	-	-	-	-	-	-	91%	76%	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	8%	2%	21%	27%	22%	-
Shorea gibbosa	Belukar	94	-	-	-	-	-	-	-	-	-	-	76%	87%	-	-	-	-	-	-	-
Shorea glauca	Acacia	93	52%	-	-	-	11%	-	21%	-	15%	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	72%	55%	-	-	-	-	-	-	-
Shorea leprosula	Acacia	92	88%	65%	90%	99%	75%	92%	70%	82%	58%	53%	-	-	-	-	-	-	-	-	-
		94	-	-	-	-	65%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	58%	61%	69%	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	9%	7%	25%	1%	14%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13%
Shorea macroptera	Acacia	93	57%	-	63%	-	45%	-	9%	-	17%	-	-	-	-	-	-	-	-	-	-
		94	-	-	-	-	80%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38%
Shorea multiflora	Belukar	94	-	-	-	-	-	-	-	-	-	-	60%	60%	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2%
Shorea ovalis	Acacia	94	74%	-	75%	-	41%	-	45%	-	58%	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	73%	76%	85%	-	-	-	-	-	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18%
Shorea ovata	Acacia	94	45%	-	42%	-	13%	-	19%	-	11%	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	24%	18%	22%	-	-	-	-	-	-
Shorea parvifolia	Acacia	92	88%	86%	65%	85%	75%	66%	53%	51%	38%	54%	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	65%	51%	36%	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	24%	14%	12%	38%	15%	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4%
Shorea pauciflora	Acacia	94	72%	-	56%	-	35%	-	24%	-	36%	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	68%	58%	53%	-	-	-	-	-	-
Shorea teluta	Belukar	94	-	-	-	-	-	-	-	-	-	-	100%	97%	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60%
Sindora sp.	Belukar	94	-	-	-	-	-	-	-	-	-	-	70%	59%	-	-	-	-	-	-	-
Swietenia macrophylla	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21%
Tectona grandis	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	91%
Toona surani	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33%

Table S70 Evaluation on Height Growth among Planting Designs and Species in Chikus site at 12 months after planting (unit

			Underplanting in Acacia mangium plantation										Underplanting in Belukar			Openplanting					Arboretum
			A		B		C		D		E		F	G	H	A	B	C	D	E	x
Species	Site	Year	EW	NS	EW	NS	EW	NS	EW	NS	EW	NS	EW	EW	EW	EW	EW	EW	EW	EW	x
Agathis borneensis	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.49
Alstonia sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.57
Calophyllum sp.	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0.53	x	0.38	0.08	x	-
Cinnamomum sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.67
Dacryodes sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20
Diatum sp.	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.69	0.75	-	-	-	-	-	-	-
Dipterocarpus cornutus	Acacia	94	0.81	-	0.88	-	0.59	-	0.73	-	0.73	-	-	-	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.22
Dryobalanops aromatica	Acacia	93	0.99	0.80	0.68	0.83	1.02	0.96	0.84	0.78	0.80	0.75	-	-	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0.80	x	0.57	x	0.55	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.54
Durio sp.	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.74
Endospermum malaccense	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	x	0.51	0.49	0.68	x	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.53
Gonystylus sp.	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.85	0.79	-	-	-	-	-	-	-
Heritiera sp.	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30
Hevea brasiliensis	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.45
Hopea odorata	Acacia	93	1.01	-	1.03	-	1.26	-	1.08	-	0.94	-	-	-	-	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	0.59	0.59	0.71	0.45	0.68	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.62
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.69
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.65
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.40
Hopea pubescens	Acacia	94	0.54	-	0.69	-	0.47	-	0.80	-	0.80	-	-	-	-	-	-	-	-	-	-
Intsia palembanica	Acacia	94	0.79	-	0.82	-	0.86	-	0.65	-	0.75	-	-	-	-	-	-	-	-	-	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.70
Koompassia malaccensis	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19
Neobalanocarpus heimii	Acacia	92	0.62	0.64	0.63	0.67	0.59	0.65	0.49	0.57	0.55	0.56	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.85	0.86	0.85	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	0.45	0.37	0.40	0.34	0.37	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50
Palaquium gutta	Acacia	93	0.55	-	0.31	-	0.44	-	0.35	-	0.46	-	-	-	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.33
Pareshorea densiflora	Acacia	93	0.82	-	0.77	-	0.98	-	0.64	-	0.38	-	-	-	-	-	-	-	-	-	-
Parkia sp.	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.63
Pentaspadon motleyi	Acacia	93	0.81	0.41	0.96	0.53	1.14	0.69	0.88	0.77	0.62	-	-	-	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0.53	x	x	0.50	0.34	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.45
Poutaria malaccana's	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	0.16	x	0.25	-
Scaphium macropodum	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20	0.26	0.34	x	0.27	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.31
Shorea acuminata	Acacia	93	1.23	0.63	1.24	0.76	1.18	0.74	1.14	0.71	0.90	0.77	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.88	0.78	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0.45	x	x	x	0.51	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.54
Shorea assamica	Acacia	94	0.71	-	0.69	-	0.77	-	0.94	-	0.81	-	-	-	-	-	-	-	-	-	-
Shorea bracteolata	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.63	0.54	-	-	-	-	-	-	-
	Open	93	-	-	-	-	-	-	-	-	-	-	-	-	-	0.41	0.57	0.36	0.33	0.36	-
Shorea gibbosa	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.76	0.76	-	-	-	-	-	-	-
Shorea glauca	Acacia	93	0.60	-	-	-	0.66	-	0.42	-	0.43	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.48	1.24	-	-	-	-	-	-	-
Shorea leprosula	Acacia	92	1.43	1.47	1.68	1.55	1.31	1.14	1.03	1.23	0.92	0.76	-	-	-	-	-	-	-	-	-
		94	-	-	-	-	1.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.62	1.37	1.44	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38	0.38	0.70	0.39	0.38	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.31
Shorea macroptera	Acacia	93	0.67	-	0.68	-	0.52	-	0.52	-	0.72	-	-	-	-	-	-	-	-	-	-
		94	-	-	-	-	1.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.66
Shorea multiflora	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.14	0.87	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.24
Shorea ovalis	Acacia	94	1.00	-	1.01	-	0.99	-	1.01	-	0.89	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.48	1.23	1.34	-	-	-	-	-	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.54
Shorea ovata	Acacia	94	1.05	-	0.88	-	0.71	-	0.80	-	0.48	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.94	0.93	0.68	-	-	-	-	-	-
Shorea parvifolia	Acacia	92	1.17	1.15	1.19	1.21	0.98	1.17	0.69	0.86	0.86	0.84	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.24	1.12	1.06	-	-	-	-	-	-
	Open	92	-	-	-	-	-	-	-	-	-	-	-	-	-	0.60	0.44	0.44	0.43	0.37	-
	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.41
Shorea pauciflora	Acacia	94	0.85	-	1.03	-	0.71	-	0.73	-	0.79	-	-	-	-	-	-	-	-	-	-
	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.21	1.17	1.07	-	-	-	-	-	-
Shorea telura	Belukar	94	-	-	-	-	-	-	-	-	-	-	1.07	1.14	-	-	-	-	-	-	-
	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34
Sindora sp.	Belukar	94	-	-	-	-	-	-	-	-	-	-	0.53	0.59	-	-	-	-	-	-	-
Swietenia macrophylla	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.67
Tectona grandis	Arboretum	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.61
Teona sureni	Arboretum	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.46

macroptera, Shorea ovalis, Shorea parvifolia, Shorea talura

In Bukit Kinta site, recommendable species can be selected from the results of measurement within one year after planting.

High survival rate (more than 80%)	: *D. baudii, S. macroptera*
High height growth (more than 60cm)	: *D. baudii, S. leprosura*
common	: *D. baudii*

Six species (*D. baudii, S. curtisii, S. leprosura, S. macroptera, S. parvifolia, S. pauciflora*) were planted in 1994 and 1995. We chose recommendable species from the results in Bukit Kinta in first year. Among these species, *D. baudii* shows best performance on both survival rate and growth performance. This seedling is only one which was collected in Bukit Kinta where it is near the planted area and nursed in Chikus nursery and then planted. This result suggests effectiveness of indigenous species. Other species except *S. curtisii* show good performance in first year so that 5 species can be expected as effective species to plant.

6.3. Recommendable Planting Season

It is recommendable to select a suitable planting season based on local meteorological data. The ideal time for the Chikus sites is from early October to early December because of its high precipitation.

7. OTHERS

7.1. Forest Fire

We have faced forest fire three times; July - August 1994 for the first in Chikus site, October 1994 for the second time in Bukit Kinta site, and June 1996 for the third time in Chikus site.

In bukit Kinta a forest fire took place in June 1994. In B block (0.26ha) the fire occurred and spread 0.38ha. Total of 206 seedlings of *S. parvifolia* planted in May 1994 were burned. Only 31 seedlings were still alive mainly seedlings planted on logging road. And regenerating saplings of *S. curtisii* also almost burnt at that time. The area were re-planted soon. In 1996, @6 plots of 3.8 ha in Chikus Block-A was burnt.

We should pay most attention to the prevention of forest fire. Once it spread over the project site, all our efforts would be in vain. We had established fire prevention system. Enlightenment of the public awareness is essential as well.

7.2. Commemorative Planting

We have received many visitors not only from Peninsular Malaysia but also all over the world. It was very good opportunity for the popularization and propaganda of the project.

Some of the visitors planted seedlings in the Chikus site as their commemorative activities. The survival and growth were not so well in Block-A due to the harsh environment.

