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EFFECTS OF LOGGING ON STREAKWATER QUALITY AND SOLUTE INPUT-OUTPUT BUDGETS IN SMALL WATERSHEDS IN PENINSULAR MALAYSIA

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EFFECTS OF LOGGING ON STREAMWATER QUALITY AND SOLUTE INPUT-OUTPUT BUDGETS IN SMALL WATERSHEDS IN PENINSULAR MALAYSIA

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

pH	-	in pH units
S.E.C.	-	Specific electrical conductivity; uS/cm (micro-Siemen per centimeter at 25^{o}C)
Turb.	-	Turbidity; N.T.U. (nephelometric turbidity units)
Colour	-	True colour; Hazen
S.S.	-	Suspended solids; mg/l
D.S.	-	Dissolved solids; mg/l
Alka.	-	Total alkalinity; mg/l as $CaCO_3$
Hard.	-	Total hardness; mg/l as $CaCO_3$
Ca^{2+}	-	Calcium; mg/l
Mg^{2+}	-	Magnesium; mg/l
Fe	-	Iron; mg/l
K^{+}	-	Potassium; mg/l
NH_3-N	-	Ammoniacal-nitrogen; mg/l
NO_3-N	-	Nitrate-nitrogen; mg/l
SO_4^{2-}	-	Sulphate; mg/l
PO_4^{2-}	-	Phosphate; mg/l
SiO_2	-	Silicate; mg/l
Cl^{-}	-	Chloride; mg/l
F^{-}	-	Flouride; mg/l
m.a.s.l.	-	meter above sea level
r	-	Coefficient of correlation
r^2	-	coefficient of determination
R^2	-	Coefficient of multiple determination
R^2adj	-	Adjusted coefficient of multiple determination

S.D. - Standard deviation

S.E. - Standard error of estimate

D.W. - Durbin Watson statistic

N - No of sample or correlation

SSR - Sum of square due to regression

MSE - Mean square error

Sg. - Sungai, a Malay word meaning river

Abstract of the thesis submitted to the Senate of Universiti Pertanian Malaysia in fulfilment of the requirements for the Degree of Master of Science.

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The effects of selective logging on streamwater quality and solute budgets were investigated using three small catchments: C1, C2 and C3. After a three-year calibration period, C1 and C3 were logged using "unsupervised" and "supervised" logging methods respectively, whereas C2 was left as control. Several control measures were imposed in the supervised C3 but none in the unsupervised C1.

During the calibration period the levels for most of the streamwater quality parameters measured were within the standards for potable water. The exceptions were colour, turbidity and iron. Significant increases in pH, specific electrical conductivity, hardness, suspended solids, alkalinity, turbidity, dissolved solids, silicate, calcium, iron, and sodium were recorded in the unsupervised C1. The levels for colour and nitrate were also elevated initially but

recovered to background values within a year. In contrast, in the supervised C3, significant changes were detected only for hardness, magnesium and iron. The impact of logging was enhanced during the wet months especially for suspended solids, turbidity and iron.

Export of suspended solids during the calibration period ranged from 0.08 to 0.24 mt/ha/yr. These levels increased twenty-fold for C1 and two-fold for C3 during the first year after logging. The monthly losses of most solutes also increased significantly for both C1 and C3 but the magnitude of loss was much greater for the former. The losses of calcium, potassium and magnesium showed a tendency to increase over time whereas the increases in nitrate losses were short-lived.

Rainfall samples contained low levels of anthropogenic pollutants and were affected more by terrestrial sources. The inputs of nutrients from rainfall constituted, on the average: 64%, 55%, 40% and 25% of the outputs of potassium, calcium, sodium and magnesium respectively. However, the inputs of calcium and magnesium were calculated based on data of a previous study conducted at a nearby site, Pasoh.

The results of the study show that proper control measures substantially reduce the effects of logging on streamwater quality and solutes losses. Further detail studies may provide better indications on the effectiveness of specific control measure.