UNIVERSITI PUTRA MALAYSIA

THE FEASIBILITY OF HARVESTING AND EXTRACTION OF LOGGING RESIDUES IN SABAH

JOSEPH AHLAN

THE FEASIBILITY OF HARVESTING AND EXTRACTION OF LOGGING RESIDUES IN SABAH

By

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Degree of Doctor of Philosophy in the
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Dedicated to my Reverend Father (Late)

Ahlan Jambul

Where dream comes true ……..

&

Dedicated to my Beloved

Mother, Brothers, Sisters, Wife and Children.

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LIST OF ABBREVIATIONS

ANOVA	-	Analysis of Variance
C.I.	-	Confidence Interval
CFR	-	Commercial Forest Reserve
dbh	-	diameter breast height
FMU	-	Forest Management Unit
HHW	-	Heavy Hardwood
INB	-	Incremental Net Benefits
ITTO	-	International Tropical Timber Organisation
LHW	-	Light Hardwood
LTC	-	Long Term Concessions
MHW	-	Medium Hardwood
MUS	-	Malaysian Uniform System
NFC	-	National Forestry Council
NLC	-	National Land Council
NPV	-	Net Present Value
OLS	-	Ordinary Least Squares
OPG	-	Operation Category
RM	-	Ringgit Malaysia
RIF	-	Regeneration Improvement Felling
RIL	-	Reduced Impact Logging
SAFODA	-	Sabah Forestry Development Authority
SFI	-	Sabah Forest Industries
spp.	-	species
SSSB	-	Sabah Softwood Sdn. Bhd.
STC	-	Short Term Concessions
S.V.	-	Stumpage Values
SFMS	-	Sustainable Forest Management System
WLS	-	Weighted Least Squares

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JOSEPH AHLAN

NOVEMBER 1998

Chairman : Shukri Mohamed, Ph.D.

Faculty : Forestry

Effective harvesting and utilisation of log and logging residues are important, in achieving the sustainable forest management and to maximize the government revenue, in the light of declining supply of conventional logs.

The aim of this study was to evaluate the feasibility of harvesting and extracting the logging residues, to estimate their economic value, to determine quality and quantity of logging residues and types, to derive a volume equations for quantifying logging residues, and to determine the factors affecting their extraction. The type, quality and quantity of logging residues were determined from two different tenures of timber concessions which were categorised into three different operations based on altitudes, vegetation types, topography and terrain characteristics. The "with" and "without" the Project approach was used in determining the Incremental Net Benefit (INB) of harvesting and extracting the logging residues. The economic value of logging residues was determined

by applying formulas that express the concept of the stumpage value of timber. The volume equation for logging residues was estimated using the OLS and WLS regression methods following the normal volume equation for log.

The economic analysis of extracting logging residue in both Short Term Concession and Long Term Concession indicate that harvesting of logging residues is profitable. The Net Present Value (NPV) of extracting logging residue per m^3 in Short Term Concession and Long Term Concession are estimated at RM37.64 and RM145.64, respectively. The estimated additional revenue for the state by extracting logging residue is about RM116.26 million per annum.

The results showed that the mean volume of logging residues based on tree portions and damaged trees are 15.94 and 13.71 m^3 per hectare, respectively. The mean volume of logging residues per tree is 2.07 m^3. The total volume of logging residues in Short Term Concession (STC) was higher than in Long Term Concession (LTC) by 56.8%. Of the different types of logging residues, branch of residue was the highest, and followed by the main stems, tops and stumps residues. The study showed that by species group, the Light Hardwood grouping of species formed the major part of the logging residues. The highest volume of logging residues was in Operation Category 2 which was estimated at 25.43 m^3 per hectare. The ratio of logging residues to total log production obtained in this study was 0.56 to 1. The regression of diameter (D^2) with volume, in a $V = a + bD^2L$, regression offers the best volume equation result

compared with other correlations. The best volume equation for deriving stumps, main stems, tops and damaged trees residues are in ordinary equation form. For branch residues, the logarithmic form provided the best volume equations.

The results showed that the average value of the logging residues per m^3 and per hectare were RM38.54 and RM1,050.45, respectively. Damaged tree residues recorded the highest value per m^3 and per hectare with RM73.49 and RM676.67, respectively. The lowest residue value was recorded by branch residue. The average selling price of logging residue for all the end-used products is RM66.33 per m^3. The average cost of extracting logging residue per m^3 is RM29.64.

Logging residue price parameters were found to be the main significant factor affecting the extraction volume of logging residues. Only the price elasticity for supply volume of branches and damaged trees residue were found to be elastic over the range studied, whereas the rest were inelastic.

The implications of the study are that the government should revise the current licensing policy on Short Term Concession by encouraging the concessionaire to harvest logging residue in order to achieve sustainable forest management. The present timber harvesting method should be improved and the conditions of the license must be strictly enforced by the government to reduce logging damage. Incentives should also be given to attract more investment to encourage logging residue utilisation.

Abstrak Dissertasi yang dikemukakan kepada Senat Universiti Putra Malaysia
Sebagai memenuhi keperluan untuk Ijazah Sains Kedoktoran.

KEBOLEHLAKSANAAN PENUAIAN DAN PENGAMBILAN SISA PEMBALAKAN DI SABAH

Oleh
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Penuaian yang berkesan dan penggunaan balak serta sisa pembalakan amatlah penting bagi mencapai pengurusan hutan secara berkekalan dan bagi memaksimakan kutipan hasil kerajaan, pada ketika bekalan balak sedang berkurangan.