Appendix S1 Measurement Date of Underplanting in Acacia mangium Plots

Block	Year	Species	Type	Direction	Date Planted	Measurement date 1st	2nd	3rd	4th	5th	6th
B	94	Dipterocarpus cornutus	A	EW	18-Mar-95	16-Apr-95	14-Sep-95	25-Mar-96			
B	94	Dipterocarpus cornutus	B	EW	14-Mar-95	30-Apr-95	13-Sep-95	25-Mar-96			
B	94	Dipterocarpus cornutus	C	EW	12-Feb-95	26-Apr-95	18-Aug-95	07-Mar-96			
B	94	Dipterocarpus cornutus	D	EW	09-Feb-95	17-Apr-95	15-Aug-95	06-Mar-96			
B	94	Dipterocarpus cornutus	E	EW	06-Feb-95	15-Apr-95	05-Aug-95	26-Feb-96			
B	93	Dryobalanops aromatica	A	EW	10-Feb-94	03-Apr-94	12-Aug-94	11-Feb-95	12-Aug-95		
B	93	Dryobalanops aromatica	B	EW	23-Mar-94	30-Apr-94	22-Sep-94	23-Mar-95	27-Sep-95		
B	93	Dryobalanops aromatica	B	EW	22-Mar-94	04-May-94	20-Sep-94	23-Mar-95	27-Sep-95		
B	93	Dryobalanops aromatica	C	EW	07-Mar-94	08-Apr-94	06-Sep-94	10-Mar-95	05-Sep-95		
B	93	Dryobalanops aromatica	D	EW	06-Mar-94	18-Apr-94	03-Sep-94	09-Mar-95	05-Sep-95		
B	93	Dryobalanops aromatica	E	EW	04-Apr-94	16-Jul-94	03-Oct-94	03-Apr-95	07-Oct-95		
B	93	Dryobalanops aromatica	A	NS	09-May-94	19-Jul-94	15-Nov-94	06-May-95	14-Nov-95		
B	93	Dryobalanops aromatica	B	NS	08-May-94	18-Jul-94	10-Nov-94	16-May-95	09-Nov-95		
B	93	Dryobalanops aromatica	C	NS	12-Apr-94	19-Jul-94	10-Oct-94	10-Apr-95	12-Oct-95		
B	93	Dryobalanops aromatica	D	NS	09-Apr-94	20-Jul-94	06-Oct-94	06-Apr-95	11-Oct-95		
B	93	Dryobalanops aromatica	E	NS	07-Apr-94	21-Jul-94	05-Oct-94	06-Apr-95	10-Oct-95		
B	93	Hopea odorata	A	EW	26-Mar-94	14-Apr-94	21-Sep-94	29-Mar-95	28-Sep-95		
B	93	Hopea odorata	A	EW	25-Mar-94	14-Apr-94	28-Sep-94	27-Mar-95	28-Sep-95		
B	93	Hopea odorata	B	EW	22-Mar-94	18-Apr-94	20-Sep-94	22-Mar-95	28-Sep-95		
B	93	Hopea odorata	C	EW	27-Mar-94	26-Apr-94	26-Sep-94	30-Mar-95	03-Oct-95		
B	93	Hopea odorata	C	EW	21-Mar-94	26-Apr-94	19-Sep-94	22-Mar-95	28-Sep-95		
B	93	Hopea odorata	D	EW	27-Mar-94	25-Apr-94	26-Sep-94	28-Mar-95	30-Sep-95		
B	93	Hopea odorata	E	EW	03-Apr-94	16-Jul-94	03-Oct-94	31-Mar-95	05-Oct-95		
B	93	Hopea odorata	E	EW	09-May-94	19-Jul-94	09-Nov-94	23-May-95	14-Nov-95		
B	94	Hopea pubescens	A	EW	14-Mar-95	17-Apr-95	13-Sep-95	25-Mar-96			
B	94	Hopea pubescens	B	EW	22-Feb-95	30-Apr-95	29-Aug-95	14-Mar-96			
B	94	Hopea pubescens	C	EW	13-Feb-95	26-Apr-95	28-Aug-95	12-Mar-96			
B	94	Hopea pubescens	D	EW	10-Feb-95	17-Apr-95	15-Aug-95	07-Mar-96			
B	94	Hopea pubescens	E	EW	06-Feb-95	13-Apr-95	10-Aug-95	28-Mar-96			
B	94	Intsia palembanica	A	EW	09-Mar-95	17-Apr-95	07-Sep-95	27-Mar-96			
B	94	Intsia palembanica	B	EW	10-Mar-95	30-Apr-95	07-Sep-95	25-Mar-96			
B	94	Intsia palembanica	C	EW	13-Feb-95	26-Apr-95	28-Aug-95	11-Mar-96			
B	94	Intsia palembanica	D	EW	10-Feb-95	17-Apr-95	15-Aug-95	07-Mar-96			
B	94	Intsia palembanica	E	EW	07-Feb-95	13-Apr-95	07-Aug-95	28-Feb-96			
B	92	Neobalanocarpus heimii	A	EW	28-Oct-92	29-Jun-93	19-Oct-93	27-Apr-94	29-Oct-94	27-Apr-95	26-Oct-95
B	92	Neobalanocarpus heimii	B	EW	28-Nov-92	29-Jun-93	23-Oct-93	25-May-94	22-Nov-94	01-Jun-95	skip
B	92	Neobalanocarpus heimii	C	EW	28-Oct-92	30-Jun-93	20-Oct-93	27-Apr-94	01-Nov-94	28-Apr-95	25-Oct-95
B	92	Neobalanocarpus heimii	D	EW	29-Oct-92	30-Jun-93	20-Oct-93	04-May-94	01-Nov-94	27-Apr-95	28-Oct-95
B	92	Neobalanocarpus heimii	E	EW	12-Nov-92	17-Jul-93	21-Oct-93	13-May-94	18-Nov-94	30-May-95	15-Nov-95
B	92	Neobalanocarpus heimii	A	NS	03-Nov-92	25-Jun-93	27-Oct-93	04-May-94	08-Nov-94	04-May-95	02-Nov-95
B	92	Neobalanocarpus heimii	B	NS	28-Nov-92	25-Jun-93	26-Oct-93	23-May-94	23-Nov-94	23-May-95	30-Nov-95
B	92	Neobalanocarpus heimii	C	NS	28-Nov-92	25-Jun-93	27-Oct-93	23-May-94	21-Nov-94	23-May-95	30-Nov-95
B	92	Neobalanocarpus heimii	D	NS	28-Nov-92	25-Jun-93	27-Oct-93	26-May-94	23-Nov-94	06-Jun-95	02-Dec-95
B	92	Neobalanocarpus heimii	E	NS	29-Oct-92	05-Jul-93	20-Oct-93	28-Apr-94	04-Nov-94	02-May-95	28-Oct-95
B	93	Palaquium gutta	A	EW	09-Feb-94	02-Apr-94	11-Aug-94	08-Feb-95	11-Aug-95		
B	93	Palaquium gutta	B	EW	11-Feb-94	04-Apr-94	13-Aug-94	13-Feb-95	17-Aug-95		
B	93	Palaquium gutta	C	EW	07-Mar-94	07-Apr-94	07-Sep-94	11-Mar-95	06-Sep-95		
B	93	Palaquium gutta	D	EW	08-Mar-94	13-Apr-94	07-Sep-94	13-Mar-95	06-Sep-95		
B	93	Palaquium gutta	E	EW	01-Apr-94	18-Jul-94	03-Oct-94	04-Mar-95	05-Oct-95		
B	93	Parashorea densiflora	A	EW	28-Mar-94	14-Apr-94	24-Sep-94	27-Mar-95	29-Sep-95		
B	93	Parashorea densiflora	B	EW	23-Mar-94	04-May-94	23-Sep-94	23-Mar-95	27-Sep-95		
B	93	Parashorea densiflora	C	EW	05-Mar-94	08-Apr-94	01-Sep-94	08-Mar-95	04-Sep-95		
B	93	Parashorea densiflora	D	EW	08-Mar-94	07-May-94	08-Sep-94	11-Mar-95	06-Sep-95		
B	93	Parashorea densiflora	E	EW	03-Apr-94	16-Jun-94	04-Oct-94	05-Mar-95	06-Oct-95		
B	93	Pentaspadon motleyi	A	EW	10-Feb-94	04-Apr-94	11-Aug-94	11-Feb-95	12-Aug-95		
B	93	Pentaspadon motleyi	B	EW	13-Feb-94	05-Apr-94	13-Aug-94	14-Feb-95	26-Aug-95		
B	93	Pentaspadon motleyi	C	EW	07-Mar-94	08-Apr-94	06-Sep-94	10-Mar-95	05-Sep-95		
B	93	Pentaspadon motleyi	D	EW	06-Mar-94	13-Apr-94	05-Jul-94	09-Mar-95	05-Sep-95		
B	93	Pentaspadon motleyi	E	EW	05-Apr-94	16-Jul-94	04-Oct-94	05-Mar-95	07-Oct-95		
B	93	Pentaspadon motleyi	A	NS	18-May-94	19-Jul-94	15-Nov-94	08-May-95	23-Nov-95		
B	93	Pentaspadon motleyi	B	NS	17-May-94	18-Jul-94	23-Nov-94	16-May-95	skip		
B	93	Pentaspadon motleyi	C	NS	13-Apr-94	19-Jul-94	12-Oct-94	10-Apr-95	11-Oct-95		
B	93	Pentaspadon motleyi	D	NS	11-Apr-94	20-Jul-94	08-Oct-94	10-Apr-95	11-Oct-95		
B	93	Pentaspadon motleyi	E	NS	10-May-94	20-Jul-94	16-Nov-94	07-May-95	18-Nov-95		
B	93	Shorea acuminata	A	EW	09-Feb-94	02-Apr-94	12-Aug-94	08-Feb-95	11-Aug-95		
B	93	Shorea acuminata	B	EW	11-Feb-94	04-Apr-94	12-Aug-94	13-Feb-95	17-Aug-95		
B	93	Shorea acuminata	C	EW	02-Mar-94	05-Apr-94	29-Aug-94	08-Mar-95	30-Aug-95		
B	93	Shorea acuminata	D	EW	03-Mar-94	13-Apr-94	29-Aug-94	08-Mar-95	01-Sep-95		
B	93	Shorea acuminata	E	EW	01-Apr-94	18-Jul-94	01-Oct-94	04-Mar-95	05-Oct-95		
B	93	Shorea acuminata	A	NS	12-May-94	19-Jul-94	15-Nov-94	06-May-95	21-Nov-95		
B	93	Shorea acuminata	B	NS	08-May-94	18-Jul-94	10-Nov-94	08-May-95	09-Nov-95		
B	93	Shorea acuminata	C	NS	11-Apr-94	21-Jul-94	10-Oct-94	11-Apr-95	11-Oct-95		
B	93	Shorea acuminata	D	NS	07-Apr-94	20-Jul-94	05-Oct-94	05-Apr-95	11-Oct-95		
B	93	Shorea acuminata	E	NS	06-Apr-94	21-Jul-94	05-Oct-94	06-Apr-95	10-Oct-95		
B	94	Shorea assamica	A	EW	17-Mar-95	16-Apr-95	20-Sep-95	03-Apr-96			
B	94	Shorea assamica	B	EW	16-Mar-95	30-Apr-95	14-Sep-95	27-Mar-96			

Block	Year	Species	Type	Direction	Date Planted	Measurement date					
						1st	2nd	3rd	4th	5th	6th
B	94	Shorea assamica	C	EW	12-Feb-95	26-Apr-95	18-Aug-95	11-Mar-96			
B	94	Shorea assamica	D	EW	09-Feb-95	19-Apr-95	14-Aug-95	06-Mar-96			
B	94	Shorea assamica	E	EW	05-Feb-95	12-Apr-95	03-Aug-95	26-Feb-96			
B	93	Shorea glauca	A	EW	24-Feb-94	04-Apr-94	30-Aug-94	23-Feb-95	28-Aug-95		
B	93	Shorea glauca	C	EW	04-Mar-94	07-Apr-94	30-Aug-94	08-Mar-95	04-Sep-95		
B	93	Shorea glauca	D	EW	08-Mar-94	11-Apr-94	08-Sep-94	11-Mar-95	06-Sep-95		
B	93	Shorea glauca	E	EW	07-May-94	19-Jul-94	10-Nov-94	29-May-95	07-Nov-95		
B	92	Shorea leprosula	A	EW	26-Oct-92	29-Jun-93	19-Oct-93	26-Apr-94	31-Oct-94	27-Apr-95	26-Oct-95
B	92	Shorea leprosula	B	EW	13-Nov-92	28-Jun-93	26-Oct-93	18-May-94	22-Nov-94	30-Apr-95	20-Nov-95
B	92	Shorea leprosula	C	EW	28-Oct-92	30-Jun-93	19-Oct-93	27-Apr-94	01-Nov-94	28-Apr-95	25-Oct-95
B	92	Shorea leprosula	D	EW	05-Nov-92	05-Jul-93	21-Oct-93	04-May-94	09-Nov-94	04-May-95	06-Nov-95
B	92	Shorea leprosula	E	EW	08-Nov-92	29-Jun-93	22-Oct-93	09-May-94	11-Nov-94	08-May-95	10-Nov-95
B	92	Shorea leprosula	A	NS	25-Oct-92	23-Jun-93	18-Oct-93	25-Apr-94	27-Oct-94	24-Apr-95	19-Oct-95
B	92	Shorea leprosula	B	NS	20-Oct-92	23-Jun-93	14-Oct-93	21-Apr-94	22-Oct-94	21-Apr-95	14-Oct-95
B	92	Shorea leprosula	C	NS	24-Oct-92	23-Jun-93	18-Oct-93	24-Apr-94	26-Oct-94	27-Apr-95	18-Oct-95
B	92	Shorea leprosula	D	NS	24-Oct-92	24-Jun-93	15-Oct-93	25-Apr-94	26-Oct-94	27-Apr-95	18-Oct-95
B	92	Shorea leprosula	E	NS	25-Oct-92	22-Jun-93	18-Oct-93	26-Apr-94	27-Oct-94	27-Apr-95	24-Oct-95
B	94	Shorea leprosula & Shorea macroptera	C	EW	19-Feb-95	skip	28-Aug-95	13-Mar-96			
B	93	Shorea macroptera	A	EW	25-Mar-94	14-Apr-94	21-Sep-94	28-Mar-95	29-Sep-95		
B	93	Shorea macroptera	B	EW	13-Feb-94	05-Apr-94	13-Aug-94	14-Feb-95	26-Aug-95		
B	93	Shorea macroptera	C	EW	05-Apr-94	14-Jul-94	03-Oct-94	05-Apr-95	07-Oct-95		
B	93	Shorea macroptera	D	EW	27-Mar-94	25-Apr-94	28-Sep-94	28-Mar-95	30-Sep-95		
B	93	Shorea macroptera	E	EW	11-May-94	18-Jul-94	18-Nov-94	18-May-95	18-Nov-95		
B	94	Shorea ovalis	A	EW	20-Mar-95	04-May-95	27-Sep-95	03-Apr-96			
B	94	Shorea ovalis	B	EW	19-Mar-95	08-May-95	27-Sep-95	01-Apr-96			
B	94	Shorea ovalis	C	EW	18-Mar-95	08-May-95	21-Sep-95	01-Apr-96			
B	94	Shorea ovalis	D	EW	17-Mar-95	19-Apr-95	20-Sep-95	27-Mar-96			
B	94	Shorea ovalis	E	EW	04-Feb-95	12-Apr-95	03-Aug-95	13-Feb-96			
B	94	Shorea ovata	A	EW	20-Mar-95	16-Apr-95	25-Sep-95	03-Apr-96			
B	94	Shorea ovata	B	EW	19-Mar-95	03-May-95	27-Sep-95	01-Apr-96			
B	94	Shorea ovata	C	EW	11-Feb-95	03-May-95	17-Aug-95	12-Mar-96			
B	94	Shorea ovata	D	EW	08-Feb-95	19-Apr-95	10-Aug-95	06-Mar-96			
B	94	Shorea ovata	E	EW	04-Feb-95	15-Apr-95	03-Aug-95	13-Feb-96			
B	92	Shorea parvifolia	A	EW	27-Oct-92	29-Jun-93	19-Oct-93	26-Apr-94	04-Nov-94	27-Apr-95	26-Oct-95
B	92	Shorea parvifolia	B	EW	27-Nov-92	28-Jun-93	25-Oct-93	23-May-94	22-Nov-94	01-Jun-95	30-Nov-95
B	92	Shorea parvifolia	C	EW	28-Oct-92	30-Jun-93	20-Oct-93	27-Apr-94	10-Nov-94	28-Apr-95	25-Oct-95
B	92	Shorea parvifolia	D	EW	05-Nov-92	05-Jul-93	21-Oct-93	07-May-94	09-Nov-94	04-May-95	06-Nov-95
B	92	Shorea parvifolia	E	EW	10-Nov-92	05-Jul-93	22-Oct-93	09-May-94	18-Nov-94	30-Apr-95	15-Nov-95
B	92	Shorea parvifolia	A	NS	20-Oct-92	24-Jun-93	14-Oct-93	20-Apr-94	22-Oct-94	24-Apr-95	17-Oct-95
B	92	Shorea parvifolia	B	NS	21-Oct-92	24-Jun-93	14-Oct-93	21-Apr-94	24-Oct-94	22-Apr-95	17-Oct-95
B	92	Shorea parvifolia	C	NS	23-Oct-92	24-Jun-93	14-Oct-93	23-Apr-94	26-Oct-94	24-Apr-95	18-Oct-95
B	92	Shorea parvifolia	D	NS	23-Oct-92	24-Jun-93	15-Oct-93	23-Apr-94	01-Nov-94	22-Apr-95	18-Oct-95
B	92	Shorea parvifolia	E	NS	31-Oct-92	24-Jun-93	18-Oct-93	28-Apr-94	01-Oct-94	28-Apr-95	24-Oct-95
B	94	Shorea pauciflora	A	EW	19-Mar-95	16-Apr-95	26-Sep-95	05-Apr-96			
B	94	Shorea pauciflora	B	EW	18-Mar-95	30-Apr-95	22-Sep-95	01-Apr-96			
B	94	Shorea pauciflora	C	EW	11-Feb-95	26-Apr-95	17-Aug-95	12-Mar-96			
B	94	Shorea pauciflora	D	EW	08-Feb-95	19-Apr-95	14-Aug-95	06-Mar-96			
B	94	Shorea pauciflora	E	EW	05-Feb-95	12-Apr-95	03-Aug-95	14-Feb-96			
B	93	Calamus manan	A	EW	09-Mar-94	14-Apr-94	09-Sep-94	13-Mar-95	07-Sep-95		
B	93	Calamus manan	B	EW	01-Mar-94	15-Apr-94	29-Aug-94	08-Mar-95	01-Sep-95		
B	93	Calamus manan	N	EW	28-Mar-94	28-Apr-94	29-Sep-94	30-Mar-95	30-Sep-95		

