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熱帯林情報No.3

熱帯林の成長データ集録

(その1)

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情報「熱帯林の成長データ集録」の発刊にあたって

私ども国際緑化推進センターでは、我が国の国際森林・林業協力を総合的に支援するため、協力を担う人材の養成・確保、技術情報の収集・整備・提供、ＮＧＯ等の民間協力活動の支援、国際緑化の普及啓発、熱帯での植林などの活動を行っております。

そして、情報活動の一つとして熱帯地域などての森林造成に必要な情報について、これを「熱帯林情報」として発刊し、熱帯地域等で協力活動に従事する方々の参考に供しております。

今回、「熱帯林の成長データ集録」と題して、熱帯地域での森林の成長と収穫に関するデータ集を発刊することになりました。

本書に掲載されたデータは、当センターが林野庁補助事業として行っている「カーボン・シンク・プロジェクト推進調査事業」の実施に当たり、熱帯林の収穫予測のために森林総合研究所の西川匡英林業経営部長が中心となって集めて頂いた資料に、同部長を始め森林総合研究所の関係者達がこれまでに収集していたデータも加えさせて頂いたもので、現在、我が国が集め得るかぎりのデータが集録されております。

地球環境の悪化が世界的に憂慮される中で、地球環境への熱帯林の果たす役割の重要性は益々増しております。とくに、地球温暖化に対する長期の炭素固定方策として熱帯地域での積極的な植林が注目される中で、熱帯林の成長に関するデータはなくてはならない資料だと思われます。

この度、西川匡英部長をはじめ関係の方々のご努力で、最新の熱帯林の成長データが整理出来ましたことは、今後の我が国の熱帯林問題への取組に大いに役立つことと信じております。

ここに、貴重な資料を収集・整理下さった森林総合研究所　西川匡英林業経営部長、高橋文敏資源計画科長、同研究所北海道支所　白石則彦天然林管理研究室長並びに秋田営林局鷹巣営林署岩野目森林事務所　増田義昭森林官の皆様に心から感謝申し上げるとともに、この情報「熱帯林の成長データ集録」が、今後、我が国の多くの協力関係者に活用され、我が国の国際森林・林業協力の推進に大きく貢献することを願っております。

１９９６年3月

㈶国際緑化推進センター
理事長　秋　山　智　英

熱帯林の成長データ集録

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1．はじめに

熱帯地域の森林の成長と収穫に関する情報は、先進国のものに比べるとまだ充分整備されていなくてその収集には困難をともなう。早生樹種については、D.Pandrey が Growth and yield of plantation species in the tropics （FAO 1983）において、熱帯林の成長と収穫をまとめている程度である。しかし、地球温暖化にともなう対応策として長期間炭素を固定する方法のひとつとして熱帯林を保全するとともに、積極的に植林していくことが近年注目されている。このため熱帯の早生樹種だけでなく、天然林についてもその成長特性を充分把握していく必要がある。

当初コンピュータによる文献検索を主体とした収集を考え、CAB, AGRICORA、AGRISなどで樹種別地域別に検索を試みたが、論文を主体としたものが多く、必ずしも有効な方法でないことがわかった。そこで前記の Pandreyのものを中心にして、多面的な方法で収集することにし、次のように個別に文献に当たることにした。

文献検索（CAB, AGRICORA, AGRIS）
ＦＡＯ（国連食糧農業機関）文献
森林総合研究所図書室、森林総合研究所海外研究情報室（ＯＤＣによる熱帯林情報収集）
海外専門家への依頼（マレーシア、タイ、インドネシア、パプア・ニューギニア、ＦＡＯなど）
単行本
その他

成長と収穫（Growth and Yield）に関しては、収穫表、成長モデルの形が一般的であるが、地位指数曲線、直径分布で表されたものもあり、天然林では定期平均成長量のみで表している場合が多い。これらの関係については項を設けて解説した。

集められた文献については、一定の様式（樹種、国、地域、データ採取地の立地環境、成長・収穫に関する表、図、式など、出典）で個表を作り整理することにした。本書はこの個表を印刷したものであるが、とくにデータ採取地の立地環境、成長・収穫に関する表、図式などは必要最小限にとどめているため、利用の際は出典に示した原文を参照することをお勧めする。また前記D.Pandrey の報告書では文中に多数の引用文献があり、これらの引用文献を含めて出典として示すことにした。なお今回は計測的な成長量を中心としたデータの収集であったが、バイオマス的な資料については、別途収集の機会を設けて行いたいと考えている。

なお樹種の学名については元森林総合研究所東北支所長の緒方健博士に校閲をお願いした。また筑波大学の松下　香、桧山千春嬢には個表の整理をお手伝いいただいた。ここに記して謝意を表する次第である。また、２－１、２－２を白石、２－３を西川、目次、索引を高橋、天然林人工林の個表作成を西川、高橋、白石、増田が担当した。

2.　本資料を利用する人のために

2－1　収穫表の概要

収穫表とは、ある樹種の森林に対して同一の取り扱いを施した場合の森林の統計量の標準的な値を、林齢の一定間隔ごとに表示した表である。森林の統計量としては、平均胸高直径、平均樹高、単位面積当りの立木本数および胸高断面積合計、材積（総成長量）、成長量などがある。人工造林樹種では、年齢ごとに間伐される林木（副林木または間伐木）と残存する林木（主林木または残存木）とに分けて、それぞれの標準的な統計量を記していることも多い。

森林では近接した林地に同一樹種が生育している場合を比較しても、土壌や地形、水分状態などの違いによって成長が大きく異なることがある。収穫表では、地位(site)という立地の生産力の違いによって、同一樹種に対しても成長の異なる複数の表が作られるのが普通である。

森林の地位は、Ⅰ、Ⅱ、Ⅲ等のように等級区分することもあるが、地位指数によって数値で表現されることも多い。最も普通の地位指数は、基準となる林齢（基準林齢）を定めて、その林齢における優勢木または主林木の平均樹高の値そのものを指数とするものである。例えば日本においてはスギやヒノキの基準林齢は伐期を勘案して40年が慣用とされており、その林齢で到達する平均樹高が地位指数である。熱帯地方では早生樹種が造林されることも多いため、基準林齢は10年とか20年など非常に若齢のことが多い。

平均樹高が地位指数の表現に利用されるのは、樹高成長が林地固有の生産力をよく表わし、かつ森林の人為的取り扱いにほとんど依存しないと考えられているからである。これに対し、林齢の明確でない森林タイプの地位の判別には、１年当りの材積成長量がしばしば用いられる。

