TENDING OF COMMERCIAL NATURAL REGENERATION IN SHRUBS AT A LOGGED-OVER TROPICAL RAINFOREST IN EAST KALIMANTAN

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Introduction

The condition and composition of the existing shrubs are very much different, depending upon sites, original forest and human intervention especially in the case of forest fire. Shrubs can be used as a starting point for industrial forest establishment, without destroying the existing vegetation and even in utilizing them as a main tree as well as protection tree for the forest to be made. As a result, the existing environment is not damaged and also the cost of exploitation can be minimized.

In many places of East Kalimantan shrubs are found in wide areas, where there is a great quantity of *Anthocephalus cadamba* and *Peronema canescens* regeneration. These tree species grow closely to each other, especially on open areas and damaged soil caused by timber yarding in logging activities.

Since 1976 the Forest Research Institute has conducted research on the growth of commercial tree species found in shrubs in logged-over tropical rainforest located in East Kalimantan. This paper discusses the preliminary results of the investigation on the tending of natural regeneration in shrubs after three years of observation and measurements.

Description of the study area

1 Geographical location

The experimental area is located in the Kenangan, Sotek and Lolo forest complexes, a concession of PT International Timber Corporation Indonesia (PT ITCI), PT Balikpapan Forestry Industries (PT BFI) and PT Telaga Mas (PT TM), respectively. The distribution of sample plots is shown in Table 2. The first two concessions belong to the Balikpapan Forest District while the latter belongs to the Pasir Forest District, East Kalimantan.

The PT ITCI forest concession is situated between 116°30′—117°30′ east longitude and between 0°15′—1°10′ south latitude. The PT BFI area is situated between 116°21′—116°45′ east longitude and between 1°5′—1°25′ south latitude, while the PT TM area is situated between 115°48′—116°02′ east longitude and between 1°30′—1°50′ south latitude.

2 Geology and soil

The study areas show a flat to slightly undulating topography, and an elevation of less than 350m, 250m and 150m above sea level for PT ITCI, PT BFI and PT TM areas, respectively.

According to the Soil Research Institute (1967), the soils of all study areas belong to the red-yellow podzolic soils derived from igneous and sedimentary rocks.

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3 Climate

The climate of all study areas is humid and belongs to rainfall type A according to Schmidt & Ferguson's classification (1951). The monthly rainfall ranges between 204 and 319 mm, and the annual rainfall is 3035 mm. The climate data of the Balikpapan meteorological station are shown in Table 1.

Table 1 Climate data of Balikpapan, 1953 – 1972

Month	Temperature, °C			Relative humidity %	Rainfall mm
	Max.	Min.	Mean		
January	30.2	23.9	26.5	85	282
February	30.1	23.7	26.5	86	263
March	30.1	23.7	26.2	87	256
April	30.0	24.0	26.7	88	218
May	30.2	24.2	26.9	86	269
June	30.0	24.1	26.8	88	238
July	29.5	23.7	27.0	85	319
August	29.7	24.0	27.0	85	218
September	29.9	24.3	27.4	84	204
October	30.0	24.5	27.8	84	235
November	30.1	24.1	27.4	85	252
December	30.3	23.3	27.4	85	252

Source: Meteorological and Geophysical Service, Jakarta

Table 2 Description of sample plots in three forest concession areas, East Kalimantan

Forest Concession	Sample plot*)	Located at Km	Elevation m a.s.l.	Area ha	Species
PT ITCI	I	34	128	0.1	*Anthocephalus cadamba*
	IIA	21	172	0.1	do.
	IIB	21	172	0.1	do.
	IIC	21	170	0.1	do.
	IIIA	32	270	0.1	do.
	IIIB	32	280	0.1	do.
	IIIC	33	348	0.1	do.
PT BFI	IIIA	18	150	0.16	*Anthocephalus cadamba*
	IIIB	18	150	0.16	do.
	IIIC	27	242	0.16	do.
PT TM	IIA	Lolo**)	109	0.16	*Peronema canescens*
	IIB	Lolo	80	0.16	do.
	IIC	Lolo	90	0.16	do.
	IIIA	Lolo	98	0.16	do.
	IIIB	Lolo	110	0.16	do.
	IIIC	Lolo	90	0.16	do.

*) A, B, C: replication.
**) Forest complex.

Methods

1 Sample plots

The sample plots are square in form, located in the shrubs which show dense regeneration of commercial tree species. Based on height the natural regeneration is classified into three groups:

I below 1.5 meters
II between 1.5—3.0 meters
III over 3.0 meters

The description of the sample plots is presented in Table 2.

2 Treatments

Shrubs that contain natural regeneration of commercial tree species such as *Anthocephalus cadamba* and *Peronema canescens*, can be converted into forest of these species by means of thinning in dense regeneration and enrichment planting in scant regeneration. Furthermore, the natural regeneration of these species is freed from weeds and other disturbing plants, so that a stand which looks like an artificial one is obtained. The next activities include thinning at certain time as practised in artificial plantation.

Results and discussion

Growth measurements of tree reproduction were carried out in March of 1976, 1977 and 1978, respectively. The calculation of height and diameter increments is presented in Table 3.