Appendix S2 Measurement Date of Openplanting Plots

Block	Year	Species	Type	Date Planted	Measurement date				
					1st	2nd	3rd	4th	5th
A	92	Hopea odorata	A	18-May-93	24-Aug-93	28-Oct-93	19-May-94	08-Nov-94	20-May-95
A	92	Hopea odorata	B	18-May-93	24-Aug-93	29-Oct-93	20-May-94	08-Nov-94	19-May-95
A	92	Hopea odorata	C	17-May-93	23-Aug-93	01-Nov-93	19-May-94	07-Nov-94	19-May-95
A	92	Hopea odorata	D	17-May-93	20-Aug-93	30-Oct-93	19-May-94	07-Nov-94	22-May-95
A	92	Hopea odorata	E	16-May-93	19-Aug-93	03-Nov-93	19-May-94	08-Nov-94	25-May-95
A	92	Neobalanocarpus heimii	A	21-Apr-93	24-Aug-93	28-Oct-93	21-Apr-94	25-Oct-94	20-Apr-95
A	92	Neobalanocarpus heimii	B	21-Apr-93	24-Aug-93	01-Nov-93	22-Apr-94	26-Oct-94	20-Apr-95
A	92	Neobalanocarpus heimii	C	22-Apr-93	20-Aug-93	01-Nov-93	22-Apr-94	24-Oct-94	21-Apr-95
A	92	Neobalanocarpus heimii	D	22-Apr-93	20-Aug-93	30-Oct-93	22-Apr-94	24-Oct-94	21-Apr-95
A	92	Neobalanocarpus heimii	E	16-Jan-93	19-Aug-93	13-Nov-93	14-Jan-94	15-Jul-94	16-Jan-95
A	92	Shorea leprosula	A	19-Apr-93	26-Aug-93	28-Oct-93	20-Apr-94	19-Oct-94	19-Apr-95
A	92	Shorea leprosula	B	19-Apr-93	24-Aug-93	29-Oct-93	20-Apr-94	19-Oct-94	19-Apr-95
A	92	Shorea leprosula	C	19-Apr-93	23-Aug-93	01-Nov-93	20-Apr-94	19-Oct-94	18-Apr-95
A	92	Shorea leprosula	D	20-Apr-93	23-Aug-93	01-Nov-93	20-Apr-94	24-Oct-94	
A	92	Shorea leprosula	E	20-Feb-93	28-Aug-93	05-Nov-93	21-Feb-94	18-Aug-94	25-Feb-95
A	92	Shorea parvifolia	A	24-Mar-93	26-Aug-93	04-Sep-93	26-Mar-94	30-Sep-94	25-Mar-95
A	92	Shorea parvifolia	B	24-Mar-93	26-Aug-93	02-Sep-93	24-Mar-94	26-Sep-94	24-Mar-95
A	92	Shorea parvifolia	C	25-Mar-93	26-Jul-93	04-Sep-93	30-Mar-94	26-Sep-94	25-Mar-95
A	92	Shorea parvifolia	D	25-Mar-93	27-Aug-93	04-Sep-93	30-Mar-94	29-Sep-94	24-Mar-95
A	92	Shorea parvifolia	E	20-Feb-93	27-Aug-93	02-Nov-93	21-Feb-94	26-Aug-94	24-Feb-95
A	93	Calophyllum sp.	A	26-Apr-94	20-Jun-94	26-Oct-94	28-Apr-95		
A	93	Calophyllum sp.	B	15-May-94	13-Jul-94	19-Nov-94	27-May-95		
A	93	Calophyllum sp.	C	25-Mar-94	09-Jun-94	28-Sep-94	27-Mar-95		
A	93	Calophyllum sp.	D	13-Apr-94	16-Jun-94	15-Oct-94	11-Apr-95		
A	93	Calophyllum sp.	E	12-May-94	01-Jul-94	21-Nov-94	12-May-95		
A	93	Dryobalanops aromatica	A	28-Apr-94	20-Jun-94	29-Oct-94	28-Apr-95		
A	93	Dryobalanops aromatica	B	12-May-94	28-Jun-94	14-Nov-94	12-May-95		
A	93	Dryobalanops aromatica	C	11-Apr-94	08-Jun-94	14-Oct-94	10-Apr-95		
A	93	Dryobalanops aromatica	D	17-Apr-94	16-Jun-94	21-Oct-94	17-Apr-95		
A	93	Dryobalanops aromatica	E	26-Apr-94	18-Jun-94	03-Nov-94	02-May-95		
A	93	Endospermum malaccense	A	10-May-94	21-Jun-94	12-Nov-94	10-May-95		
A	93	Endospermum malaccense	B	16-Apr-94	21-Jul-94	17-Oct-94	16-May-95		
A	93	Endospermum malaccense	C	16-Apr-94	10-Jun-94	17-Oct-94	13-Apr-95		
A	93	Endospermum malaccense	D	14-Apr-94	10-Jun-94	17-Oct-94	11-Apr-95		
A	93	Endospermum malaccense	E	13-May-94	06-Jul-94	17-Nov-94	13-May-95		
A	93	Pentaspadon motleyi	A	27-Apr-94	20-Jun-94	29-Oct-94	29-Apr-95		
A	93	Pentaspadon motleyi	B	15-May-94	05-Jun-94	19-Nov-94	15-May-95		
A	93	Pentaspadon motleyi	C	15-Apr-94	09-Jun-94	15-Oct-94	15-Apr-95		
A	93	Pentaspadon motleyi	D	13-Apr-94	13-Jun-94	15-Oct-94	11-Apr-95		
A	93	Pentaspadon motleyi	E	01-Jun-94	01-Jul-94	30-Nov-94	08-Jun-95		
A	93	Pouteria malaccensis	A	10-May-94	05-Jul-94	12-Nov-94	10-May-95		
A	93	Pouteria malaccensis	B	14-May-94	29-Jun-94	14-Nov-94	14-May-95		
A	93	Pouteria malaccensis	C	16-Apr-94	08-Jun-94	17-Oct-94	13-Apr-95		
A	93	Pouteria malaccensis	D	16-Apr-94	20-Jun-94	17-Oct-94	13-Apr-95		
A	93	Pouteria malaccensis	E	27-Apr-94	18-Jun-94	03-Nov-94	02-May-95		
A	93	Scaphium macropodum	A	24-Apr-94	20-Jun-94	25-Oct-94	29-Apr-95		
A	93	Scaphium macropodum	B	11-May-94	28-Jun-94	12-Nov-94	17-May-95		
A	93	Scaphium macropodum	C	11-May-94	15-Jun-94	17-Nov-94	22-May-95		
A	93	Scaphium macropodum	D	10-Apr-94	10-Jun-94	18-Oct-94	13-Apr-95		
A	93	Scaphium macropodum	E	19-Apr-94	13-Jun-94	21-Oct-94	20-Apr-95		
A	93	Shorea acuminata	A	23-Apr-94	20-Jun-94	25-Oct-94	29-Apr-95		
A	93	Shorea acuminata	B	11-May-94	21-Jun-94	12-Nov-94	16-May-95		
A	93	Shorea acuminata	C	14-May-94	29-Jun-94	14-Nov-94	17-May-95		
A	93	Shorea acuminata	D	17-Apr-94	14-Jun-94	18-Oct-94	13-Apr-95		
A	93	Shorea acuminata	E	17-Apr-94	17-Jun-94	18-Oct-94	13-Apr-95		
A	93	Shorea bracteolata	A	25-Apr-94	20-Jun-94	29-Oct-94	29-Apr-95		
A	93	Shorea bracteolata	B	12-May-94	27-Jul-94	14-Nov-94	22-May-95		
A	93	Shorea bracteolata	C	11-May-94	17-Jul-94	17-Nov-94	11-May-95		
A	93	Shorea bracteolata	D	11-Apr-94	08-Jun-94	14-Oct-94	10-Apr-95		
A	93	Shorea bracteolata	E	20-Apr-94	14-Jun-94	24-Oct-94	20-Apr-95		