地位の判別目的ばかりでなく、林齢に伴う材積の成長量の変化は森林の成長を扱う場合にきわめて重要である。材積成長量は、平均化する期間の取り方によって、次のように大別される。

平均成長量　　　Mean Annual Increment (MAI)
連年成長量　　　Current Annual Increment (CAI)
定期平均成長量　Periodic Annual Increment (PAI)

平均成長量は材積を林齢で割った１年当り平均の成長量で、全生育期間を均した成長量の平均値と考えられる。連年成長量はある林齢の前後１年間の成長量であり、２年以上の期間について成長量の年平均を取ったものは定期平均成長量と呼ばれている。林齢の変化に伴う平均成長量と連年成長量、総成長量の関係は下図に示されている。天然林のように林齢（ｔ）が明確でない森林の成長量は、連年（または定期平均）成長量が比較される場合が多く、それはまた地位の判別にも利用されている。

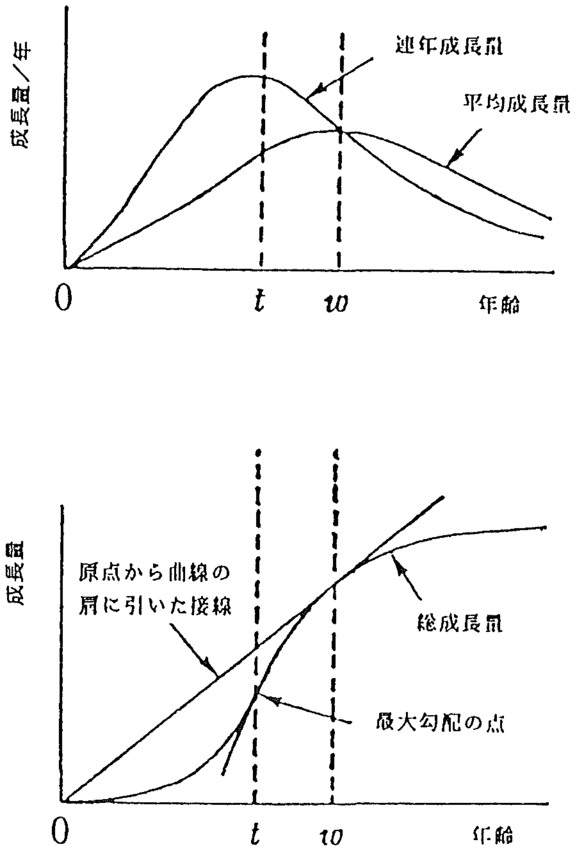

図２－１　平均成長量と連年成長量、総成長量の関係

平均成長量が最大となる林齢（w）において、その値は連年成長量と一致する。総成長量、平均成長量、連年成長量のいずれかがわかれば他の２者は計算可能である。

２－２　収穫表のタイプ分類

ここでは熱帯地方を中心に、さまざまな国や地域からさまざまな樹種についての成長量の資料を広く収集した。その中には収穫表と呼ぶにふさわしい体裁を備えた森林成長の資料もあるが、収穫表の要素（材積、直径、樹高、本数等）の一部分しか整っていなかったり、あるいは天然林で林齢が明確でないため林齢ごとの統計量という形式で表示されていない資料もある。

収集された成長資料にどのような種類の情報が載っているかを示すことは有益であり、そのためには資料をタイプによって分類しておく必要がある。そこでここでは基本的な要素の整った正常な収穫表の体裁を基本とし、それ以外の資料のタイプを以下のように分類した。

① 収穫表タイプ（林齢に対して材積はしめ各種統計量が示されている）

1． 完全な形の収穫表

2． 不完全な形の収穫表（成長量の資料は完備しているが、それ以外の立木本数、平均胸高直径、平均樹高等の情報か不完全なもの）

② 地位指数曲線タイプ（直接に成長量に結びつかないが、その基礎となりうる統計量が林齢に対する変化として示されている）

1． 樹高～林齢

2 その他（胸高直径、胸高断面積等）～林齢

③ 連年（または定期）成長量のみのタイプ（生育期間の一部についての成長量の資料）

1． 天然林等のＣＡＩ，ＰＡＩ

2 その他

④ その他のタイプ

1． 直径階に対する直径成長量

2． 直径分布の変化

3． その他

2－3 収穫表に用いられる主な用語一覧（英・和）

今回収集された収穫表には専門的な用語がかなり用いられている。ここではこれらの用語をまとめ、日本語と解説を付し利用に供することにした。

英語	日本語	解説
average diameter	平均直径	普通胸高直径の平均を指す。表ではAv. diam.や$\overline{d}$と略記することがある。
age	林齢、樹齢	森林や樹木の年齢
accum. vol(yield)	累積収穫量	現材積にそれまでの間伐収穫量を累積した合計の収穫量
annual percent mortality	枯損率	mortality rateに同じ
annual mortality percent	枯損率	mortality rateに同じ
annual ingrowth percent	進階率	進階木の本数または材積の全林に対する割合
bark yield	樹皮量	樹皮量は、重量、面積、束などの単位で表す。
base age	基準林齢	地位指数を定める基準となる林齢
basal area	胸高断面積	地上1.2 または 1.3mの高さの木の幹の断面の面積
basal area growth	胸高断面積成長量	胸高断面積合計の年間成長量
d.b.h.(diameter at breast height)	胸高直径	地上1.2 または 1.3mの高さの木の幹の直径

