Leaflet No. 13/ 93-94

Union of the Government of Myanmar
Ministry of Forestry
Forest Department

Study on the Selective Logging of Non-Teak Hardwoods in the Bago and Yangon Divisions

U Shwe Kyaw, B.Sc. [For.], [Rgn], M.Sc. [ANU, Canberra].
Deputy Director,
Forest Research Institute
1993

Conversion Factors

Length

1 foot = 0.3048 metre ; 1m = 3.28088 ft

1 mile = 1.6093 kilometers; 1 km = 0.6214 mile

Area

1 acre = 0.4047 hectare ; 1 ha = 2.471 ac

1 sq. mile = 2.59 sq. km ; 1 km^2 = 0.3861 sq. mile

1 sq. foot = 0.0929 sq. metre ;1 sq. m = 10.764173 sq. ft.

Volume

1 cubic foot	=	0.028317 m^3 ; 1 m^3 = 35.3147 ft^3
1 ton(true)	=	1.4159 m^3
1 ton (hoppus)	=	1.8024 m^3
1 ton (true) /ac	=	3.4986 m^3/ ha
1 ton (hoppus)/ ac	=	4.4537m^3/ ha

ပဲခူးတိုင်း နှင့် ရန်ကုန်တိုင်းတို့တွင် ကျွန်းမှအပ သစ်မာရွေးချယ်ထုတ်လုပ်ခြင်းကို လေ့လာခြင်း။

ဦးရွှေကျော် (B.Sc.), [For.], [Rgn], M.Sc. [ANU, Canberra].
ဒု-ညွှန်ကြားရေးမှူး
သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

ကျွန်းမှအပ သစ်မာရွေးချယ်ထုတ်လုပ်ရာတွင် သစ်ထုတ်လုပ်ခြင်းကြောင့် ထိခိုက်ပျက်စီးမှုများ၊ အပြစ်အနာ အဆာများနှင့် ဆုံးရှုံးမှုများသာမက အသားတင် သစ်ထွက်ရှိမှုတို့၏ ပမာဏကို သိရှိရန် ပဲခူးတိုင်း နှင့် ရန်ကုန်တိုင်းတို့တွင် ဆောင်ရွက်ခဲ့ပါသည်။ သစ်ထုတ်လုပ်မှုကြောင့် ထိခိုက်ပျက်စီးသာ အပင်အရေအတွက်သည် သစ်မထုတ်ဘဲ ကျန်ရှိသည့် ရင်စို့အချင်း ၂၀ စင်တီမီတာနှင့် အထက်ရှိ အပင်များ၏ ၃.၂% ဖြစ်ပါသည်။ အပြစ်အနာအဆာနှင့် အခြားဆုံးရှုံးမှုများကြောင့် စုစုပေါင်း သစ်ထုထည် ပမာဏမှ လျော့နည်းသည့်နှုန်းမှာ သစ်မျိုးနှင့် အရွယ်အစားပေါ်မူတည်၍ ၃% မှ ၂၆% အထိဖြစ်ပါသည်။ အဆိုပါလျော့နည်းမှုနှုန်းသည် ယေဘုယျအားဖြင့် ခုတ်လှဲမည့် အပင်များ၊ အရွယ်အစား ကြီးလေ များလေ ဖြစ်ပါသည်။လေ့လာသည့်ဧရိယာတွင် တစ်ဟက်တာရှိ အသားတင်သစ်ထွက်ရှိမှုမှာ ၂၃.၄၈ ကုဗမီတာဖြစ်ပြီး ပျဉ်းကတိုးသည် ၁၆.၅ ကုဗမီတာ ပါဝင်၍ စုစုပေါင်း သစ်ထွက်ရှိမှု၏ ၇၀% ဖြစ်ပါသည်။

Study on the Selective Logging of Non-Teak Hardwoods in the Bago and Yangon Divisions

U Shwe Kyaw, B.Sc. [For.], [Rgn], M.Sc. [ANU, Canberra].
Deputy Director,
Forest Research Institute

Abstract

Assessment of logging-induced damages, defects and wastages and net log outturn were carried out in the selective logging of non-teak hardwoods in the Bago and Yangon Divisions. The overall percentage of number of trees damaged to the residual trees of 20 cm dbh + is 3.2%. The rate of deduction due to defects and wastages to the gross volume varies from 3% to 26% depending on the species and size classes. The deduct rate generally increases as the size of the cut trees increases. The net log outturn per hectare in the study area is 23.48 m^3 (5.3 hoppus ton/acre) out of which Pyinkado (*Xylia dolabriformis*) forms 16.5 m^3 contributing about 70% of the total outturn.