Appendix S3 Measurement Date of Underplanting in Belukar Plots

Block	Year	Species	Type	Date Planted	Measurement date		
					1st	2nd	3rd
A	94	Dialium sp.	F	03-Feb-95	24-May-95	01-Aug-95	08-Feb-96
A	94	Dialium sp.	G	16-Mar-95	18-May-95	18-Sep-95	23-Mar-96
A	94	Dialium sp.	G	18-Mar-95	05-May-95	23-Sep-95	30-Mar-96
A	94	Gonystylus sp.	F	27-Feb-95	19-May-95	30-Aug-95	16-Mar-96
A	94	Gonystylus sp.	G	06-Feb-95	29-May-95	04-Aug-95	12-Feb-96
A	94	Gonystylus sp.	G	16-Mar-95	29-May-95	18-Sep-95	23-Mar-96
A	94	Neobalanocarpus heimii	F	22-Feb-95	26-May-95	23-Aug-95	15-Mar-96
A	94	Neobalanocarpus heimii	F	19-Mar-95	02-Jun-95	25-Sep-95	04-Apr-96
A	94	Neobalanocarpus heimii	G	17-Feb-95	30-May-95	22-Aug-95	08-Mar-96
A	94	Neobalanocarpus heimii	G	16-Feb-95	13-May-95	23-Aug-95	08-Mar-96
A	94	Neobalanocarpus heimii	H	21-Mar-95	24-May-95	26-Sep-95	10-Apr-96
A	94	Shorea acuminata	F	03-Feb-95	23-May-95	01-Aug-95	09-Feb-96
A	94	Shorea acuminata	G	05-Feb-95	19-May-95	04-Aug-95	10-Feb-96
A	94	Shorea acuminata	G	10-Feb-95	05-May-95	14-Aug-95	08-Mar-96
A	94	Shorea bracteolata	F	09-Feb-95	02-Jun-95	12-Aug-95	15-Feb-96
A	94	Shorea bracteolata	G	17-Mar-95	30-May-95	20-Sep-95	28-Mar-96
A	94	Shorea bracteolata	G	16-Mar-95	25-May-95	21-Sep-95	23-Mar-96
A	94	Shorea gibbosa	F	03-Feb-95	23-May-95	01-Aug-95	08-Feb-96
A	94	Shorea gibbosa	G	18-Mar-95	05-May-95	23-Sep-95	30-Mar-96
A	94	Shorea gibbosa	G	04-Feb-95	02-May-95	02-Aug-95	09-Feb-96
A	94	Shorea glauca	F	24-Feb-95	19-May-95	25-Aug-95	15-Mar-96
A	94	Shorea glauca	G	06-Feb-95	29-May-95	04-Aug-95	12-Feb-96
A	94	Shorea glauca	G	05-Feb-95	25-May-95	04-Aug-95	10-Feb-96
A	94	Shorea leprosula	F	22-Feb-95	20-May-95	23-Aug-95	15-Mar-96
A	94	Shorea leprosula	F	20-Mar-95	05-Jun-95	25-Sep-95	05-Apr-96
A	94	Shorea leprosula	G	09-Mar-95	17-May-95	11-Sep-95	18-Mar-96
A	94	Shorea leprosula	G	17-Feb-95	13-May-95	22-Aug-95	08-Mar-96
A	94	Shorea leprosula	H	20-Mar-95	07-Jun-95	26-Sep-95	10-Apr-96
A	94	Shorea multiflora	F	03-Feb-95	23-May-95	01-Aug-95	08-Feb-96
A	94	Shorea multiflora	G	08-Feb-95	13-May-95	10-Aug-95	16-Feb-96
A	94	Shorea multiflora	G	04-Feb-95	24-May-95	02-Aug-95	09-Feb-96
A	94	Shorea ovalis	F	24-Feb-95	22-May-95	24-Aug-95	14-Mar-96
A	94	Shorea ovalis	F	10-Feb-95	02-Jun-95	14-Aug-95	27-Feb-96
A	94	Shorea ovalis	G	27-Feb-95	17-May-95	29-Aug-95	02-Mar-96
A	94	Shorea ovalis	G	18-Mar-95	24-May-95	23-Sep-95	30-Mar-96
A	94	Shorea ovalis	H	22-Feb-95	22-May-95	24-Aug-95	16-Mar-96
A	94	Shorea ovata	F	16-Mar-95	22-May-95	18-Sep-95	29-Mar-96
A	94	Shorea ovata	F	20-Mar-95	02-Jun-95	25-Sep-95	05-Apr-96
A	94	Shorea ovata	G	27-Feb-95	18-May-95	29-Aug-95	17-Mar-96
A	94	Shorea ovata	G	18-Mar-95	30-May-95	23-Sep-95	02-Apr-96
A	94	Shorea ovata	H	21-Mar-95	09-May-95	25-Sep-95	11-Apr-96
A	94	Shorea parvifolia	F	24-Feb-95	22-May-95	24-Aug-95	14-Mar-96
A	94	Shorea parvifolia	F	09-Feb-95	02-Jun-95	12-Aug-95	27-Feb-96
A	94	Shorea parvifolia	G	09-Mar-95	08-May-95	11-Sep-95	21-Mar-96
A	94	Shorea parvifolia	G	17-Feb-95	30-May-95	22-Aug-95	09-Mar-96
A	94	Shorea parvifolia	H	18-Mar-95	05-Jun-95	25-Sep-95	02-Apr-96
A	94	Shorea pauciflora	F	24-Feb-95	20-May-95	25-Aug-95	15-Mar-96
A	94	Shorea pauciflora	F	17-Mar-95	05-Jun-95	21-Sep-95	29-Mar-96
A	94	Shorea pauciflora	G	09-Mar-95	08-May-95	11-Sep-95	21-Mar-96
A	94	Shorea pauciflora	G	09-Mar-95	17-May-95	11-Sep-95	18-Mar-96
A	94	Shorea pauciflora	H	28-Mar-95	05-May-95	30-Sep-95	11-Apr-96
A	94	Shorea talura	F	03-Feb-95	24-May-95	02-Aug-95	06-Feb-96
A	94	Shorea talura	G	16-Mar-95	18-May-95	18-Sep-95	23-Mar-96
A	94	Shorea talura	G	18-Mar-95	09-May-95	23-Sep-95	29-Mar-96
A	94	Sindora sp.	F	19-Mar-95	02-Jun-95	25-Sep-95	04-Apr-96
A	94	Sindora sp.	G	18-Mar-95	05-May-95	22-Sep-95	29-Mar-96
A	94	Sindora sp.	G	17-Mar-95	29-May-95	20-Sep-95	28-Mar-96

Appendix S4 Measurement Date of Arboretum Plots

Block	Year	Species	Date Planted	Measurement date				
				1st	2nd	3rd	4th	5th
Arboretum	93	Agathis borneensis	17-May-94	26-Jun-94	21-Nov-94	26-May-95		
Arboretum	93	Alstonia sp.	18-Oct-93	15-Dec-93	18-Apr-94	18-Oct-94	14-Apr-95	13-Oct-95
Arboretum	93	Calophyllum sp.	15-Jul-94	19-Sep-94				
Arboretum	93	Cinnamomum sp.	17-Oct-93	13-Dec-93	16-Apr-94	18-Oct-94	14-Apr-95	12-Oct-95
Arboretum	93	Dacryodes sp.	25-May-94	25-Jun-94	21-Nov-94	26-May-95		
Arboretum	93	Dipterocarpus cornutus	15-May-94	02-Jul-94	17-Nov-94	17-May-95		
Arboretum	92	Dryobalanops aromatica	11-May-93	02-Sep-93	11-Nov-93	12-May-94	15-Nov-94	09-May-95
Arboretum	92	Durio sp.	04-May-93	03-Sep-93	11-Nov-93	04-May-94	09-Nov-94	04-May-95
Arboretum	93	Endospermum malaccense	18-Oct-93	11-Dec-93	18-Apr-94	18-Oct-94	15-Apr-95	14-Oct-95
Arboretum	93	Heritiera sp.	18-May-94	24-Jun-94	21-Nov-94	26-May-95		
Arboretum	92	Hevea brasiliensis	16-May-93	03-Sep-93	11-Nov-93	14-May-94	19-Nov-94	05-Jun-95
Arboretum	92	Hopea odorata	16-May-93	01-Sep-93	08-Nov-93	14-May-94	08-Nov-94	09-May-95
Arboretum	92	Hopea odorata	01-Feb-93	04-Sep-93	12-Nov-93	03-Feb-94	11-Aug-94	03-Feb-95
Arboretum	93	Hopea odorata	12-May-93	02-Sep-93	08-Nov-93	14-May-94	skip	09-May-95
Arboretum	93	Hopea odorata	13-May-94	02-Jul-94	14-Nov-94	17-May-95		
Arboretum	92	Intsia palembanica	13-Jun-93	01-Sep-93	14-Dec-93	14-Jun-94	02-Dec-94	31-Jul-95
Arboretum	93	Koompassia malaccensis	26-May-94	25-Jun-94	21-Nov-94	26-May-95		
Arboretum	92	*Neobalanocarpus heimii*	23-May-93	01-Sep-93	08-Nov-93	18-May-94	22-Nov-94	09-May-95
Arboretum	93	Palaquium gutta	18-May-94	24-Jun-94	21-Nov-94	26-May-95		
Arboretum	92	Parkia sp.	05-Jun-93	03-Sep-93	14-Dec-93	09-Jun-94	03-Dec-94	08-Jun-95
Arboretum	92	Pentaspadon motleyi	06-May-93	02-Sep-93	11-Nov-93	04-May-94	10-Nov-94	05-May-95
Arboretum	92	Scaphium macropodum	13-Jan-93	04-Sep-93	12-Nov-93	13-Jan-94	13-Jun-94	14-Jan-95
Arboretum	92	Shorea acuminata	17-May-93	01-Sep-93	08-Nov-93	18-May-94	19-Nov-94	17-May-95
Arboretum	92	Shorea leprosula	04-Feb-93	26-Aug-93	04-Feb-94	11-Aug-94		
Arboretum	93	Shorea macroptera	09-May-94	02-Jul-94	17-Nov-94	20-May-95		
Arboretum	93	Shorea multiflora	12-May-94	02-Jul-94	14-Nov-94	17-May-95		
Arboretum	92	Shorea ovalis	09-May-93	02-Sep-93	08-Nov-93	11-May-94	12-Nov-94	09-May-95
Arboretum	92	Shorea parvifolia	16-Aug-93	04-Sep-93	14-Feb-94	17-Aug-94	15-Feb-95	
Arboretum	93	Shorea talura	27-May-94	02-Jul-94	14-Nov-94	17-May-95		
Arboretum	92	Swietenia macrophylla	05-May-93	02-Sep-93	11-Nov-93	04-May-94	09-Nov-94	05-May-95
Arboretum	92	Tectona grandis	11-Jun-93	04-Sep-93	14-Dec-93	14-Jun-94	29-Nov-94	09-Jun-95
Arboretum	93	Toona sureni	17-Oct-93	10-Dec-93	16-Apr-94	18-Oct-94	14-Apr-95	13-Oct-95

Appendix S5 Number of Surviving and Dead Trees

						Months after Planting													
Site	Year	Species	Direction	Type	Alive/Dead	1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
Acacia	92	Neobalanocarpus heimii	EW	A	Alive								113			113	112	104	105	102
					Dead								4			4	5	13	11	15
				B	Alive								48			43	44	40	35	
					Dead								56			61	60	64	69	
				C	Alive								73			74	73	65	64	62
					Dead								31			30	31	39	40	42
				D	Alive								66			61	54	46	34	31
					Dead								37			42	49	57	69	72
				E	Alive								140			130	100	55	31	28
					Dead								95			105	135	180	204	207
			NS	A	Alive								82			83	80	78	71	68
					Dead								23			22	25	27	34	37
				B	Alive								90			90	88	88	84	83
					Dead								14			14	16	16	20	21
				C	Alive								94			92	90	86	73	71
					Dead								20			22	24	28	41	43
				D	Alive								83			77	73	62	41	41
					Dead								37			43	47	58	79	79
				E	Alive								170			162	147	130	97	105
					Dead								79			87	102	119	152	144
		Shorea leprosula	EW	A	Alive								98			98	98	98	96	96
					Dead								14			14	14	14	16	16
				B	Alive								93			92	89	88	83	85
					Dead								9			10	13	14	19	17
				C	Alive								77			76	73	71	69	69
					Dead								25			26	29	31	33	33
				D	Alive								69			68	67	64	61	60
					Dead								28			29	30	33	36	37
				E	Alive								138			134	130	110	105	103
					Dead								95			99	103	123	128	130
			NS	A	Alive								87			88	87	82	80	78
					Dead								16			15	16	21	23	25
				B	Alive								97			97	93	80	75	74
					Dead								1			1	5	18	23	24
				C	Alive								91			91	81	47	39	39
					Dead								8			8	18	52	60	60
				D	Alive								91			90	89	80	78	77
					Dead								19			20	21	30	32	33
				E	Alive								137			125	85	60	48	46
					Dead								101			113	153	178	190	192
		Shorea parvifolia	EW	A	Alive								107			103	99	88	85	86
					Dead								10			14	18	29	32	31
				B	Alive								71			66	65	40	39	38
					Dead								30			35	36	61	62	63
				C	Alive								77			78	74	67	66	66
					Dead								27			26	30	37	38	38
				D	Alive								59			54	50	16	15	13
					Dead								43			48	52	86	87	89
				E	Alive								100			92	81	47	34	35
					Dead								140			148	159	193	206	205
			NS	A	Alive								82			80	77	74	74	73
					Dead								11			13	16	19	19	20
				B	Alive								89			88	86	77	69	69
					Dead								15			16	18	27	35	35
				C	Alive								72			70	68	63	60	62
					Dead								34			36	38	43	46	44
				D	Alive								69			64	53	50	42	41
					Dead								56			61	72	75	83	84
				E	Alive								139			126	117	87	62	58
					Dead								93			106	115	145	170	174
	93	Dryobalanops aromatica	EW	A	Alive	115					93					66	52			
					Dead	9					31					58	72			
				B	Alive	254					139					71	56			