英　　　　　語	日　本　語	解　　　　　　説
diameter class	直径階	一定の直径の範囲をまとめた（括約した）階級。わが国では２ｃｍ括約、スイスでは、４ｃｍ括約、フランス、ドイツでは５ｃｍ括約が行われる。
diameter distribution	直径分布	森林内の木の直径（通常胸高直径）の頻度分布
diameter growth	直径成長（量）	胸高直径の定期成長（量）
d. o. b.	皮付き直径	樹皮付きの直径
bole	幹材、樹幹	stemに同じ。樹木の幹部
circumference(girth)	円周	樹木の円周を用いて直径の大きさを表す。
cohort	コーホート	ある特定の期間に出生した人口を表すが、動物一般では生命表作成を特定時期に出生したグループについて行ったときなどに用いられる。
coupe	クーペ	伐採の区画単位
codominant trees	準優勢木	樹冠の一般的なレベルには達しており、上方から充分の光を受けているが、側面からはほとんど受けていない樹木をさす。
CFI (continuous forest inventory)	森林継続調査法	観側点またはプロットをシステマティックに配置し、定期的に森林資源内容を観側する森林資源調査法。近年生態的な情報や環境情報をも側定する多目的な資源調査法が採用される傾向にある。
conversion factor	変換率	薪など層積から実積へ換算する場合の割合。針葉樹、広葉樹によってまた、径級の大きさによって異なる。
crop standing volume	立木蓄積	standing tree, またはstumpage volume ともいう。森林内の立木の材積
crop diameter	樹木直径	tree diameter　に同じ
crop height	樹高	tree height　に同じ
culm	茎	節のある茎
cumulative thinnings	累積間伐木量	間伐木の本数または材積を加算したもの
de liocourt's quotients	リオクールの公比	異齢林の直径分布は逆Ｊ字型をなすが、隣接する直径階の本数比（ｑで表す）を等比級数の公比として用いれば、一番大きな直径階の本数をｎとすると、n, nq, nq^2, ………　のように表される。

英　　　　　語	日　本　語	解　　　　　説
DBH	胸高直径	diameter at breast height の略で、胸高の部位（普通1.2 または 1.3m）の樹木の直径を指す。
diameter growth projection table	直径成長予測表	直径階毎の成長の推移を示したもので、stand table に同じ
dominant　height	優勢木樹高 主林木樹高	優勢木または主林木の樹高
dry bark	乾燥樹皮量	樹皮を乾燥処理をしたもの
dry weight	乾（燥）重（量）	生物体重の計測で含水量の影響を除外したい時に用いる。普通 105℃で乾燥し、重量が安定した時を持って乾重とみなす。
dummy variables	ダミー変数	重回帰式の説明変量に用いられるもので、分類尺度の数量的な表現である。例えば、機械がA、B２台ある場合、説明変数ｘ＝１，（機械Aがある時）、ｘ＝０，（機械Bがある時）というように、A，Bを分類するために任意の二つの実数を用いる。１、０が簡単であるためよく用いられる。
form factor	形数、幹形形数	樹幹のある位置における直径に等しい直径を底面とし、その樹高に等しい高さをもつ仮想的な円柱の体積とその幹材積との比を形数という。
fresh weight	生重（量）	乾燥処理を行わない生木の状態の重量
girth (class)	胴回り、樹幹周囲	樹木の直径で大きさを表す代わりに、周囲で表したもので、熱帯地域では、よくこの単位が用いられる。（例えば、半島マレーシアの利用材積表）。
green　bark	樹皮生重	生木の状態の樹皮
gross volume	粗成長量	森林の全林木より生産された全材積
growth	成長（速度）	広義の成長全般を表わす。
growth rate	成長率	ある一定の時期からの樹木の成長を示し、普通１ｃｍ当たりの年輪数等で表すが、樹木または林分の材積、価値、あるいはその他の成長量で表すこともある。
growth prediction table	収穫予測表	収穫表に同じ
heavily thinned stands	強度の間伐を 行った林分	被圧木、介在木、一部の準優勢木を除く間伐

英　　　　語	日　本　語	解　　　　説
height class	樹高級（階）	樹高をいくつかの階級に分けたもの。高さ階級
high forest	高林、喬林、高木林	熱帯では、サバンナ林、低林に対比して高木よりなるうっぺい林をいう。
increment	成長（量）	「増分」に相当する概念
ingrowth	進階成長量	測定されるように定められた最小直径階以下の木が成長して最小直径以上に達した木を進階木といい、その本数、または材積の量を進階成長量という。
inner bark	皮内	樹皮を除いた場合を表わす（樹皮なしの直径など）。
improvement felling (cutting)	整理伐、除伐 保育伐	価値のある樹木を育成するため、価値のない樹木を除去することであるが、とくに混交異齢林において行う。
inside bark	皮内	inner barkに同じ
LAI	葉面積指数	leaf area index 単位土地面積上にある全葉面積。普通記号Ｆで表す。
LAR	比面積	葉面積比（SLA:specific leaf area）に同じ。葉面積（㎠）を葉乾重（ｇ）で割ったもの。葉の厚さに関係しており、同一樹種では上層の葉ほどSLAは小さい。
liberation thinning	上木伐採	幼齢木の成長を促すため上木または老齢木を伐採する。
linear regression weighted by the inverse of variance	重みつき線形回帰	分散の逆数を重みとした線形回帰
logistic function	ロジステック関数	Verhulst(1838)が提案し、Pearlらに再発見された動物・人間の増殖の数学的なモデル。個体の成長曲線も群落の現存量の増加曲線もロジスティック曲線で近似される場合が多い。
LWR	葉重比	leaf weight ratio 。葉重を全植物体重で割った値
low thinning	弱度の間伐	被圧木のみの間伐
main crop	主林木、主伐木	間伐されず残される木。主として英国で用いられる。
main stand	主林木、主伐木	間伐されず残される木。主として英国で用いられる。

英　　　語	日　本　語	解　　　説
mean diameter	平均（胸高）直径	地上1.2 または 1.3mの高さの直径の平均値
mean diameter by basal area method	平均断面積木	一定面積内のすべての林木の胸高断面積合計を林木本数で割ったものを平均断面積という。平均断面積木の直径は、常に算術平均直径より大きい。
mean height	平均樹高	森林全体の木の高さの平均
medium thinning	中庸度の間伐	すべての被圧木と介在木の一部を間伐する。
merchantable volume	利用（可能）材積	市場に適したサイズや品質の樹木または林分の材積
modified Malaysian uniform system	修正マレーシアユニフォームシステム	マレーシア・ユニフォームシステムは予備伐、下種伐を省略した、均等に（樹群単位ではない）択伐する前更作業すなわち傘伐作業の一種である。
mortality rate	枯損（死）率	火災、病虫害、風害等で枯損し、利用できなかった木の本数または材積の全林木に対する割合を表す。
NAR	純同化率	葉の光合成速度を示す。
No. of stems	立木本数	単位面積に生立している木の本数
number of stems(trees)	立木本数	単位面積に生立している木の本数
o. b.	皮付き	over bark の略
outer bark	皮付き	樹皮付直径など樹皮を付けたままの状態を表す。
outside bark	皮付き	樹皮付直径など樹皮を付けたままの状態を表す。
over bark	皮付き	樹皮付直径など樹皮を付けたままの状態を表す。
/ha, per ha	ha当り	材積など合計量を比較する単位面積。中国語の文献では毎公頃。１公頃は約16畝（ムー）
per rai	ライ	面積の単位で、１ライは0.16haに当たる。
poison treatment	巻きがらし	girdling, ringing ともいい、立木に材分に達する切り込みをめぐらし、立木のまま枯死させる。造林地にある利用価値のない立木で伐採整理すると経費が引き合わない場合などに行われる。
predominant height	準優勢木樹高	準優勢木の樹高
preliminary yield table	予備的な収穫表	サンプル数が少ない等の理由で、予備的に作成する収穫表