Contents

1. Introduction

For better decision making, the forest manager must have reliable and realistic information about the state of the forest. Ordinarily, part of their information consists of stand and stock tables (number of trees and average volume by diameter classes per unit area) by species and forest type. The National Forest Inventory Project of Myanmar (NFI) also provides stand and stock tables by species for different forest types. The stock tables were prepared based on the stand tables and volume equations which were constructed based on gross volume of clean boles. For management planning purposes, these gross inventory estimates need to be converted to realistic net values applying deduction factors for defects and wastages.

Selective logging had been successfully applied in the forests of Myanmar. In this system, the remaining standing stock after logging had been affected to some extent due to felling and extraction damages. For efficient management planning, it is desirable to know the degree of this logging-induced damages.

This is the purpose of the present study to assess the rate of defect and wastages, net log outturn and logging-induced damages in the selective logging of non-teak hardwoods in the Bago and Yangon Divisions. The field work was conducted in 1990-91 and 1991-92 along with the annual operation of the NFI project.

2. Study Area

Twenty five blocks of forests, each 4 ha in size (200 x 200 m) were distributed in the 4 study areas as shown in table 1. The blocks were selected subjectively in the Myanmar Timber Enterprise (MTE) logging areas in Bago and Yangon Division. Topography of the blocks was undulating to fairly steep ranging from 15 % to 60 % of slope. The blocks were grouped in four study areas based on the slope present and locality.

Table 1. Study Area and Number of Blocks.

Division (1)	District (2)	Township (3)	Forest reserve (4)	Compartment No. (5)	Number of Study block (6)
Study area I					
Bago	Tharyawady	Tharyawady	Thonze	33	4
Bago	`	`	Thonze	34	4
Bago	`	`	Thonze	42	4
Study area II					
Yangon	Insein	Taikkyi	Okkan	69	6
Study area III					
Yangon	Insein	Taikkyi	Okkan	70	3
Bago	Taungoo	Phyu	Pyuchaung	42	2
Study area IV					
Bago	Taungoo	Phyu	Pyuchaung	39	1
Bago	Bago	Kyauktaga	Aidongon	64	1
Total number of blocks					25

3. Method

A study block is square (200 x 200 m) in shape. Before and immediately after non-teak hardwood logging, 100% enumerations were carried out in each block for all trees of 20 cm DBH and up. The blocks were subdivided into 100 record units of 20 x 20 m as shown in Fig. 1. The record units were surveyed in continuous strips of 10 plots starting in one direction along one side of the square and returning in opposite direction for the adjacent strip etc. for a total of 10 strips.

	10	11	30	31	50	51	70	71	91	91
	9									92
	8									93
	7									94
200 m	6									95
	5									96
	4									97
	3									98
	2									99
	1	20	21	40	41	60	61	80	81	100

200 m

Fig. 1. A study block with 100 recording units.

Before felling commenced, the DBH or DAB (Diameter above buttress) and species for trees of 20cm DBH + in a block were recorded together with positions. Trees which were marked for selective felling were also measured and recorded.

After 100 % enumeration had been done, the marked trees were felled and measured in selections from butt to crown-point to derive gross volume (bole volume) for each tree. The MTE employees were then allowed to cut the felled trees into logs, rejecting the butt and top ends defective portions of the bole. Before post-logging enumeration started, all recovered logs were extracted from the study blocks to the outside. For each log, end diameters and length were measured and quality was also assessed.

After extraction was completed, the post-logging enumeration was carried out classifying all recorded tress into one of the following classes.

1 : tree entirely pushed over, seriously leaning or bole broken below crown point;
2 : tree with serious stem and crown damages;
3 : tree with serious stem damages only;
4 : tree with minor stem damages and serious crown damages;
5 : tree with minor stem damages and minor crown damages;
6 : tree with serious crown damages only;
7 : tree with minor crown damages only;
8 : no damage apparent;

Serious stem damage : Minimum of bark ripped-off on bole over an area of 10 % of circumference at the position, at least 60 cm in bole length (e.g at least 15 cm x 60 cm bark loss at circumference 150 cm - 50 cm diameter, or at least 0.5 ft x 2 ft at circumference 5 ft.

Serious crown damage : Minimum of 25 % of main branches in crown are broken-off or broken.

4. Analysis of the Results

4.1 Rates of Deduction to Gross Volume

Deduct rates to gross volume were assessed from all 471 felled and extracted trees in 25 study blocks. Deductions were caused due to external and internal defects, breakges and wastages. The deduct rates in percent by species and size classes were presented in table 2 and also in Fig. 2 with abundant species.