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
					Dead	40					155					223	238			
				C	Alive	128					46					41	35			
					Dead						82					87	93			
				D	Alive	130					48					42	30			
					Dead	6					88					94	106			
				E	Alive	100					57					42	27			
					Dead	76					119					134	149			
			NS	A	Alive	79					60					49	44			
					Dead	53					72					83	88			
				B	Alive	113					87					73	55			
					Dead	25					51					65	83			
				C	Alive	95					77					59	53			
					Dead	17					35					53	59			
				D	Alive	76					58					41	25			
					Dead	68					86					103	119			
				E	Alive	98					75					17	10			
					Dead	142					165					223	230			
		Hopea odrata	EW	A	Alive	276					246					228	228			
					Dead	4					34					52	52			
				B	Alive	120					105					92	95			
					Dead	1					16					29	26			
				C	Alive	259					244					240	238			
					Dead	9					24					28	30			
				D	Alive	114					109					102	99			
					Dead	6					11					18	21			
				E	Alive	374					347					329	295			
					Dead	58					85					103	137			
		Palaquium gutta	EW	A	Alive	117					102					93	82			
					Dead	3					18					27	38			
				B	Alive	119					79					54	38			
					Dead	1					41					66	82			
				C	Alive	120					55					39	30			
					Dead	8					73					89	98			
				D	Alive	133					41					32	22			
					Dead	3					95					104	114			
				E	Alive	132					84					23	4			
					Dead	108					156					217	236			
		Parashorea densiflora	EW	A	Alive	118					88					75	58			
					Dead	3					33					46	63			
				B	Alive	125					100					91	79			
					Dead	10					35					44	56			
				C	Alive	129					90					62	55			
					Dead	2					41					69	76			
				D	Alive	112					81					62	49			
					Dead	24					55					74	87			
				E	Alive	95					54					15	8			
					Dead	70					111					150	157			
		Pentaspadon motleyi	EW	A	Alive	110					81					55	41			
					Dead	1					30					56	70			
				B	Alive	107					89					81	72			
					Dead	13					31					39	48			
				C	Alive	127					80					69	63			
					Dead	1					48					59	65			
				D	Alive	127					62					49	38			
					Dead	9					74					87	98			
				E	Alive	67					36					17	12			
					Dead	109					140					159	164			
			NS	A	Alive	51					28					5	8			
					Dead	82					105					128	125			
				B	Alive	57					27					18				
					Dead	81					111					120				
				C	Alive	54					44					34	28			
					Dead	58					68					78	84			

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
				D	Alive	61					46					21	11			
					Dead	83					98					123	133			
				E	Alive	51					20									
					Dead	189					220									
		Shorea acuminata	EW	A	Alive	117					109					86	86			
					Dead	2					10					33	33			
				B	Alive	120					100					71	64			
					Dead						20					49	56			
				C	Alive	111					91					66	66			
					Dead	1					21					46	46			
				D	Alive	131					55					49	46			
					Dead	13					89					95	98			
				E	Alive	125					105					79	48			
					Dead	114					134					160	191			
			NS	A	Alive	89					67					26	22			
					Dead	44					66					107	111			
				B	Alive	124					111					45	47			
					Dead	14					27					93	91			
				C	Alive	93					84					77	58			
					Dead	19					28					35	54			
				D	Alive	70					45					40	22			
					Dead	74					99					104	122			
				E	Alive	146					105					74	58			
					Dead	94					135					166	182			
		Shorea glauca	EW	A	Alive	115					83					62	46			
					Dead	4					36					57	73			
				C	Alive	124					58					15	14			
					Dead	7					73					116	117			
				D	Alive	129					42					29	3			
					Dead	8					95					108	134			
				E	Alive	202					129					35	16			
					Dead	38					111					205	224			
		Shorea macroptera	EW	A	Alive	125					95					76	65			
					Dead	8					38					57	68			
				B	Alive	117					88					75	68			
					Dead	2					31					44	51			
				C	Alive	35					25					16	9			
					Dead	69					79					88	95			
				D	Alive	128					17					14	7			
					Dead	24					135					138	145			
				E	Alive	135					69					41	10			
					Dead	105					171					199	230			
	94	Dipterocarpus cornutus	EW	A	Alive	106					97					88				
					Dead	11					20					29				
				B	Alive	94					80					70				
					Dead	26					40					50				
				C	Alive	114					85					76				
					Dead	14					43					52				
				D	Alive	101					99					67				
					Dead	35					37					69				
				E	Alive	190					168					135				
					Dead	50					72					105				
		Hopea pubescens	EW	A	Alive	117					91					52				
					Dead						26					65				
				B	Alive	119					95					61				
					Dead	1					25					59				
				C	Alive	100					86					30				
					Dead	28					42					98				
				D	Alive	103					88					68				
					Dead	30					45					65				
				E	Alive	175					167					119				
					Dead	65					73					121				
		Intsia palembanica	EW	A	Alive	112					92					79				

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
					Dead	5					25					38				
				B	Alive	119					95					95				
					Dead	1					25					25				
				C	Alive	122					109					99				
					Dead	6					19					29				
				D	Alive	107					99					73				
					Dead	29					37					63				
				E	Alive	142					131					120				
					Dead	98					109					120				
		Shorea assamica	EW	A	Alive	116					104					94				
					Dead	1					13					23				
				B	Alive	113					91					84				
					Dead	7					29					36				
				C	Alive	112					91					80				
					Dead	16					37					48				
				D	Alive	87					81					73				
					Dead	49					55					63				
				E	Alive	183					150					103				
					Dead	57					90					137				
		Shorea leprosula	EW	C	Alive						43					30				
					Dead						3					16				
		Shorea macroptera	EW	C	Alive						48					43				
					Dead						6					11				
		Shorea ovalis	EW	A	Alive	114					109					87				
					Dead	3					8					30				
				B	Alive	113					110					92				
					Dead	9					12					30				
				C	Alive	100					81					52				
					Dead	28					47					76				
				D	Alive	78					75					61				
					Dead	58					61					75				
				E	Alive	199					153					139				
					Dead	41					87					101				
		Shorea ovata	EW	A	Alive	111					90					53				
					Dead	6					27					64				
				B	Alive	104					82					50				
					Dead	14					36					68				
				C	Alive	98					61					17				
					Dead	30					67					111				
				D	Alive	102					84					26				
					Dead	34					52					110				
				E	Alive	110					43					26				
					Dead	130					197					214				
		Shorea pauciflora	EW	A	Alive	115					95					84				
					Dead	2					22					33				
				B	Alive	112					101					70				
					Dead	8					19					50				
				C	Alive	107					85					45				
					Dead	21					43					83				
				D	Alive	104					63					33				
					Dead	32					73					103				
				E	Alive	177					139					87				
					Dead	63					101					153				
Belukar	94	Dialium sp.	EW	F	Alive	82					82					73				
					Dead	14					14					23				
				G	Alive	216					196					177				
					Dead	8					28					47				
		Gonystylus sp.	EW	F	Alive	90					82					78				
					Dead	6					14					18				
				G	Alive	165					153					134				
					Dead	59					71					90				
		Neobalanocarpus heimii	EW	F	Alive	171					164					148				
					Dead	21					28					44				

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
				G	Alive	183					166					144				
					Dead	41					58					80				
				H	Alive	99					96					84				
					Dead	21					24					36				
		Shorea acuminata	EW	F	Alive	65					60					43				
					Dead	30					36					53				
				G	Alive	125					100					61				
					Dead	99					124					163				
		Shorea bracteolata	EW	F	Alive	89					90					87				
					Dead	7					6					9				
				G	Alive	213					199					171				
					Dead	11					25					53				
		Shorea gibbosa	EW	F	Alive	89					85					73				
					Dead	7					11					23				
				G	Alive	179					168					150				
					Dead	45					56					74				
		Shorea glauca	EW	F	Alive	81					79					69				
					Dead	15					17					27				
				G	Alive	140					134					125				
					Dead	84					90					99				
		Shorea leprosula	EW	F	Alive	149					138					111				
					Dead	43					54					81				
				G	Alive	190					157					136				
					Dead	34					67					88				
				H	Alive	102					89					83				
					Dead	18					31					37				
		Shorea multiflora	EW	F	Alive	69					66					58				
					Dead	27					30					38				
				G	Alive	165					154					134				
					Dead	59					70					90				
		Shorea ovalis	EW	F	Alive	168					160					140				
					Dead	24					32					52				
				G	Alive	202					187					171				
					Dead	22					37					53				
				H	Alive	112					105					102				
					Dead	8					15					18				
		Shorea ovata	EW	F	Alive	140					112					47				
					Dead	52					80					145				
				G	Alive	171					103					40				
					Dead	53					121					184				
				H	Alive	106					66					26				
					Dead	14					54					94				
		Shorea parvifolia	EW	F	Alive	171					161					125				
					Dead	21					31					67				
				G	Alive	165					153					114				
					Dead	59					71					110				
				H	Alive	86					72					46				
					Dead	34					48					74				
		Shorea pauciflora	EW	F	Alive	168					157					130				
					Dead	24					35					62				
				G	Alive	195					167					129				
					Dead	29					57					95				
				H	Alive	100					76					64				
					Dead	20					44					56				
		Shorea talura	EW	F	Alive	95					95					96				
					Dead	1					1									
				G	Alive	221					222					218				
					Dead	3					2					6				
		Sindora sp.	EW	F	Alive	88					81					67				
					Dead	8					15					29				
				G	Alive	204					177					133				
					Dead	20					47					91				
Open	92	Hopea odorata	EW	A	Alive			108			97					96	86	88		

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
					Dead			16			27					28	38	36		
				B	Alive			91			87					88	85	70		
					Dead			23			27					26	29	44		
				C	Alive			87			77					77	75	67		
					Dead			24			34					34	36	44		
				D	Alive			113			110					100	83	75		
					Dead			15			18					28	45	53		
				E	Alive			213			212					212	207	192		
					Dead			30			31					31	36	51		
		Neobalanocarpus heimii	EW	A	Alive				63		49					36	27	19	16	
					Dead				57		71					84	93	101	104	
				B	Alive				50		38					15	9	8	8	
					Dead				65		77					100	106	107	107	
				C	Alive				58		48					28	10	9	7	
					Dead				54		64					84	102	103	105	
				D	Alive				78		68					35	18	10	9	
					Dead				50		60					93	110	118	119	
				E	Alive							115			98	85	68	60	47	
					Dead							124			141	154	171	179	192	
		Shorea leprosula	EW	A	Alive				35		24					11	5			
					Dead				82		93					106	112			
				B	Alive				35		13					8	3			
					Dead				72		94					99	104			
				C	Alive				40		29					29	22	13		
					Dead				74		85					85	92	101		
				D	Alive				17		9					2	1			
					Dead				118		126					133	134			
				E	Alive						68		45			36	24	20		
					Dead						182		206			214	226	230		
		Shorea parvifolia	EW	A	Alive					49	41					29	22	19		
					Dead					72	80					92	99	102		
				B	Alive					38	24					16	8	8		
					Dead					75	89					97	105	105		
				C	Alive					24	17					14	4	3		
					Dead					91	98					101	111	112		
				D	Alive					79	65					49	26	19		
					Dead					51	65					81	104	111		
				E	Alive						79		41			38	17	15		
					Dead						166		204			209	228	230		
	93	Calophyllum sp.	EW	A	Alive		96				9					4				
					Dead		37				124					129				
				B	Alive		92				3									
					Dead		23				112									
				C	Alive		76				14					8				
					Dead		36				98					104				
				D	Alive		96				16					1				
					Dead		48				128					143				
				E	Alive		48				3									
					Dead		192				237									
		Dryobalanops aromatica	EW	A	Alive		113				14					7				
					Dead		20				119					126				
				B	Alive		79				3									
					Dead		59				135									
				C	Alive		84				37					9				
					Dead		27				74					102				
				D	Alive		89				13									
					Dead		55				131									
				E	Alive		150				39					9				
					Dead		90				201					231				
		Endospermum malaccens	EW	A	Alive		86				3									
					Dead		47				130									
				B	Alive		137				21					16				
					Dead		1				117					122				

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
				C	Alive		85				11					7				
					Dead		27				101					105				
				D	Alive		129				53					41	33			
					Dead		15				91					103	111			
				E	Alive		44				14									
					Dead		181				211									
		Pentaspadon motleyi	EW	A	Alive		73				7					3				
					Dead		60				126					130				
				B	Alive		97				4									
					Dead		33				126									
				C	Alive		69				31									
					Dead		43				81									
				D	Alive		107				58					16	18			
					Dead		37				86					128	126			
				E	Alive		173				57					20				
					Dead		66				182					219				
		Pouteria malaccensis	EW	A	Alive		51				11									
					Dead		82				122									
				B	Alive		64				1									
					Dead		74				137									
				C	Alive		56				4					2				
					Dead		56				108					110				
				D	Alive		64				17									
					Dead		80				127									
				E	Alive		64				12					1				
					Dead		176				228					239				
		Scaphium macropodum	EW	A	Alive		91				19					5				
					Dead		42				114					128				
				B	Alive		90				26					16				
					Dead		48				112					122				
				C	Alive		60				28					3				
					Dead		52				84					109				
				D	Alive		74				11									
					Dead		70				133									
				E	Alive		181				93					40	21			
					Dead		59				147					200	219			
		Shorea acuminata	EW	A	Alive		104				23					12				
					Dead		29				110					121				
				B	Alive		56				4									
					Dead		82				134									
				C	Alive		13				2									
					Dead		99				110									
				D	Alive		80				20									
					Dead		64				124									
				E	Alive		153				50					16				
					Dead		87				190					224				
		Shorea bracteolata	EW	A	Alive		104				45					11				
					Dead		29				87					122				
				B	Alive		117				59					3				
					Dead		21				79					135				
				C	Alive		88				38					23				
					Dead		24				74					89				
				D	Alive		98				64					39	23			
					Dead		46				80					105	121			
				E	Alive		160				77					52				
					Dead		80				163					188				
X(Arboretum)	92	Dryobalanops aromatica	x	x	Alive				48		38					14	5			
					Dead				60		70					94	103			
		Durio sp.	x	x	Alive				73		69					56	25	19		
					Dead				32		36					49	80	86		
		Hevea brasiliensis	x	x	Alive				57		53					24	12	7		
					Dead				108		112					141	153	158		
		Hopea odorata	x	x	Alive				90		81					75	75	55		