英　　　　語	日　本　語	解　　　　説
provisional normal yield table	地方的正常収穫表	正常収穫表は、充分の蓄積のある（fullystocked)林分の収穫表のことで、これを地域的に作成したもの。
q value	q値	樹木の直径分布において隣接する直径階の本数比で表す。択伐林の林型の指標になる。
RD		予測断面積に対する実断面積の比
RGR	相対成長率	relative growth rateの略で植物の乾量成長過程を複利的な成長とみなし、その利率に相当する値をいう。
recruitment	進階量	与えられた期間内に測定できる（最小直径限界を越えた）大きさに達した樹木の本数または材積。ingrowthに同じ。
recruits group	進階木グループ	進階木のグループ
reference age	基準林齢	地位指数を定める基準となる林齢
remainings	残存木	間伐の後にも残存する樹木
remaining stands	残存林分 保残林分	間伐の後にも残存する林分
retained	残存する	間伐の後にも残存する
roundwood volume	丸太材積	丸太の材積のことで、スマリアン法、フーバー法、末口自乗法等で求める。
S	平均幹距	林木の平均的な樹幹距離を示す。
site class	地位級	地位をいくつかの等級に区分したもの
site index	地位指数	地位を表わす指数で、基準林齢における上層木、または優勢木の平均樹高が用いられる。
site index curves	地位指数曲線	各地位指数に対応する上層木または優勢木の平均樹高成長曲線を地位指数曲線という。
site quality	地位	林地の肥沃度、生産力
size class	サイズクラス	樹木の大きさを表わしたもので、樹高級と直径級などにより表わす。
Sr	相対幹距	平均幹距（ｓ）と林分の上層木の平均樹高（$\sqrt{H}$）との比を相対幹距または樹高ー幹距比といい、次のように百分率で表す。 $Sr = S\sqrt{H} \times 100$（%） 林分密度の尺度の一つで、間伐の尺度になる。

英　　　　　語	日　本　語	解　　　　　説
stacked volume	層積	積み重ねた空間を含む容積をいう。薪など一定長の木材を一定の幅と高さに積み上げ、その体積を測るもので、実績(solid volume)に対して用いられる。
stand density	立木密度 林分密度	林分の密度は本数、断面積合計等１変数で表す場合と２変数の組み合わせ（相対幹距等）で表す場合がある。
stand table	林分表	直径階本数表の年次的な推移を表した表
stocking	立木度	最良の林分状態または管理された林分と比較して表した林分の状態
stump	伐根	木を伐倒したときの根株
suppressed　(trees)	被圧木、劣勢木 下層木	被圧された木
survival percent	残存率	枯損等森林から除去された樹木を除いて残存する樹木の本数、または材積の全林木に対する割合
survival rate	残存率	survival percentに同じ
thick　wood	成材材積	伐採点以下の材積を除いた木の皮付き直径７ｃｍ以上の部分の材積をいう。ドイツでは皮付き材積を指すが、東南アジア諸国では、樹皮なし材積を指す。
thinned	間伐された	間伐された（木または材積）
thinning	間伐	人為的に本数を減らすこと。間引き
thinnings	間伐木、副林木	間伐される木
tip end	末口	丸太で直径の小さい方の断面を末口、大きい方の断面を元口という。
top height	上層木樹高	上層樹冠を構成する優勢な木の樹高
total volume	主幹材積	木の主幹の材積、広葉樹によく見られるように主幹が明らかでないときは、枝下高までの材積をいう。主幹が（大枝を持たず）明らかなものは頂端までの材積をいう。
treated	処理をした	間伐など人の手を加えた状態を指す。
under bark (u.b.)	皮内直径	樹皮付きの状態の直径
unthinned stands	無間伐林	間伐が行われない林分で自然の推移にまかせている林分

英　　　　語	日　本　語	解　　　　説
untreated	無処理の	間伐など人の手の入らない、無処理の森林の状態を指し、間伐の施業比較試験地等では対照区となる。
upper height	上層高	林分内の上層木の平均樹高。林分から万遍なく上層木をとる必要があるため、例えば0.25ha内のプロットでは0.01haの２５個のプロットを設定し、それぞれのプロットの最高の樹高を有する木の平均樹高を求める。これはha当たり１００本に相当する。英国では top heightという。
volume	材積	材木の量
volume over bark (V.O.B.)	皮付き材積	樹皮付きの材積
volume thinned	間伐材積	間伐される木の材積
yield	収穫（量）	森林から除去されようがされまいが、年々または定期的に伐倒される林木の材積
yield table	収穫表	ある樹種に対し一定の作業法を採用した場合に、一定年度ごとの単位面積当たりの本数、材積およびこれに関係のある主な林分因子の値を時系列的に表示したもの。

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第１分冊（天然林及び針葉樹人工林）

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アフリカ

コートジボアール（象牙海岸）

ガーナ

ケニア

マラウィ

モロッコ

ナイジェリア

中　米

ジャマイカ

プエルトリコ

トリニダッドトバコ

南　米

コロンビア

ブラジル

スリナム

多 国 籍

ポルトガル

スペイン

（天然林及び針葉樹人工林）

天然林　アジア　インド

Moist deciduous forestの多様な樹種について樹種別の直径成長

Uttara kannada district, Karnataka State, India

データ採取地の立地環境

STUDY AREA

The seven study areas are located in Haliyal and Yellapur forest divisions of Uttara Kannada district of Karnataka State in India All of these study sites are located within a 20 *km* radius from the industrial township Dandeli. The study plots are called Linear Tree Increment (LTI) or permanent sample plots (PSP). They are 20 m wide and 140 *m* (2 plots) or 160 *m* long. The plots are located in moist deciduous forests. The average rainfall in the tract is around 2500 *mm*. Parent rocks in the area are quartzites and mica schists. Some other attributes of the study areas are given in Table 1. Environmental conditions obtained in the seven study areas are comparable. Most of the rainfall is from June to August.