Table 2. Rates of deduction in percent to gross volume.

Species	No. of trees (2)	BDG classes in cm				All size (7)
		55-65 (3)	65-75 (4)	75-100 (5)	100 + (6)	
1. **Pyinkado** *(Xylia dolabriformis)*	327	3	8	10	7	8
2. **Pyinma** *(Lagerstroemia speciosa)*	37	4	3	19	16	13
3. **Taukkyan** *(Terminalia tomentosa)*	25	5	21	10	-	14
4. **Kanyin** *(Dipterocarpus* spp.*)*	22	-	-	6	26	10
5. **Yon** *(Anogeissus acuminata)*	19	7	15	-	-	10
6. **Thadi** *(Protium serrata)*	18	11	8	19	-	14
7. **Other spp.** combined	23	7	21	5	-	14
Total	471	4	10	11	9	11

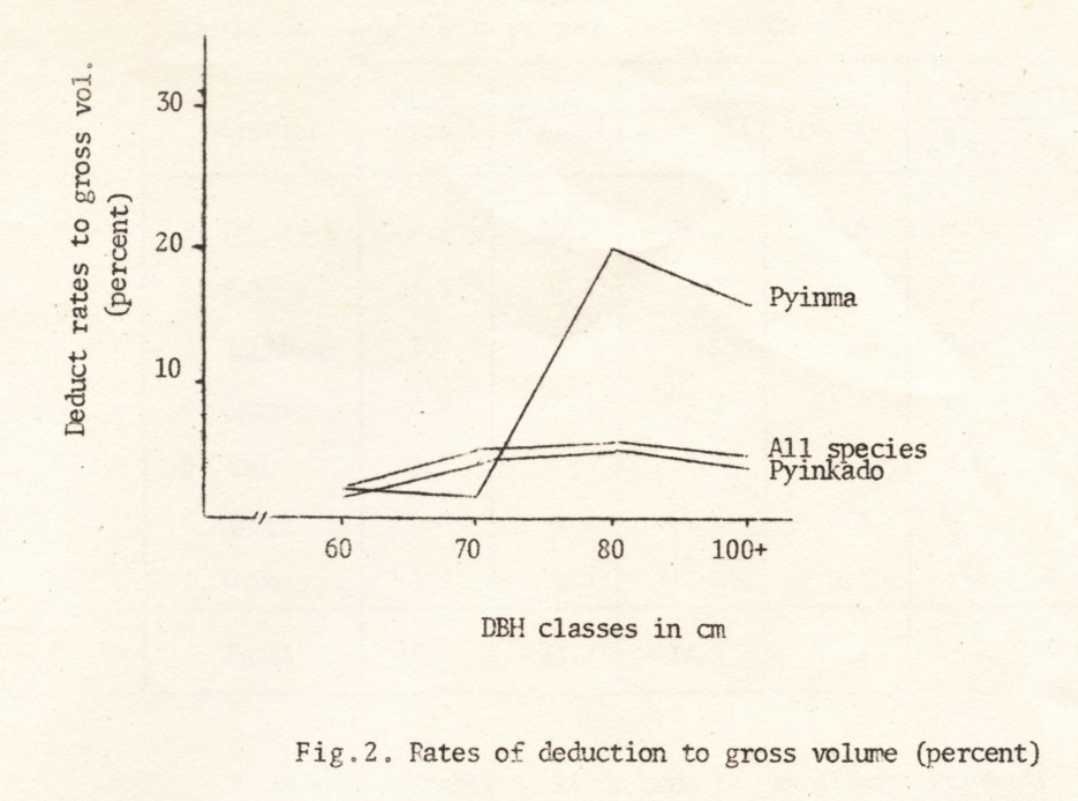

Fig.2. Rates of deduction to gross volume (percent)

The deduct percents of Pyinkado for all DBH classes are less than 10% except in 75-100 cm class where it is 10%. The deduct percents in the 55-65 cm DBH class are usually lower than the higher classes as excepted. It ranges from 3 % to 11 %. If all sizes are combined, the deduct percents for different species varies from 8 % to 14%. If all species are taken together, the deduct percents for 65 to 75 cm-100 cm + DBH classes are around 10 % and for 55-65 cm class it is 4 %.

4.2 Log outturn

The average log production per hectare was calculated by study area and presented in table 3.

Table 3. Log outturn per hectare in m^3.