Appendix S5 Number of Surviving and Dead Trees

Site	Year	Species	Direction	Type	Alive/Dead	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
					Dead				17		26					32	32	52		
		Hopea odorata-1	x	x	Alive							89		90		90	91	91	89	
					Dead							16		15		15	14	14	16	
		Intsia palembanica	x	x	Alive			59			51					24	14	6		
					Dead			60			68					95	105	113		
		Neobalanocarpus heimii	x	x	Alive				68		63					50	27	14		
					Dead				40		45					58	81	94		
		Parkia sp.	x	x	Alive			77			44					28	26	16		
					Dead			49			82					98	100	110		
		Pentaspadon motleyi	x	x	Alive				32		26					11	7			
					Dead				74		80					95	99			
		Scaphium macfopodum	x	x	Alive								54		44	34	14	3		
					Dead								51		61	71	91	102		
		Shorea acuminata	x	x	Alive				37		23					9	1			
					Dead				71		85					99	107			
		Shorea leprosula	x	x	Alive							17				14	5			
					Dead							90				93	102			
		Shorea ovalis	x	x	Alive				54		42					19	8	1		
					Dead				54		66					89	100	107		
		Shorea parvifolia	x	x	Alive	113					45					5				
					Dead	13					81					121				
		Swietenia macrophylla	x	x	Alive				57		47					26	21	10		
					Dead				66		76					97	102	113		
		Tectona grandis	x	x	Alive			125			121					115	118	104		
					Dead			1			5					11	8	22		
	93	Agathis borneensis	x	x	Alive		92				8					5				
					Dead		41				125					128				
		Alstonia sp.	x	x	Alive		165				158					128	122	117		
					Dead		8				15					45	51	56		
		Cinnamomum sp.	x	x	Alive		151				150					113	92	88		
					Dead		7				8					45	66	70		
		Dacryodes sp.	x	x	Alive		74				26					12				
					Dead		59				107					121				
		Dipterocarpus cornutus	x	x	Alive		129				39					8				
					Dead		4				94					125				
		Endospermum malaccens	x	x	Alive		146				114					46	34	33		
					Dead		15				47					115	127	128		
		Heritiera sp.	x	x	Alive		98				43					33				
					Dead		34				89					99				
		Hopea odorata-2	x	x	Alive				60		55					40		7		
					Dead				48		53					68		101		
		Hopea odorata-3	x	x	Alive		91				58					48				
					Dead		42				75					85				
		Koompassia malaccensis	x	x	Alive		53				1					1				
					Dead		80				132					132				
		Palaquium gutta	x	x	Alive		72				10					6				
					Dead		61				123					127				
		Shorea macroptera	x	x	Alive		91				61					50				
					Dead		42				72					83				
		Shorea multiflora	x	x	Alive		75				6					2				
					Dead		58				127					131				
		Shorea talura	x	x	Alive		132				103					80				
					Dead		1				30					53				
		Toona sureni	x	x	Alive		155				143					52	17	10		
					Dead		5				17					108	143	150		

Appendix S6 Survival Rate

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
Acacia	92	Neobalanocarpus heimii	EW	A								96.6%			96.6%	95.7%	88.9%	90.6%	87.2%
				B								46.2%			41.3%	42.3%	38.5%	33.7%	
				C								70.2%			71.2%	70.2%	62.5%	61.5%	59.6%
				D								64.1%			59.2%	52.4%	44.7%	33.0%	30.1%
				E								59.6%			55.3%	42.6%	23.4%	13.2%	11.9%
			NS	A								78.1%			79.0%	76.2%	74.3%	67.6%	64.8%
				B								86.5%			86.5%	84.6%	84.6%	80.8%	79.8%
				C								82.5%			80.7%	78.9%	75.4%	64.0%	62.3%
				D								69.2%			64.2%	60.8%	51.7%	34.2%	34.2%
				E								68.3%			65.1%	59.0%	52.2%	39.0%	42.2%
		Shorea leprosula	EW	A								87.5%			87.5%	87.5%	87.5%	85.7%	85.7%
				B								91.2%			90.2%	87.3%	86.3%	81.4%	83.3%
				C								75.5%			74.5%	71.6%	69.6%	67.6%	67.6%
				D								71.1%			70.1%	69.1%	68.0%	62.9%	61.9%
				E								59.2%			57.5%	55.8%	47.2%	45.1%	44.2%
			NS	A								84.5%			85.4%	84.5%	79.6%	77.7%	75.7%
				B								99.0%			99.0%	94.9%	81.6%	78.5%	75.5%
				C								91.9%			91.9%	81.8%	47.5%	39.4%	39.4%
				D								82.7%			81.8%	80.9%	72.7%	70.9%	70.0%
				E								57.6%			52.5%	35.7%	25.2%	20.2%	19.3%
		Shorea parvifolia	EW	A								91.5%			88.0%	84.6%	75.2%	72.6%	73.5%
				B								70.3%			65.3%	64.4%	39.6%	38.6%	37.6%
				C								74.0%			75.0%	71.2%	64.4%	63.5%	63.5%
				D								57.8%			52.9%	49.0%	15.7%	14.7%	12.7%
				E								41.7%			38.3%	33.8%	19.6%	14.2%	14.6%
			NS	A								88.2%			86.0%	82.8%	79.6%	79.6%	78.5%
				B								85.6%			84.6%	82.7%	74.0%	68.3%	68.3%
				C								67.9%			66.0%	64.2%	59.4%	58.6%	58.5%
				D								55.2%			51.2%	42.4%	40.0%	33.6%	32.8%
				E								59.9%			54.3%	50.4%	37.5%	26.7%	25.0%
	93	Dryobalanops aromatica	EW	A	92.7%					75.0%					53.2%	41.9%			
				B	86.4%					47.3%					24.1%	19.0%			
				C	100.0%					35.9%					32.0%	27.3%			
				D	95.6%					35.3%					30.9%	22.1%			
				E	56.8%					32.4%					23.9%	15.3%			
			NS	A	59.8%					45.5%					37.1%	33.3%			
				B	81.9%					63.0%					52.9%	39.9%			
				C	84.8%					68.8%					52.7%	47.3%			
				D	52.8%					40.3%					28.5%	17.4%			
				E	40.8%					31.3%					7.1%	4.2%			
		Hopea odrata	EW	A	98.6%					87.9%					81.4%	81.4%			
				B	99.2%					86.8%					76.0%	78.5%			
				C	96.6%					91.0%					89.6%	88.8%			
				D	95.0%					90.8%					85.0%	82.5%			
				E	86.6%					80.3%					76.2%	68.3%			
		Palaquium gutta	EW	A	97.5%					85.0%					77.5%	68.3%			
				B	99.2%					65.8%					45.0%	31.7%			
				C	93.8%					43.0%					30.5%	23.4%			
				D	97.8%					30.1%					23.5%	16.2%			
				E	55.0%					35.0%					9.6%	1.7%			
		Parashorea densiflora	EW	A	97.5%					72.7%					62.0%	47.9%			
				B	92.6%					74.1%					67.4%	58.5%			
				C	98.5%					68.7%					47.3%	42.0%			
				D	82.4%					59.6%					45.6%	36.0%			
				E	57.6%					32.7%					9.1%	4.8%			
		Pentaspadon motleyi	EW	A	99.1%					73.0%					49.5%	36.9%			
				B	89.2%					74.2%					67.5%	60.0%			
				C	99.2%					62.5%					53.9%	49.2%			
				D	93.4%					45.6%					36.0%	27.9%			
				E	38.1%					20.5%					9.7%	6.8%			
			NS	A	38.3%					21.1%					3.8%	6.0%			
				B	41.3%					19.6%					13.0%				
				C	48.2%					39.3%					30.4%	25.0%			
				D	42.4%					31.9%					14.6%	7.6%			
				E	21.3%					8.3%									
		Shorea acuminata	EW	A	98.3%					91.6%					72.3%	72.3%			
				B	100.0%					83.3%					59.2%	53.3%			
				C	99.1%					81.3%					58.9%	58.9%			

Appendix S6 Survival Rate

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
				D	91.0%					38.2%					34.0%	31.9%			
				E	52.3%					43.9%					33.1%	20.1%			
			NS	A	66.9%					50.4%					19.5%	16.5%			
				B	89.9%					80.4%					32.6%	34.1%			
				C	83.0%					75.0%					68.8%	51.8%			
				D	48.6%					31.3%					27.8%	15.3%			
				E	60.8%					43.8%					30.8%	24.2%			
		Shorea glauca	EW	A	96.6%					69.7%					52.1%	38.7%			
				C	94.7%					44.3%					11.5%	10.7%			
				D	94.2%					30.7%					21.2%	2.2%			
				E	84.2%					53.8%					14.6%	6.7%			
		Shorea macroptera	EW	A	94.0%					71.4%					57.1%	48.9%			
				B	98.3%					73.9%					63.0%	57.1%			
				C	33.7%					24.0%					15.4%	8.7%			
				D	84.2%					11.2%					9.2%	4.6%			
				E	56.3%					28.8%					17.1%	4.2%			
	94	Dipterocarpus cornutus	EW	A	90.6%					82.9%					75.2%				
				B	78.3%					66.7%					59.3%				
				C	89.1%					66.4%					59.4%				
				D	74.3%					72.8%					49.3%				
				E	79.2%					70.0%					56.3%				
		Hopea pubescens	EW	A	100.0%					77.8%					44.4%				
				B	99.2%					79.2%					50.8%				
				C	78.1%					67.2%					23.4%				
				D	77.4%					66.2%					51.1%				
				E	72.9%					69.6%					49.6%				
		Intsia palembanica	EW	A	95.7%					78.6%					67.5%				
				B	99.2%					79.2%					79.2%				
				C	95.3%					85.2%					77.3%				
				D	78.7%					72.8%					59.7%				
				E	59.2%					54.6%					50.0%				
		Shorea assamica	EW	A	99.1%					88.9%					80.3%				
				B	94.2%					75.8%					70.0%				
				C	87.5%					71.1%					62.5%				
				D	64.0%					59.6%					53.7%				
				E	76.3%					62.5%					42.9%				
		Shorea leprosula	EW	C						93.5%					65.2%				
		Shorea macroptera	EW	C						88.9%					79.6%				
		Shorea ovalis	EW	A	97.4%					93.2%					74.4%				
				B	92.6%					90.2%					75.4%				
				C	78.1%					63.3%					40.6%				
				D	57.4%					55.1%					44.9%				
				E	82.9%					63.8%					57.9%				
		Shorea ovata	EW	A	94.9%					78.9%					45.3%				
				B	88.1%					69.5%					42.4%				
				C	76.6%					47.7%					13.3%				
				D	75.0%					61.8%					19.1%				
				E	45.8%					17.9%					10.6%				
		Shorea pauciflora	EW	A	98.3%					91.2%					71.8%				
				B	93.3%					84.2%					58.3%				
				C	83.6%					68.4%					35.2%				
				D	76.5%					45.3%					24.3%				
				E	73.8%					57.9%					36.3%				
Belukar	94	Dialium sp.	EW	F	85.4%					76.0%					76.0%				
				G	98.4%					87.5%					79.0%				
		Gonystylus sp	EW	F	93.8%					85.4%					81.3%				
				G	73.7%					68.3%					59.8%				
		Neobalanocarpus heimii	EW	F	89.1%					85.4%					77.1%				
				G	81.7%					74.1%					64.3%				
				H	82.5%					80.0%					70.0%				
		Shorea acuminata	EW	F	68.8%					62.5%					44.8%				
				G	55.8%					44.6%					27.2%				
		Shorea bracteolata	EW	F	92.7%					93.8%					90.6%				
				G	95.1%					88.8%					78.3%				
		Shorea gibbosa	EW	F	92.7%					88.5%					76.0%				
				G	79.9%					75.0%					67.0%				
		Shorea glauca	EW	F	84.4%					82.3%					71.9%				
				G	62.5%					59.6%					55.8%				