MATERIALS AND METHODS

Most of the study plots were set up in 1950, those which could not be completed were taken up for further recording in 1953. Individual trees of all the important species which were 10 *cm* diameter breast height (dbh) (1.37 *m* from ground level) at the time of setting up were measured and an inventory was made. Two diameters at right angles to each other were recorded. The point of diameter measurement was marked in paint by a plus (+) mark. A permanent number embossed on a metal plate was affixed on each tree. Subsequently these study areas were visited annually to check and renew the paint marks, if required. The plots were 20 *m* in width, 10 *m* on either side of a central line, which was aligned with the help of a Prismatic compass and the line was well marked on the ground with the help of marking posts at 20 *m* interval Trees in these plots were measured subsequently at intervals, varying from five to nine years. At the time of formation of the plots the dominance class of the trees was also recorded.

The tract supports moist deciduous type of forest with the top canopy layer being around 25 - 30 *m* height. The study areas can be broadly grouped into two categories:

i) Teak is the prominent species of the overwood in Bailapa, Jambaga, Shingatgeri and Shiroli areas; and

ii) Teak is an associate, of overwood species in Phansoli, Usoda and Virampali areas.

At the beginning of the study most sites had only partial regeneration, particularly on patches which experienced direct sunlight. Shiroli site had fair regeneration of *Xylia dolabriformis*. Jambaga and Shingatgeri had some regeneration of main species, while regeneration was absent in Phansoli and Usoda areas. In Virampali the regeneration was killed by fire. All the sites have undergrowth of three important species of bamboos dowga (*Bambusa arundinacea*), medar (*Dendrocalamus strictus*) and chiva (*Oxytenenthera monostigma*), in varying proportions. Towards the moister localities there is a higher proportion of dowga and chiva while towards the drier localities there is more of medar bamboo. Grasses formed the ground cover in open patches in all the sites. A list of important species from these sites is given in Appendix I.

Table 3. Annual Diameter Increment (+cm) for various species in different dominance classes in moist deciduous forest of Western Ghats

Species	Dominant class			Mean ± S.E.
	Dominant	Godominant	Suppressed	
A. cordifolia	.29 ± .08 (7)	-	-	.29 ± .08 (7)
A. latifolia	.29 ± .03 (5)	-	-	.29 ± .03 (5)
B. racemosa		-	.21 ±.02 (8)	.21 ± .02 (8)
B. Lowii	.13 ± .03 (3)	-	-	.13 ± .03 (3)
C. arborea		.29 ± .14 (6)	.19 ± .03 (23)	.24 ± .03 (34)
D. latifolia	.23 ± .03 (32)	.19 ± .02 (44)	.20 ± .04 (44)	.21 ± .01 (84)
D. pentagyna	.23 ± .06 (16)	.35 ± .05 (23)	.23 ± .07 (6)	.27 ± .03 (45)
E. officinalis	.22 ± .14 (3)	.20 ± .02 (4)	.27 ± .08 (8)	.25 ± .05 (15)
G. tilaefolia	.36 ± .03 (26)	.34 ± .02 (54)	.24 ± .03 (10)	.31 ± .02 (90)
L. coromendalica	-	.29 ± .06 (7)	-	.29 ± .06 (7)
L. lanceolata	.34 ± .03 (72)	.37 ± .03 (38)	.39 ± .07 (13)	.37 ± .02 (123)
M. parviflora	-	-	.49 ± .06 (3)	.49 ± .06 (3)
S. acuminata	.49 ± .18 (3)	.46 ± .23 (3)	.65 ± .23 (3)	.54 ± .10 (9)
S. ?	-	-	.36 ± .13 (3)	.36 ± .18 (3)
T. grandis	.31 ± .02 (23)	.33 ± .02 (79)	.40 ± .03 (38)	.35 ± .01 (210)
T. glata	.35 ± .03 (41)	.29 ± .04 (14)	.35 ± .13 (5)	.33 ± .02 (60)
T. paniculata	.40 ± .02 (102)	.36 ± .03 (66)	.39 ± .02 (44)	.38 ± .01 (212)
W. tinctoria	-	-	.17 ± .04 (6)	.16 ± .04 (6)
K. spinosa	-	.31 ± .07 (3)	.33 ± .05 (17)	.32 ± .04 (20)
X. dolariformis	.31 ± .08 (94)	.29 ± .01 (211)	.31 ± .02 (148)	.30 ± .01 (453)

Note: Annual diameter increment (in cm) is given with S.S. Figures below in the parenthesis are the number of trees on which the observation is made. The dominance classification was made originally and the same has been continued.

出典

Rai, S.N (1989) Rate of diameter growth of tree species in humid tropics of Western Ghats, India. Growth and yield in tropical mixed/ moist forests (1989) Kuala lumpur, Malaysia

実験林 アジア インドネシア（カリマンタン）

フタバガキ科林のlogged over forestと対象地での成長解析例。

Pulau Laut Island, South Kalimantan, Indonesia

データ採取地の立地環境

DESCRIPTION OF OBSERVED AREA

The observed loggedover Dipterocarps forest area is located in the Pulau Laut island, the province of Sonth Kalimantan. The island stretchs lengthwise from north to south with around 96 km in maximum length and 36 km in maximum width, and a total area of 207.800 hectares. It belongs to the rainfall type A and B (Schmid and Ferguson), covering an area of 30 % in the northern part and 70 % in the

loggedover of seven years old and the other two plots on loggedover of eight years old.

Two rectangular plots of the same size have been estab - lished on loggedover area of 5 years old.

The plots were made on purposively selected locations based on practical and subjective considerations regarding the existing forest condition.

Treatments and Observations.

The first four mentioned plots were refined, and enrich - ment planting were done on required sites. All seedlings and sapling of non Dipterocarps species having diameter of less than 10 cm were removed, whereas Dipterocarps regeneration (including the planted seedlings) were kept remain. All Dipterocarps regenerations of diameter 7 cm and up, and the non Dipterocarps regenerations of over 10 cm in diameter were numbered and measured periodically every two years.

The last two rectangular plots were kept untreated. No refining and enrichment planting have been carried out, but numbering and measurements were done/carried in the same way as at the first four plots.

The location of each tree within each plot were sketched to make tree enumeration and monitoring of ingrowth and mortality could be implemented easily.