Species	study area I	study area II	study area III	study area IV	Over all	
					m^3 / ha	%
1. Pyinkado	9.2	18.8	25.6	30.6	16.5	70.3
2. Pyinma	2.3	1.4	0.7	-	1.6	6.7
3. Taukkyan	1.7	-	-	-	0.8	3.4
4. Kanyin	0.8	-	0.3	22.4	2.3	9.8
5. Yon	1.2	-	0.1	-	0.6	2.5
6. Thadi	-	0.2	1.0	0.8	0.3	1.3
7. Others	1.7	1.3	1.4	0.3	1.4	6.0
Total	16.9	21.7	29.1	54.1	23.5	100.0

As seen in table 3, study area IV has highest Pyinkado log outturn with 30.6 m^3 / ha, and the study area I, lowest with 9.2 m^3 / ha which result in an average

outturn of about 16.5 m^3 / ha for the four study areas if taken together, constituting about 70% of total production.

The overall log outturns of other species are less than 2.5 m^3 / ha. If all species are combined, the study area IV has also the highest outturn with 54.1 m^3 / ha and the study area I, lowest with 16.9 m^3 / ha. The overall average outturn is 23.5 m^3 / ha if all areas and species are taken together.

4.3 Basal area per hectare and intensity of cut

The capacity of the forest and cut in basal area (BA) per hectare of trees of 20 cm DBH + and the cut percentage of total basal areas by study area are presented in table 4.

Table 4. Basal area per hectare and intensity of cut in percent of total basal area (BA in m^2)

Category (1)	Study area I (1)	Study area II (3)	Study area III (4)	Study area IV (5)
Pyinkado	2.3	5.9	6.9	6.3
Other species	16.8	9.3	12.3	17.9
Total	19.3	15.2	13.2	24.2
cut	2.0	2.4	3.8	5.4
Cut % of total BA	10%	15%	19%	19%

The total basal area is the highest in the study area IV with 24.2 m^2 and the lowest in the study area II with 15.2 m^2. More cuts in the study areas III and IV than the other two areas are noticed, as there are more BA of Pyinkado in the areas.

4.4 logging-induced damage

Logging-induced damage was expressed as percent of the number of trees damaged to the remaining number of trees after cutting. Serious and minor logging-induced damages by size classes for different study areas and the whole area are presented in table 5 and also in Fig. 3. Serious damage category consists of damage classes 1 and 2 which are explained in section 3. Trees which are entirely pushed over, seriously leaning, bole broken or trees with serious stem and crown damages are put in this category.

Table .5 Logging-induced damage in percent.

Category	DBH Classes in cm 200-299	300-399	400-499	500-599	600 +	Total
Study area I						
Serious	0.8	0.6	0.3	0.1	-	0.5
Minor	2.0	1.8	3.2	3.3	1.1	2.7

Total	2.8	2.4	3.5	3.4	1.1	3.2
Study area II						
Serious	-	0.3	0.9	-	-	0.4
Minor	1.2	1.2	2.3	2.3	1.8	1.7
Total	1.2	1.5	3.2	2.3	1.8	2.1
Study area III						
Serious	1.4	1.1	1.2	2.5	1.4	1.4
Minor	3.3	3.9	2.4	2.6	2.0	3.0
Total	4.7	5.0	3.6	5.1	3.4	4.4
Study area IV						
Serious	1.6	1.4	1.9	1.3	1.6	1.6
Minor	2.4	2.8	4.9	3.7	2.0	2.8
Total	4.0	4.2	6.8	5.0	3.6	4.4
Overall						
Serious	0.9	0.9	0.7	0.5	0.5	0.7
Minor	2.4	3.1	3.0	3.1	1.6	2.5
Total	3.3	4.0	3.7	3.6	2.1	3.2