For *Anthocephalus cadamba* tree reproduction in PT ITCI, the average height increment between the second and the third measurement was 0.69, 1.22 and 1.48m per year for group I, II and III, respectively, while the average diameter increment for the same groups was 0.81, 2.71 and 3.58cm per year. There was a tendency for the height and diameter increments to correspond to the increasing average height and diameter of tree reproduction mentioned above. The same also applied to *Peronema canescens* tree reproduction of groups II and III in PT TM. It is suspected that the treatments exert a significantly larger influence on group III than on groups I and II. After the tree reproduction of group III is harvested, the next felling will be done for group II and group I. It is necessary to stress here that the harvesting is conducted when the tree reproduction has reached the maturity stage. This implies that sustained production can be maintained.

In PT BFI sample plots, the average height increment of *Anthocephalus cadamba* tree reproduction group III between the first and the second measurement was 0.45m per year, and that between the second and the third measurement was 1.69m per year, while the average diameter increments were 1.16 and 3.40cm per year, respectively. The tree growth in terms of height and diameter increments tended to increase in each measurement, which means that there was an increase in volume as well. These findings also applied to group III of *Peronema canescens* tree reproduction in PT TM. The increase of height and diameter is expected to lead to the optimum volume of the tree reproduction by the time of harvesting.

The establishment of *Anthocephalus cadamba* and *Peronema canescens* stands on open areas in the shrubs at a logged-over tropical rainforest, will be able to decrease the apprehension of the existing production gap of industrial wood for plywood, where *Anthocephalus cadamba* stand can supply wood for core veneer while *Peronema canescens* can supply wood for face veneer.

Table 3 Height and diameter increments of commercial tree reproduction in the sample plots

Forest concession	Sample plot	Species*)	Number of trees	Average height (m)			Height increment (m/year)		Average diameter (cm)			Diameter increment (cm/year)	
				1976	1977	1978	1976–1977	1977–1978	1976	1977	1978	1976–1977	1977–1978
PT ITCI	I	A.c.	72	–	2.75	3.44	–	0.69	–	3.04	3.85	–	0.81
	IIA	A.c.	47	–	5.29	6.26	–	0.97	–	6.01	8.58	–	2.57
	IIB	A.c.	50	–	3.74	4.99	–	1.25	–	4.51	7.39	–	2.88
	IIC	A.c.	38	–	3.58	5.03	–	1.45	–	4.49	7.18	–	2.69
	Mean				4.20	5.43		1.22		5.00	7.71		2.71
	IIA	A.c.	39	–	7.57	9.09	–	1.52	–	7.96	11.56	–	3.60
	IIIB	A.c.	54	–	8.11	9.63	–	1.52	–	9.22	12.32	–	3.10
	IIIC	A.c.	49	–	9.68	11.09	–	1.41	–	10.50	14.53	–	4.03
	Mean				8.45	9.94		1.48		9.23	12.81		3.58
PT BFI	IIIA	A.c.	17	18.89	19.36	21.71	0.47	2.35	21.39	22.25	25.67	0.86	3.42
	IIIB	A.c.	35	16.54	17.00	18.51	0.46	1.51	18.13	18.87	21.60	0.74	2.73
	IIIC	A.c.	38	15.57	16.11	17.33	0.54	1.22	19.06	20.94	24.98	1.88	4.04
	Mean			17.00	17.49	19.18	0.49	1.69	19.53	20.68	24.08	1.16	3.40
PT TM	IIA	P.c.	244	–	2.68	3.41	–	0.73	–	2.63	3.06	–	0.43
	IIB	P.c.	146	–	2.27	2.88	–	0.61	–	2.39	2.91	–	0.52
	IIC	P.c.	185	–	2.05	2.62	–	0.57	–	2.30	2.80	–	0.50
	Mean				2.33	2.97		0.64		2.44	2.92		0.48
	IIA	P.c.	88	12.56	13.22	15.11	0.66	1.89	12.85	13.08	14.06	0.23	0.98
	IIIB	P.c.	93	12.82	13.40	14.89	0.58	1.49	10.56	11.10	12.03	0.54	0.93
	IIIC	P.c.	105	10.19	10.72	12.20	0.53	1.48	7.47	8.10	8.64	0.63	0.54
	Mean			11.86	12.45	14.07	0.59	1.62	10.29	10.76	11.58	0.47	0.82

*) A.c.: *Anthocephalus cadambe*; P.c.: *Peronema canescens*.

Conclusion

Although the preliminary results of the current investigation as reported here are far from complete, the following conclusions can be drawn:

1. Tree growth, in terms of height and diameter increments of commercial tree reproduction is satisfactory enough. This implies that when sufficient amount of tree reproduction is left in the shrubs, they will sustain the level of productivity.
2 Tending of commercial tree reproduction (natural regeneration) is required if a sufficient amount of young trees has to be obtained. A sufficient amount of young trees is needed to maintain the productivity after each cutting cycle.

Summary

As a consequence of mechanical logging such as that applied in East Kalimantan, shrubs are found in wide areas where there is a great quantity of commercial natural regeneration of *Anthocephalus cadamba* and *Peronema canescens* species. These tree species grow closely to each other, especially on open areas and damaged soil caused by timber yarding.

By conducting the treatments such as thinning in dense regeneration and enrichment planting in empty areas or in zones with less regeneration, cleaning of weeds and other disturbing plants, a stand which looks like an artificial one is eventually obtained.

The preliminary results of the investigation showed that the tree growth, in terms of height and diameter increments in commercial natural regeneration was satisfactory. Tending of commercial natural regeneration (tree reproduction) is required if a sufficient amount of young trees has to be obtained. A sufficient amount of commercial tree reproduction is needed to maintain the productivity after each cutting cycle.

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