成長・収穫に関する表，図，式など

Table 2. Annual Growth of Shorea spp. and All Species on Treated and Untreated Plots on Loggedover Dipterocarps Forest in Pulau Laut, South Kalimantan

Plot	Group of species	Annual Growth: Average diameter (cm)	%	Basal area/ha (m2)	%
Treated remaining forest stand					
IA	Shorea spp.	0.98	7.2	1.332	26.4
	All species	0.72	4.0	1.128	10.2
IB	Shorea spp.	1.03	8.2	1.864	31.5
	All species	0.90	6.3	1.788	22.5
IIIA	Shorea spp.	1.20	10.3	2.068	27.9
	All species	1.15	9.6	2.040	25.6
IIIB	Shorea spp.	1.21	7.4	1.908	19.4
	All species	0.79	3.7	1.808	8.4
Untreated remaining forest stand					
IIA	Shorea spp.	0.37	1.4	0.968	10.5
	All species	0.53	2.3	1.380	6.9
IIB	Shorea spp.	0.64	5.2	0.584	19.0
	All species	0.67	4.0	1.500	9.5

Table 3. Mean Diameter Growth Rates of Undamaged Trees Six Years after Logging and Similar Trees in a Virgin Forest, ITCI Concession, East Kalimantan

Diameter class (cm)	Mean diameter growth (cm/year): Virgin forest	Logging severity: 4 %	15 %	20 %
15 - 24.9	0.2	0.4*	0.4*	1.6*
25 - 34.9	0.6	0.4	0.6	1.2*
35 - 44.9	0.7	0.4	1.0	1.6*

* Significantly different from virgin forest at 95 % level by t-test

Table 4. Basal Area and Mean Annual Basal Area Increase (m2/ha)

	Treated plots		Untreated plots	
	B.a. increment (m2/ha)	%	B.a. increment (m2/ha)	%
PICOP				
50 fastest Dipt.	0.223	30.7	0.093	12.4
Total Dipt.	0.814	6.3	0.107	0.5
Total	1.226	6.1	0.468	1.4
GONPU				
50 fastest Dipt.	0.324	31.4	0.182	16.7
Total Dipt.	1.036	9.9	0.370	5.9
Total	1.430	8.1	1.252	3.9
ARTIMCO				
50 fastest Dipt.	0.747	11.5	0.655	10.8
Total Dipt.	1.379	7.6	1.255	5.5
Total	1.615	5.9	1.484	3.7

出典

Soemarna, Komar and Harbagung (1988). Growth study on loggedover dipterocarps forest (Case study . The effect of refining and enrichment planning on diameter and basal area growth). Growth and yield in tropical mixed/moist forests (1988). Kuala Lumpur, Malaysia.

熱帯林　アジア　マレーシア（1）（サラワク）
フタバガキ科について、3試験地での直径成長量。

データ採取地の立地環境

Materials and methods

In 1965, three forests, selected to represent the range of mixed dipterocarp forest structure and soils found in Sarawak (Table 1), were chosen for an intensive comparative study. Each site is a relatively uniform example of a particular community type in primary forest that has never been cut. These sites have been investigated for species composition, productivity, physiognomy, soils, topography and meteorology (Ashton 1973, 1976; Baillie 1978; Jamaluddin 1978). The following is a brief description of each forest type:

Bukit Mersing is a tall forest (average canopy height 32 m) on generally moderate slopes with a relatively low mean density of massive trees and relatively new sub-canopy trees. The mature phase canopy is dense and fairly uniform with little light penetration through the canopy. Many large trees are found in groves. The loamy soil has a comparatively high nutrient content and water-holding capacity (Table 1). Trees are relatively shallow rooted and large canopy gaps are created when trees fall.

Lambir is intermediate between Bako and Mersing in soil characteristics and tree density. In contrast with Bako and Mersing, much of the forest is on steep topography (greater than 35°) and subject to land-slips. Average canopy height is 38 m.

3. Bako is a relatively low forest (canopy trees average about 23 m in height) with a high density of small trees and an abundance of saplings. The canopy is not dense, and there is considerable light penetration to the sup-canopy layer and lower. The sandy soil has a low nutrient content and water-holding capacity. The trees are relatively deeply rooted and generally remain standing after they die. When the tree finally die, relatively little canopy damage occurs.

In 1965 and 1966, four to five permanent plots, totalling 2.4-3 hectares, were set up at each of these three forests. In these plots, every tree with a diameter at breast height of over 9.7 cm was permanently tagged, identified, measured for height and girth at breast height. In 1975, a ring was painted around each tree at the point of girth measurement to increase the accuracy of growth measurements. These plots have over 1,300 trees per site. The high species diversity characteristic of dipterocarp forests is seen in the large numbers of tree species found on these plots (Table 1). At five-year intervals (1970-71, 1975-76, 1980-81), the Sarawak Forest Department has re-measured these trees for girth. Beginning in 1975, canopy position was also recorded, and new adult recruits were tagged, identified, measured for girth and permanently included in the census. Analysis of certain aspects of the first ten years of data has been completed (Jamaluddin 1978), and data for the Moraceae have been analyzed up to 1980 (Primack *et al.*, 1985).

These present analysis considers only dipterocarp trees. The results are all presented as annual diameter increments (cm/year).

Table 1. Summary of characteristics at the three primary forest research sites in Sarawak, Malaysia from Ashton (1973) and Baillie (1978).

Characteristic	Bako	Lambir	Mersing
Mean mineral soil characteristics at 22 cm*			
pH	4.5	4.2	5.1
P	31	83	1325
Ca	112	160	1717
Mg	About 100	715	4692
Fe + Al	1.1	5.1	35
K	700	2505	5292
Soil type	podosolic sand	sandy loam	latosolic loam
Humus layer	Ca. 15 cm deep	intermediate	patchy
Canopy height	23 m	38 m	32 m
Canopy structure of mature phase	Even, many subcanopy trees	Irregular	Even
Number of hectares	2.4	2.4	3
Total number of trees. (1965)	1863	1748	1361
Volume of trees (m^3) per hectare in 1980	419	895	928
Number of tree species	290	360	152
Nature of gap formation	Death of standing individuals	Uprooting of emergents	Uprooting of emergents

* Mean based on 12 samples. Nutrients expressed as parts per million following the methods developed for highly weathered Borneo soils by Bailey (1967). Nitrogen was also sampled extensively but was found to be so variable within a site and over time that it was not considered useful indicator of soil fertility.

\+ The canopy height refers to the approximate height of most canopy trees The actual canopy layer is uneven with gaps between trees and ocasional emergent trees which are higher than the other trees.