Kajian ini adalah bertujuan untuk menilai kebolehlaksanaan penuaian dan pengambilan sisa pembalakan, menganggar nilai ekonomiknya, menentukan jenis, kualiti dan kuantiti sisa pembalakan, mendapatkan persamaan isipadu bagi sisa pembalakan, serta menentukan faktor-faktor yang mempengaruhi pengambilannya. Dua jenis konsesi yang berbeza jangkamasa kuatkuasanya dipilih dan dibahagikan kepada 3 kategori operasi yang berbeza ciri-ciri altitud/ketinggian, jenis tumbuhan, topograpi, dan kecerunannya bagi menentukan jenis, kualiti dan kuantiti sisa pembalakan. Pendekatan dengan dan

tanpa projek adalah digunakan untuk menentukan INB penuaian dan pengambilan sisa pembalakan. Manakala nilai ekonomi sisa pembalakan pula ditentukan dengan menggunakan konsep formula nilai stumpej. Persamaan isipadu untuk sisa pembalakan adalah dianggar menggunakan kaedah regreassi OLS and WLS dengan mengikuti persamaan isipadu biasa untuk balak.

Analisa ekonomi bagi penuaian sisa pembalakan dari konsesi jangka pendek(STC) dan konsesi jangka panjang(LTC) menunjukkan bahawa penuaian sisa pembalakan adalah menguntungkan. NPV bagi pengambilan sisa pembalakan dari konsesi jangka pendek dan konsesi jangka panjang adalah masing-masing bernilai RM37.64 and RM29.12 se m^3. Adalah dianggarkan tambahan hasil negeri akan bertambah sebanyak RM116.26 juta dalam setahun sekiranya sisa pembalakan diambil.

Keputusan kajian menunjukkan bahawa purata isipadu sisa pembalakan berasaskan bahagian pokok dan pokok yang dirosakkan adalah masing-masing bernilai 15.94 dan 13.71 m^3 se hektar. Purata isipadu sisa pembalakan sepokok adalah 2.07 m^3. Jumlah sisa pembalakan pada konsisi jangka pendek didapati lebih tinggi dari konsisi jangka panjang sebanyak 56.8%. Isipadu sisa pembalakan sehektar untuk dahan adalah yang tertinggi dan diikuti oleh sisa pembalakan dari batang, "top" dan banir. Kumpulan LHW adalah kumpulan spesis yang utama menghasilkan sisa pembalakan dalam kajian ini. Jumlah sisa pembalakan yang tinggi adalah diperolehi dari kategori operasi ke-2. Nisbah jumlah sisa pembalakan kepada jumlah pengeluaran balak adalah 0.56 kepada 1.

Regressi diantara D^2 diameter dengan isipadu, dalam persamaan $V = a + b D^2L$, menunjukkan persamaan isipadu yang terbaik berbanding dengan korrelasi yang lain. Persamaan isipadu yang terbaik untuk banir, batang, "top" dan pokok yang terosak adalah dalam bentuk linear. Manakala, persamaan dalam bentuk bukan linear adalah yang terbaik untuk dahan.

Hasil kajian menunjukkan bahawa purata nilai sisa pembalakan se m3 dan se hektar adalah masing-masing bernilai RM38.54 dan RM1,050.45. Nilai sisa pembalakan dari pokok yang dirosakkan adalah yang tertinggi dengan nilai RM73.49 se m^3 dan RM676.67 se hektar. Nilai sisa pembalakan yang terendah adalah direkod oleh sisa pembalakan daripada dahan. Purata harga jualan sisa pembalakan bagi semua jenis hasil gunaakhir adalah RM66.33 se m^3. Manakala purata kos pengambilan sisa pembalakan dalam se m^3 adalah RM29.64.

Keanjalan harga untuk isipadu keatas kedua-dua dahan dan pokok yang terosak adalah elastik dalam renj kajian ini, manakala harga elastisiti bagi sisa pembalakan yang selebihnya adalah tidak elastik.

Implikasi kajian adalah pihak kerajaan haruslah mengkaji semula polisi perlesenan konsesi jangka pendek ketika ini dan mengalakkan pihak konsesi untuk menuai sisa pembalakan bagi mendapai tahap pengurusan secara berkekalan. Kaedah penuaian balak masakini juga haruslah diperbaiki dan syarat-syarat lesen haruslah dikuatkuasakan dengan ketat oleh kerajaan bagi mengurangkan kerosakan akibat pembalakan. Insentif juga haruslah diberikan bagi menarik lebih banyak pelaburan dan penggunaan sisa pembalakan.

CHAPTER I

INTRODUCTION

Realising the full potential of harvesting logs and logging residues from logging concessions and utilisation of the same is one of the main concerns of sustainable forest management. New ideas, techniques and approaches have been developed and tested, to prove and realise their potentials in maximising profit from timber harvesting and utilisation of the residues (Frederick and Kollert, 1996).

Logging residues, is defined as any portion of wood which, under the present highest available stage of technological development, could be used in manufacturing but is left in the forest or lost in the course of logging (Kantola, 1965). Logging residues are classified into two main groups depending on their origin, namely (i) logging residues from the felled trees that were left in forest such as tree portions, branches, stumps, tops, stems, and (ii) trees damaged during felling operations, including fallen or standing trees and also damaged trees caused by extraction and skidding operations and which are deemed to have very small chance of survival (Mohd. Hamami *et al.*, 1995).