Appendix S6 Survival Rate

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
		Shorea leprosula	EW	F	77.6%					71.6%					57.8%				
				G	84.6%					70.1%					60.7%				
				H	85.0%					74.2%					69.2%				
		Shorea multiflora	EW	F	71.6%					68.8%					60.4%				
				G	73.7%					68.8%					59.6%				
		Shorea ovalis	EW	F	87.5%					83.3%					72.9%				
				G	90.2%					83.5%					76.3%				
				H	93.3%					87.5%					85.0%				
		Shorea ovata	EW	F	72.9%					58.3%					24.5%				
				G	76.3%					46.0%					17.9%				
				H	88.3%					55.0%					21.7%				
		Shorea parvifolia	EW	F	89.1%					83.9%					65.1%				
				G	73.7%					68.3%					50.9%				
				H	71.7%					60.0%					38.3%				
		Shorea pauciflora	EW	F	87.5%					81.8%					67.2%				
				G	87.1%					74.6%					57.6%				
				H	83.3%					63.3%					53.3%				
		Shorea talura	EW	F	99.0%					99.0%					100.0%				
				G	98.7%					99.1%					97.3%				
		Sindora sp.	EW	F	91.7%					84.4%					69.6%				
				G	91.1%					79.0%					59.4%				
Open	92	Hopea odorata	EW	A			87.1%			78.2%					77.4%	69.4%	71.0%		
				B			79.8%			76.3%					77.2%	74.6%	61.4%		
				C			78.4%			69.4%					69.4%	67.6%	60.4%		
				D			88.3%			85.9%					78.1%	64.8%	58.6%		
				E			87.7%			87.2%					87.2%	85.2%	79.0%		
		Neobalanocarpus heimii	EW	A				52.5%		40.8%					30.0%	22.5%	15.8%	13.3%	
				B				43.5%		33.0%					13.0%	7.8%	7.0%	7.0%	
				C				51.8%		42.9%					25.0%	8.9%	8.0%	6.3%	
				D				60.9%		53.1%					27.3%	14.1%	7.8%	7.0%	
				E							48.1%			41.0%	35.6%	28.5%	25.1%	19.7%	
		Shorea leprosula	EW	A				29.8%		20.5%					9.4%	4.3%			
				B				32.7%		12.1%					7.5%	2.8%			
				C				35.1%		25.4%					25.4%	19.3%	11.4%		
				D				12.6%		6.7%					1.5%	0.7%			
				E						27.2%		18.0%			14.4%	9.6%	8.0%		
		Shorea parvifolia	EW	A					40.5%	33.6%					24.0%	18.2%	15.7%		
				B					33.6%	21.2%					14.2%	7.1%	7.1%		
				C					20.6%	14.8%					12.2%	3.5%	2.6%		
				D					60.8%	50.0%					37.7%	20.0%	14.6%		
				E						32.2%		16.7%			14.7%	8.9%	6.1%		
	93	Calophyllum sp.	EW	A		72.2%				6.8%					3.0%				
				B		80.0%				2.6%									
				C		67.9%				12.5%					7.1%				
				D		66.7%				11.1%					0.7%				
				E		20.0%				1.3%									
		Dryobalanops aromatica	EW	A		65.0%				10.5%					5.3%				
				B		57.2%				2.2%									
				C		75.7%				33.3%					8.1%				
				D		61.6%				9.0%									
				E		62.5%				16.3%					3.6%				
		Endospermum malaccense	EW	A		64.7%				2.3%									
				B		99.3%				15.2%					11.6%				
				C		75.9%				9.6%					6.3%				
				D		89.6%				38.8%					28.5%	22.9%			
				E		19.6%				6.2%									
		Pentaspadon motleyi	EW	A		54.9%				5.3%					2.3%				
				B		74.6%				3.1%									
				C		61.6%				27.7%									
				D		74.3%				40.3%					11.1%	12.5%			
				E		72.4%				23.6%					8.4%				
		Pouteria malaccensis	EW	A		38.9%				8.3%									
				B		46.4%				0.7%									
				C		50.0%				3.6%					1.8%				
				D		44.4%				11.8%									
				E		26.7%				5.0%					0.4%				
		Scaphium macropodum	EW	A		68.4%				14.3%					3.6%				
				B		65.2%				18.6%					11.6%				

Appendix S6 Survival Rate

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
				C		53.6%				25.0%					2.7%				
				D		51.4%				7.6%									
				E		75.4%				38.8%					16.7%	8.8%			
		Shorea acuminata	EW	A		78.2%				17.3%					9.0%				
				B		40.6%				2.9%									
				C		11.6%				1.6%									
				D		55.6%				13.9%									
				E		83.8%				20.8%					8.7%				
		Shorea bracteolata	EW	A		78.2%				34.6%					8.3%				
				B		84.6%				42.8%					2.2%				
				C		78.6%				33.9%					20.5%				
				D		68.1%				44.4%					27.1%	16.0%			
				E		66.7%				32.1%					21.7%				
X(Arboretum)	92	Dryobalanops aromatica	x	x				44.4%		35.2%					13.0%	4.6%			
		Durio sp.	x	x				69.5%		65.7%					53.3%	23.8%	18.1%		
		Hevea brasiliensis	x	x				34.5%		32.1%					14.5%	7.3%	4.2%		
		Hopea odorata	x	x				84.1%		75.7%					70.1%	70.1%	51.4%		
		Hopea odorata-1	x	x							84.8%		85.7%		85.7%	86.7%	86.7%	84.8%	
		Intsia palembanica	x	x			49.6%			42.9%					20.2%	11.8%	5.0%		
		Neobalanocarpus heimii	x	x				63.0%		58.3%					46.3%	25.0%	13.0%		
		Parkia sp.	x	x			61.1%			34.9%					22.2%	20.6%	12.7%		
		Pentaspadon motleyi	x	x				30.2%		24.5%					10.4%	6.6%			
		Scaphium macfopodum	x	x								51.4%		41.9%	32.4%	13.3%	2.6%		
		Shorea acuminata	x	x				34.3%		21.3%					8.3%	0.9%			
		Shorea leprosula	x	x							15.9%				13.1%	4.7%			
		Shorea ovalis	x	x				50.0%		38.9%					17.6%	7.4%	0.9%		
		Shorea parvifolia	x	x	89.7%					35.7%					4.0%				
		Swietenia macrophylla	x	x				46.3%		38.2%					21.1%	17.1%	8.1%		
		Tectona grandis	x	x			99.2%			96.0%					91.3%	93.7%	82.5%		
	93	Agathis borneensis	x	x		69.2%				6.0%					3.8%				
		Alstonia sp.	x	x		95.4%				91.3%					74.0%	70.5%	67.6%		
		Cinnamomum sp.	x	x		95.6%				94.9%					71.5%	58.2%	55.7%		
		Dacryodes sp.	x	x		55.6%				19.5%					9.0%				
		Dipterocarpus cornutus	x	x		97.0%				29.3%					6.0%				
		Endospermum malaccense	x	x		90.7%				70.8%					28.6%	21.1%	20.5%		
		Heritiera sp.	x	x		74.2%				32.6%					25.0%				
		Hopea odorata-2	x	x				55.6%		50.9%					37.0%		8.5%		
		Hopea odorata-3	x	x		68.4%				43.6%					38.1%				
		Koompassia malaccensis	x	x		39.8%				0.8%					0.8%				
		Palaquium gutta	x	x		54.1%				7.5%					4.5%				
		Shorea macroptera	x	x		68.4%				45.9%					37.6%				
		Shorea multiflora	x	x		56.4%				4.5%					1.5%				
		Shorea talura	x	x		99.2%				77.4%					60.2%				
		Toona sureni	x	x		96.9%				89.4%					32.5%	10.6%	6.3%		

Appendix S7 Growth of Mean Height

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
Acacia	92	Neobalanocarpus heimii	EW	A								0.52			0.62	0.84	0.99	1.24	1.50
				B								0.47			0.63	0.84	1.01	1.35	
				C								0.50			0.59	0.89	1.16	1.49	1.79
				D								0.45			0.49	0.55	0.74	0.83	0.94
				E								0.48			0.56	0.72	0.96	1.50	1.87
			NS	A								0.51			0.64	0.82	1.03	1.27	1.53
				B								0.52			0.67	0.99	1.23	1.54	1.89
				C								0.46			0.65	0.95	1.20	1.69	1.96
				D								0.39			0.57	0.78	0.87	1.58	1.76
				E								0.48			0.56	0.85	1.14	1.61	1.95
		Shorea leprosula	EW	A								1.04			1.43	2.37	3.26	4.36	5.35
				B								1.16			1.68	3.04	3.92	5.48	6.88
				C								1.01			1.31	2.33	3.44	5.13	6.53
				D								0.84			1.03	1.85	2.54	3.91	5.18
				E								0.75			0.92	1.60	2.11	3.19	4.27
			NS	A								1.03			1.47	2.47	3.13	4.24	5.63
				B								1.10			1.55	2.61	2.93	4.26	5.59
				C								0.89			1.14	1.30	1.52	2.71	3.51
				D								0.93			1.23	1.92	2.59	4.22	5.26
				E								0.65			0.76	1.04	1.52	2.70	3.41
		Shorea parvifolia	EW	A								0.87			1.17	1.80	2.41	3.24	3.85
				B								0.84			1.19	1.81	2.12	2.89	4.15
				C								0.78			0.98	1.51	2.05	2.93	3.94
				D								0.79			0.89	1.30	2.03	2.78	3.57
				E								0.68			0.86	1.30	1.74	2.72	3.10
			NS	A								0.82			1.15	1.91	2.41	3.21	3.84
				B								0.88			1.21	2.02	2.52	3.60	4.13
				C								0.82			1.17	1.79	2.24	3.31	3.97
				D								0.66			0.86	1.32	1.78	2.57	3.09
				E								0.67			0.84	1.16	1.61	2.49	2.95
	93	Dryobalanops aromatica	EW	A	0.46					0.58					0.99	1.56			
				B	0.32					0.41					0.68	0.99			
				C	0.43					0.59					1.02	1.60			
				D	0.43					0.58					0.84	1.67			
				E	0.47					0.56					0.80	1.02			
			NS	A	0.45					0.54					0.80	1.37			
				B	0.52					0.59					0.83	1.38			
				C	0.50					0.57					0.96	1.63			
				D	0.51					0.60					0.78	1.26			
				E	0.46					0.61					0.75	1.21			
		Hopea odrata	EW	A	0.31					0.45					1.01	1.62			
				B	0.35					0.51					1.03	1.57			
				C	0.40					0.57					1.26	2.19			
				D	0.61					0.67					1.08	1.30			
				E	0.35					0.45					0.94	1.63			
		Palaquium gutta	EW	A	0.22					0.33					0.55	0.85			
				B	0.13					0.18					0.31	0.62			
				C	0.16					0.21					0.44	0.74			
				D	0.14					0.21					0.35	0.58			
				E	0.43					0.44					0.46	0.83			
		Pareshorea densiflora	EW	A	0.29					0.41					0.82	1.31			
				B	0.35					0.46					0.77	1.17			
				C	0.49					0.59					0.98	1.45			
				D	0.44					0.43					0.64	1.16			
				E	0.16					0.22					0.38	0.92			
		Pentaspadon motleyi	EW	A	0.30					0.44					0.81	1.46			
				B	0.34					0.47					0.96	2.07			
				C	0.39					0.55					1.14	2.05			
				D	0.28					0.44					0.88	1.78			
				E	0.26					0.34					0.62	1.43			
			NS	A	0.20					0.25					0.41	0.93			
				B	0.16					0.21					0.53				
				C	0.36					0.36					0.69	1.32			
				D	0.31					0.39					0.77	1.48			
				E	0.27					0.28									

Appendix S7 Growth of Mean Height

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
		Shorea acuminata	EW	A	0.61					0.75					1.23	1.95			
				B	0.62					0.71					1.24	2.17			
				C	0.69					0.76					1.18	1.66			
				D	0.64					0.65					1.14	1.86			
				E	0.62					0.68					0.90	1.55			
			NS	A	0.44					0.53					0.63	0.98			
				B	0.42					0.57					0.76	1.29			
				C	0.44					0.53					0.74	1.24			
				D	0.40					0.46					0.71	1.27			
				E	0.39					0.47					0.77	1.27			
		Shorea glauca	EW	A	0.28					0.35					0.60	0.78			
				C	0.33					0.38					0.66	0.95			
				D	0.27					0.32					0.42	1.00			
				E	0.34					0.35					0.43	0.65			
		Shorea macroptera	EW	A	0.24					0.34					0.67	0.98			
				B	0.30					0.41					0.68	1.10			
				C	0.30					0.38					0.52	0.82			
				D	0.19					0.36					0.52	1.12			
				E	0.37					0.50					0.72	1.42			
	94	Dipterocarpus cornutus	EW	A	0.41					0.51					0.81				
				B	0.45					0.49					0.88				
				C	0.27					0.39					0.53				
				D	0.30					0.39					0.73				
				E	0.30					0.40					0.73				
		Hopea pubescens	EW	A	0.20					0.29					0.64				
				B	0.45					0.49					0.69				
				C	0.23					0.25					0.47				
				D	0.33					0.45					0.80				
				E	0.38					0.49					0.80				
		Intsia palembanica	EW	A	0.48					0.57					0.79				
				B	0.44					0.57					0.82				
				C	0.50					0.56					0.86				
				D	0.50					0.53					0.65				
				E	0.53					0.61					0.75				
		Shorea assamica	EW	A	0.42					0.51					0.71				
				B	0.47					0.51					0.69				
				C	0.39					0.57					0.77				
				D	0.51					0.57					0.94				
				E	0.50					0.59					0.81				
		Shorea leprosula	EW	C						0.81					1.60				
		Shorea macroptera	EW	C						0.73					1.10				
		Shorea ovalis	EW	A	0.29					0.48					1.00				
				B	0.34					0.54					1.01				
				C	0.31					0.51					0.99				
				D	0.39					0.52					1.01				
				E	0.35					0.47					0.89				
		Shorea ovata	EW	A	0.55					0.63					1.05				
				B	0.44					0.44					0.88				
				C	0.49					0.43					0.71				
				D	0.46					0.47					0.80				
				E	0.41					0.44					0.48				
		Shorea pauciflora	EW	A	0.37					0.54					0.85				
				B	0.39					0.53					1.03				
				C	0.32					0.43					0.71				
				D	0.37					0.44					0.71				
				E	0.34					0.45					0.79				
Belukar	94	Dialium sp.	EW	F	0.38					0.44					0.69				
				G	0.29					0.40					0.75				
		Gonystylus sp.	EW	F	0.47					0.60					0.85				
				G	0.43					0.53					0.79				
		Neobalanocarpus heimii	EW	F	0.46					0.55					0.86				
				G	0.62					0.62					0.86				
				H	0.61					0.63					0.85				
		Shorea acuminata	EW	F	0.48					0.49					0.88				
				G	0.40					0.46					0.78				