Table 2. Annual diameter increments (cm/year) for trees at 3 contrasting forests.

	Bako				Lambir				Mersing			
	x	s.d.	N	fast trees	x	s.d.	N	fast trees	x	s.d.	N	fast trees
All dipterocarps	0.30	0.26	385	—	0.23	0.20	374	—	0.41	0.40	279	—
Cotylelobium	0.20	0.12	65	0.45	—	—	—	—	—	—	—	—
Dipterocarpus	—	—	—	—	0.16	0.12	66	0.40	0.29	0.28	60	0.67
Dryobalanops	0.47	0.29	70	1.02	0.30	0.17	28	0.58	0.36	0.30	106	1.10
Hopea	0.30	0.18	65	0.69	—	—	—	—	0.38	0.48	60	0.82
Parashorea	—	—	—	—	—	—	—	—	0.54	0.48	12	—
Shorea	0.26	0.30	135	0.96	0.25	0.20	218	0.80	0.67	0.53	41	1.10
Vatica	0.23	0.20	39	0.62	0.14	0.13	47	0.42	—	—	—	—

Note: Values reported are mean, standard deviation and sample size for genera having a sample size of at least 10 individuals. For each genus having at least 20 trees, the mean growth rate of the five fastest growing trees is also presented.

Table 3. Annual diameter increments (cm/year) of individual *Shorea* species at three primary forests over a 15 years period.

Timber	Bako				Lambir				Mersing			
	Species	x	s d.	N	Species	x	s.d.	N	Species	x	s.d.	N
Red meranti	*S. beccarina*	0 42	0.43	18	*S. acuta*	0 24	0.18	32	*S. rexburghii*	0 42	0.32	10
					S. beccariana	0.21	0 14	38				
					S. kunstleri	0.14	0.10	11				
					S. macroptera	0.16	0 21	10				
					S. ovata	0.30	0.29	11				
					S. rubella	0 40	0.24	11				
					S. smithiana	0.31	0.26	12				
Yellow meranti	*S. cuspidata*	0.13	0.14	33	*S. laxa*	0.29	0.13	26	*S. hopeifolia*	0.82	0.69	17
Selangan batu	*S. falcifera*	0 32	0.43	33								

Note: Values presented are the mean, standard deviation and sample size.

Table 4. Diameter (cm) annual diameter increments (cm/year) for the fastest growing 3 individuals at each primary forest site.

Forest	Species	Diameter (cm)	Annual Diameter (cm/year)	Increments	
		1965	1965-70	1970-75	1975-80
Bako	*Shorea scaberrima*	31.9	1.1.	1.0	1.2
	Dryobalanops beccarii	20.8	2.3	0.7	0.8
	Shorea beccariana	51.9	1.6	1.0	1.1
Lambir	*Shorea fallax*	68.8	1.1	0.7	1.1
	Hopea beccariana	53.5	0.6	0.7	0.8
	Parashorea smythiesii	62.3	1.4	1.1	2.9
Mersing	*Dryobalanops lanceolata*	33.5	1.1	1.2	2.0
	Parashorea macrophylla	52.9	1.6	1.6	1.3
	Shorea hopeifolia	36.8	1.3	1.4	2.0

Table 5. Mean annual diameter increment (cm/year) of six common species by size class (dbh).

Forest	Species	DBH (cm)	$\bar{x}$	s.d.	N	% in each size class
Bako	*Cotylelobium melanoxylan*	10-19	0.19	0.11	41	73
		20-29	0.23	0.14	11	20
		30-39	0.23	0.06	3	5
		≥ 40	0.21	0.00	1	2
	Dryobalanops beccarii	10-19	0.29	0.19	31	44
		20-29	0.58	0.31	25	36
		30-39	0.61	0.14	9	13
		≥ 40	0.80	0.20	5	7
Lambir	*Dipterocarpus globosus*	10-19	0.07	0.06	18	31
		20-29	0.17	0.10	11	19
		30-39	0.17	0.08	5	9
		≥ 40	0.23	0.12	24	41
Mersing	*Dipterocarpus caudiferus*	10-19	0.16	0.10	10	17
		20-29	0.26	0.10	9	16
		30-39	0.24	0.20	6	10
		≥ 40	0.36	0.35	33	57

Dryobalanops lanceolata	10-19	0.18	0.19	33	31
	20-29	0.30	0.18	17	16
	30-39	0.53	0.40	13	12
	≥ 40	0.48	0.31	43	41
Hopea andersonii	10-19	0.06	0.30	17	30
	20-29	0.38	0.35	9	16
	30-39	0.35	0.21	4	7
	≥ 40	0.60	0.55	26	46

Note; Data presented are mean, standard deviation, sample size, and percent distribution in each size class.

Table 6. Fifteen year survival rates, annual survival rate, and annual percent mortality for 12 dipterocarp populations.

Forest	Species	Initial Sample Size	Number Surviving	Fifteen-year Survival Rate	Annual Surivival Rate	Annual % Mortality
Bako	*Cotylelobium melanoxylon*	58	53	0.91	0.094	0.6
	Hopea vesquei	38	28	0.74	0.980	2.0
	Shorea cuspidata	33	24	0.73	0.979	2.1
	Shorea falcifera	40	29	0.72	0.978	2.2
Lambir	*Dipterocarpus globosus*	60	56	0.93	0.995	0.5
	Shorea acuta	35	30	0.86	0.990	1.0
	Shorea beccariana	38	31	0.82	0.987	1.3
	Shorea laxa	29	25	0.86	0.990	1.0
	Vatica micran tha	27	21	0,78	0.984	1.6
Mersing	*Dipterocarpus caudiferus*	62	56	0.84	0.988	1.2
	Dryobalanops lanceolata	116	85	0.73	0.979	2.1
	Hopea andersonii	56	45	0.80	0.985	1.5

note: Species with an initial sample size of at least 25 trees were selected.

出典

Primack, R B., Chai, E.O.K., Tan, S.S. and Lee, H.S (1987). The silviculture of dipterocarp trees in Sarawak, Malaysia. I. Introduction to the series and performance in primary forest. Malaysian Forester, Vol. 50, No. 1 : 29-42.

データ採取地の立地環境

Materials and methods

The research plots were set up by the Sarawak Forest Department during the period 1935-55. Descriptions and locations of the plots are given in an old log book that is preserved by the Research Records Office of the Forest Department. These plots were all abandoned sometime in the past, so that locating most of these plots at the present time would be difficult if not impossible. The site descriptions and species identifications are derived from this log book and cannot be confirmed. Many of these sites were examined for soils and forest types by Ashton (1973) though the exact location of the Improvement Felling plots within each forest is not known. Certain species probably require name changes as a result of improved taxonomy (P. Ashton, per. comm.).