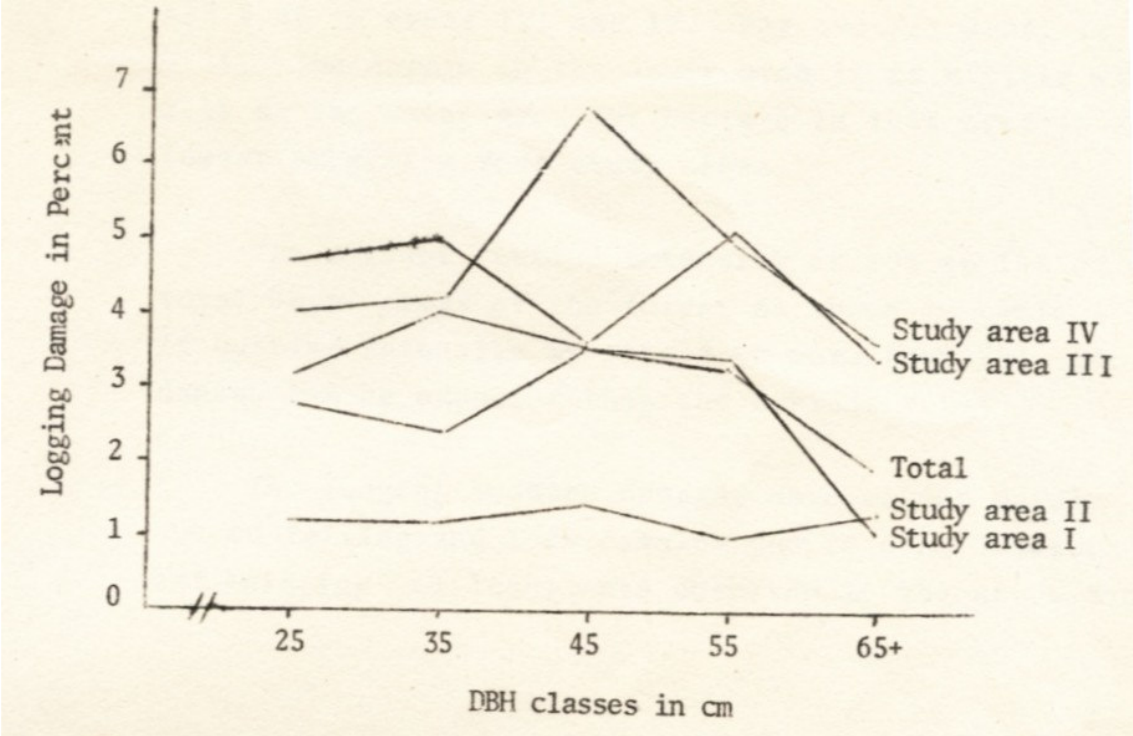

Fig. 3. Logging-induced damage in different areas.

The logging-induced damages are related to the basal area levels and cutting intensities of the forest. The higher the basal area and cutting intensity, the more damages can be expected.

As seem in table 5, serious logging-induced damage for all classes is the highest, in study area IV with 1.6 % and the lowest, in study area II with 0.4 %. It ranges from 0.1% to 2.5% in different size classes. For overall area, it is 0.7 %.

The total logging damages (serious + minor) for all trees of 20 cm DBH + are 3.2 % in area I, 2.1 % in area II and 4.4 % in areas III and IV. For overall area, it is 3.2 %. The damage in the study area II is minimum with 2.1%, as the basal area per hectare in this area is the lowest among the four study areas.

The current cutting intensity is 10% to 19% of total basal areas of the forest as shown in table 4. If cutting intensity is raised to more than 20%, more damage can be expected than the current rate.

The logging-induced damages were caused mainly due to felling and less damages due to other factors eg: snigging of logs; were observed in the study areas.

5. Conclusion

The results of the study lead to the following conclusions:

(a) The rate of deduction to gross volume due to defects, breakages and wastages varies with species and size classes. If all species are taken together, the deduct percent for trees of 65 cm DBH + is around 10 % and for 55-65 cm class, it is 4%.

(b) The highest basal area per hectare of all species of 20 cm DBH + is 24.2 m^2 in Pyu and Kyauktaga townships and the lowest is 15.2 m^2 in Taikkyi township.

(c) The overall average log outturn per hectare of all species is 23.5 m^2 (5.3 hoppus ton /acre), of which Pyinkado constitutes about 70%.

(d) The percentages of number of trees with serious and minor damages to the residual trees of 20 cm DBH + are 0.7 % and 2.5% respectively, amounting to total damage rate of 3.2%. The damage percent is lowest in Taikkyi Township where the basal are per hectare is minimum with 15.2 m^2.

(e) The requirement of information depends on the intensity of management. Detailed information for small areas are required for intensive forest management.

Due to increasing population pressure, accelerated timber and wood fuel demand and expanded encroachment of agriculture, the commercial forests of Myanmar have been somewhat decreased or degraded especially in the last decade or two. Without intensive forest management and taking necessary protective measures, it is questionable to ensure sustained yield from those forests. Thus it is recommended to carry out post-logging inventory by compartment as applied in Malaysia (Thang, 1992) to determine the status of the residual forest in terms of stocking, composition, size and distribution and prescribe appropriate silvicultural treatments to ensure its development under Sustained yield Management.

Reference

1. Thang, H. C. 1992. " Guidelines on the interpretation of post-felling inventory results". Paper presented at the Workshop on the management of evergreen forest ecosystem held in Yangon on 28-30 December 1992.