Appendix S7 Growth of Mean Height

Site	Year	Species	Direction	Type	Months after Planting 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
		Shorea bracteolata	EW	F	0.47					0.51					0.63				
				G	0.36					0.40					0.54				
		Shorea gibbosa	EW	F	0.28					0.39					0.76				
				G	0.29					0.39					0.76				
		Shorea glauca	EW	F	0.52					0.73					1.48				
				G	0.65					0.71					1.24				
		Shorea leprosula	EW	F	0.55					0.81					1.62				
				G	0.52					0.74					1.37				
				H	0.59					0.76					1.44				
		Shorea multiflora	EW	F	0.70					0.69					1.14				
				G	0.37					0.47					0.87				
		Shorea ovalis	EW	F	0.48					0.66					1.48				
				G	0.45					0.56					1.23				
				H	0.59					0.68					1.34				
		Shorea ovata	EW	F	0.47					0.50					0.94				
				G	0.49					0.53					0.93				
				H	0.42					0.50					0.68				
		Shorea parvifolia	EW	F	0.43					0.59					1.24				
				G	0.41					0.59					1.17				
				H	0.35					0.42					1.06				
		Shorea pauciflora	EW	F	0.50					0.73					1.21				
				G	0.53					0.66					1.17				
				H	0.40					0.56					1.07				
		Shorea talura	EW	F	0.48					0.60					1.07				
				G	0.40					0.64					1.34				
		Sindora sp.	EW	F	0.39					0.39					0.53				
				G	0.37					0.41					0.59				
Open	92	Hopea odorata	EW	A			0.49			0.48					0.59	0.74	0.92		
				B			0.49			0.49					0.59	0.71	1.10		
				C			0.39			0.44					0.71	0.86	1.48		
				D			0.43			0.42					0.45	0.48	0.62		
				E			0.52			0.52					0.68	0.81	0.96		
		Neobalanocarpus heimii	EW	A				0.44		0.44					0.45	0.51	0.49	0.60	
				B				0.30		0.29					0.37	0.47	0.57	0.70	
				C				0.40		0.40					0.40	0.45	0.49	0.63	
				D				0.33		0.31					0.34	0.32	0.37	0.47	
				E							0.32			0.35	0.37	0.55	0.55	0.68	
		Shorea leprosula	EW	A				0.56		0.50					0.38	0.49			
				B				0.46		0.42					0.38	0.63			
				C				0.47		0.48					0.70	0.87	1.40		
				D				0.36		0.35					0.39	0.35			
				E						0.41		0.36			0.38	0.48	0.83		
		Shorea parvifolia	EW	A					0.41	0.40					0.60	0.73	0.73		
				B					0.45	0.42					0.44	0.60	0.55		
				C					0.42	0.45					0.44	0.32	0.52		
				D					0.52	0.51					0.43	0.59	0.95		
				E						0.37		0.38			0.37	0.51	0.61		
	93	Calophyllum sp.	EW	A		0.15				0.23					0.33				
				B		0.34				0.10									
				C		0.14				0.22					0.38				
				D		0.13				0.14					0.08				
				E		0.15				0.27									
		Dryobalanops aromatica	EW	A		0.45				0.48					0.80				
				B		0.52				0.41									
				C		0.48				0.48					0.57				
				D		0.46				0.51									
				E		0.44				0.48					0.55				
		Endospermum malaccens	EW	A		0.50				0.29									
				B		0.67				0.52					0.51				
				C		0.58				0.53					0.49				
				D		0.53				0.56					0.68	1.24			
				E		0.52				0.44									
		Pentaspadon motleyi	EW	A		0.21				0.34					0.53				
				B		0.34				0.23									
				C		0.20				0.27									

Appendix S7 Growth of Mean Height

					Months after Planting														
Site	Year	Species	Direction	Type	1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
				D		0.22				0.26					0.50	0.79			
				E		0.17				0.22					0.34				
		Pouteria malaccensis	EW	A		0.16				0.18									
				B		0.16				0.05									
				C		0.15				0.25					0.16				
				D		0.16				0.17									
				E		0.17				0.19					0.25				
		Scaphium macropodum	EW	A		0.24				0.25					0.20				
				B		0.23				0.25					0.28				
				C		0.27				0.26					0.34				
				D		0.24				0.24									
				E		0.23				0.25					0.27	0.32			
		Shorea acuminata	EW	A		0.42				0.41					0.45				
				B		0.43				0.34									
				C		0.39				0.31									
				D		0.46				0.41									
				E		0.43				0.45					0.51				
		Shorea bracteolata	EW	A		0.27				0.33					0.41				
				B		0.30				0.33					0.57				
				C		0.25				0.29					0.36				
				D		0.27				0.30					0.33	0.44			
				E		0.35				0.37					0.36				
X(Arboretum)	92	Dryobalanops aromatica	x	x				0.39		0.41					0.54	0.51			
		Durio sp.	x	x				0.72		0.72					0.74	0.81	0.97		
		Hevea brasiliensis	x	x				0.41		0.34					0.45	0.58	1.37		
		Hopea odorata	x	x				0.31		0.34					0.62	0.78	1.10		
		Hopea odorata-1	x	x							0.65		0.66		0.69	0.91	1.30	2.04	
		Intsia palembanica	x	x			0.63			0.58					0.70	0.56	0.56		
		Neobalanocarpus heimii	x	x				0.51		0.47					0.50	0.57	0.62		
		Parkia sp.	x	x			0.40			0.39					0.63	0.63	1.38		
		Pentaspadon motleyi	x	x				0.21		0.24					0.45	0.53			
		Scaphium macfopodum	x	x								0.38		0.38	0.31	0.37	0.55		
		Shorea acuminata	x	x				0.56		0.53					0.54	0.54			
		Shorea leprosula	x	x							0.62				0.31	0.58			
		Shorea ovalis	x	x				0.66		0.60					0.54	0.51	0.40		
		Shorea parvifolia	x	x	0.44					0.41					0.41				
		Swietenia macrophylla	x	x				0.56		0.54					0.67	0.80	1.15		
		Tectona grandis	x	x			0.23			0.25					0.61	0.77	1.23		
	93	Agathis borneensis	x	x		0.31				0.41					0.49				
		Alstonia sp.	x	x		0.30				0.40					0.57	0.88	1.12		
		Cinnamomum sp.	x	x		0.55				0.62					0.67	0.76	1.01		
		Dacryodes sp.	x	x		0.12				0.14					0.20				
		Dipterocarpus cornutus	x	x		0.29				0.29					0.22				
		Endospermum malaccens	x	x		0.44				0.48					0.53	0.73	0.99		
		Heritiera sp.	x	x		0.23				0.22					0.30				
		Hopea odorata-2	x	x				0.66		0.65					0.65		0.81		
		Hopea odorata-3	x	x		0.27				0.29					0.40				
		Koompassia malaccensis	x	x		0.12				0.21					0.19				
		Palaquium gutta	x	x		0.23				0.24					0.33				
		Shorea macroptera	x	x		0.31				0.49					0.66				
		Shorea multiflora	x	x		0.47				0.21					0.24				
		Shorea talura	x	x		0.33				0.34					0.34				
		Toona sureni	x	x		0.52				0.41					0.46	0.45	0.71		

Appendix S8 Growth of Mean Diameter

Site	Year	Species	Direction	Type	Month 1	2	3	4	5	6	7	8	9	10	12	18	24	30	36
Acacia	92	Neobalanocarpus heimii	EW	A								0.61			0.74	0.90	1.01	1.17	1.37
				B								0.52			0.74	0.90	1.01	1.22	
				C								0.61			0.75	0.93	1.23	1.63	1.77
				D								0.64			0.73	0.85	0.98	1.19	1.34
				E								0.66			0.77	0.99	1.22	1.71	2.03
			NS	A								0.61			0.78	0.95	1.08	1.23	1.50
				B								0.64			0.77	1.09	1.27	1.61	1.88
				C								0.62			0.81	1.17	1.35	1.85	2.14
				D								0.61			0.76	1.14	1.40	1.97	2.46
				E								0.65			0.77	1.10	1.36	1.94	2.39
		Shorea leprosula	EW	A								0.92			1.32	2.18	2.92	3.80	4.80
				B								0.94			1.53	2.79	3.80	5.25	6.30
				C								1.01			1.54	2.82	3.91	5.54	6.72
				D								0.93			1.25	2.29	3.15	4.80	6.50
				E								0.87			1.19	2.18	2.85	4.34	6.19
			NS	A								0.88			1.43	2.31	3.28	4.43	5.56
				B								1.00			1.57	2.79	3.77	4.77	5.96
				C								0.97			1.44	2.19	2.78	3.65	4.42
				D								0.97			1.49	2.62	3.75	5.31	6.85
				E								0.78			1.06	1.66	2.33	3.65	5.17
		Shorea parvifolia	EW	A								0.73			1.01	1.68	2.36	3.06	3.70
				B								0.67			0.99	1.59	1.94	2.66	3.25
				C								0.73			0.87	1.47	2.07	2.79	3.82
				D								0.76			0.98	1.39	2.09	2.84	4.12
				E								0.68			0.90	1.52	1.97	3.13	4.08
			NS	A								0.72			0.94	1.56	2.14	2.77	3.44
				B								0.79			1.04	1.73	2.35	3.32	3.98
				C								0.83			1.14	2.05	2.72	3.53	4.53
				D								0.70			0.92	1.49	1.91	2.83	4.10
				E								0.64			0.99	1.53	2.09	3.31	4.81
	93	Dryobalanops aromatica	EW	A	0.43					0.49					0.70	1.03			
				B	0.38					0.45					0.63	0.73			
				C	0.39					0.57					0.79	1.14			
				D	0.41					0.55					0.73	1.23			
				E	0.48					0.66					0.68	0.95			
			NS	A	0.40					0.47					0.55	0.89			
				B	0.38					0.45					0.50	0.82			
				C	0.45					0.48					0.68	1.03			
				D	0.46					0.55					0.66	0.91			
				E	0.45					0.54					0.72	1.22			
		Hopea odrata	EW	A	0.39					0.66					1.20	2.11			
				B	0.53					0.73					1.23	1.80			
				C	0.54					0.93					1.77	2.90			
				D	0.78					0.86					1.19	1.58			
				E	0.51					0.71					1.33	2.33			
		Palaquium gutta	EW	A	0.33					0.35					0.46	0.62			
				B	0.22					0.28					0.43	0.50			
				C	0.25					0.31					0.44	0.62			
				D	0.23					0.37					0.43	0.58			
				E	0.67					0.73					0.78	0.93			
		Parashorea densiflora	EW	A	0.33					0.46					0.67	1.15			
				B	0.39					0.51					0.76	1.05			
				C	0.51					0.67					1.02	1.32			
				D	0.54					0.63					0.83	1.27			
				E	0.26					0.33					0.49	0.66			
		Pentaspadon motleyi	EW	A	0.36					0.43					0.67	1.19			
				B	0.35					0.46					0.81	1.46			
				C	0.37					0.57					1.01	1.71			
				D	0.30					0.47					0.79	1.51			
				E	0.28					0.38					0.58	1.19			
			NS	A	0.13					0.23					0.30	0.73			
				B	0.12					0.19					0.26				
				C	0.29					0.40					0.56	1.02			
				D	0.30					0.39					0.66	1.30			
				E	0.19					0.25									
		Shorea acuminata	EW	A	0.62					0.71					1.00	1.45			