In these experimental plots, trees of the selected species were freed by felling or girdling overtopping trees. The selected trees were then measured for diameter at breast height (dbh) or in some designated cases at a higher point, if the tree had buttresses. Trees were repeatedly measured for dbh at the same point of measurement.

Trees which were either of poor form or attacked by insects were discarded form the analysis. Also discarded were trees that died during the course of the study (often as a result of crown damage or termite attack) and trees that required a change in the position of the measurement point.

A problem with evaluating these old studies is that we do not know the intensity of the Improvement Felling treatments, that is, How many trees were killed? How large were these felled trees? Were the felled trees left on the ground or removed for commercial and domestic purposes? We do not know what the criteria were for selecting these species for study. A further difficulty is that the initial size of the trees in the study varies considerably among sites (Table 1) Despite these difficulties, the large number of plots and the long duration of continued assessments provide insight into the silviculture of dipterocarp forest.

成長・収穫に関する表，図，式など

Table 1. Annual diameter increments (cm/year) of dipterocarp species following Improvement Felling.

Species	Silvicultural Type	Forest	Initial Size	Mean Growth Rate	N	# Years	Max
Shorea macroptera	Red meranti	Nyabau, Forest Bintulu	16.0 ± 8.3	0 28	49	5	0 63
Shorea splendida	Red meranti	Semengoh Forest, Kuching[1]	1.1 ± 0 4	0.68	36	19	1.16
Shorea splendida	Red meranti	Semengoh Forest, Kuching	20.7 ± 10.5	0.93	31	19	1 51
Shorea parvifolia	Red meranti	Selang, Kuching	20 6 ± 13.0	0 43	32	11	0.97
Shorea sp.	Red meranti	Semengoh Forest, Kuching	32.9 ± 12.9	0 52	15	20	0.76
Shorea multiflora	Yellow meranti	Semengoh Forest, Kuching	27 1 ± 8 4	0 21	10	20	0.28
Shorea scrobiculata	Selangan batu	Nyabau Forest, Bintulu	27.8 ± 14 6	0 16	36	5	0 34
Dryobalanops beccarii	Kapur	Selang, Kuching	14 7 ± 10 9	0 47	54	11	0 92
Dryobalanops beccarii	Kapur	Gunung Ngili, Sadong	6 7 ± 9 1	0 67	12	21	0 96
Dryobalanops oblongifolia	Kapur	Gunung Ngili, Sadong	7 6 ± 3 5	0 60	23	21	0.81
Dryobalanops rappa	Kapur	Setapak Forest, Kuching[2]	4 3 ± 2 2	0 87	17	19	1 23
Dipterocarpus rigidus	Keruing	Nyabau Forest, Bintulu	49 2 ± 18 6	0 27	40	5	0 65
Vatica sp	Resak	Semengoh Forest, Kuching	26 9 ± 8.4	0 22	18	20	0 28

[1]Plantation Forest
[2]Peat Swamp Forest

Note Data also include for a plantation Data given are mean initial tree diameter in cm (mean + standard deviation), mean annual diameter increment, sample size, number of years of study, and the maximum growth rate (based on the five fastest growing trees)

Figure 1. Mean growth rate of two species of *Dryobalanops at Gunung Ngili over 21-year period beginning in 1925.*

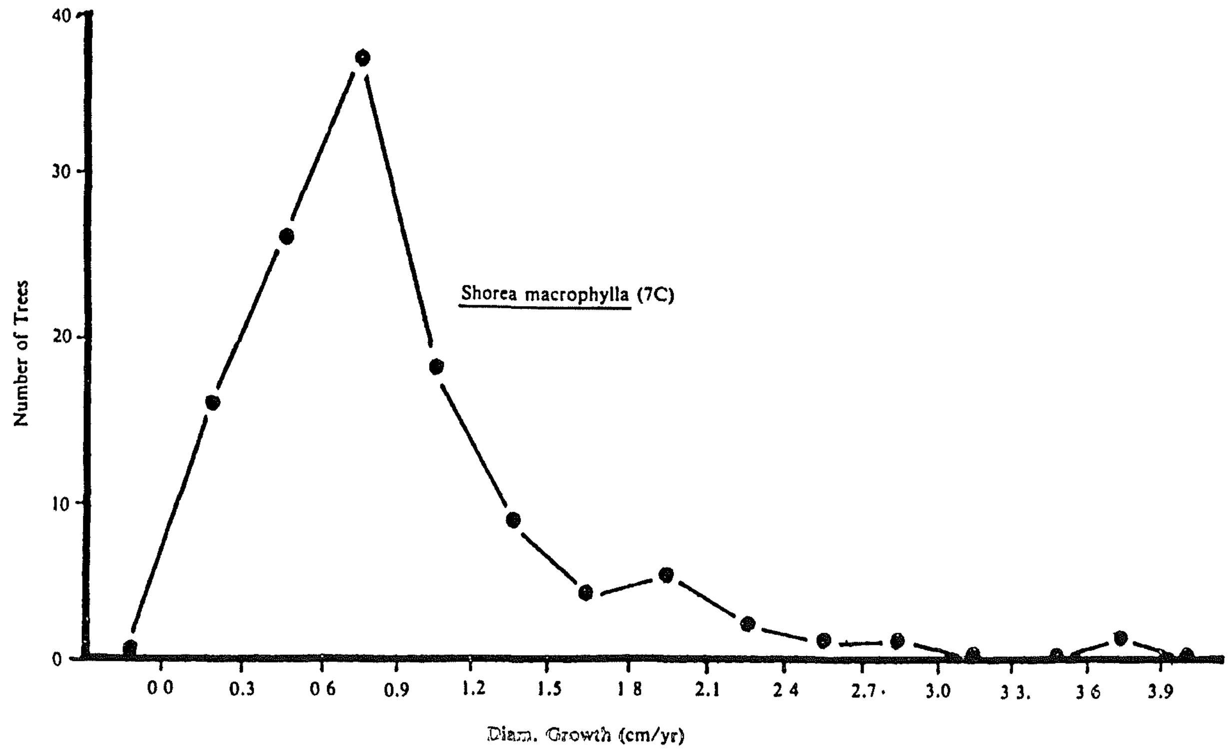
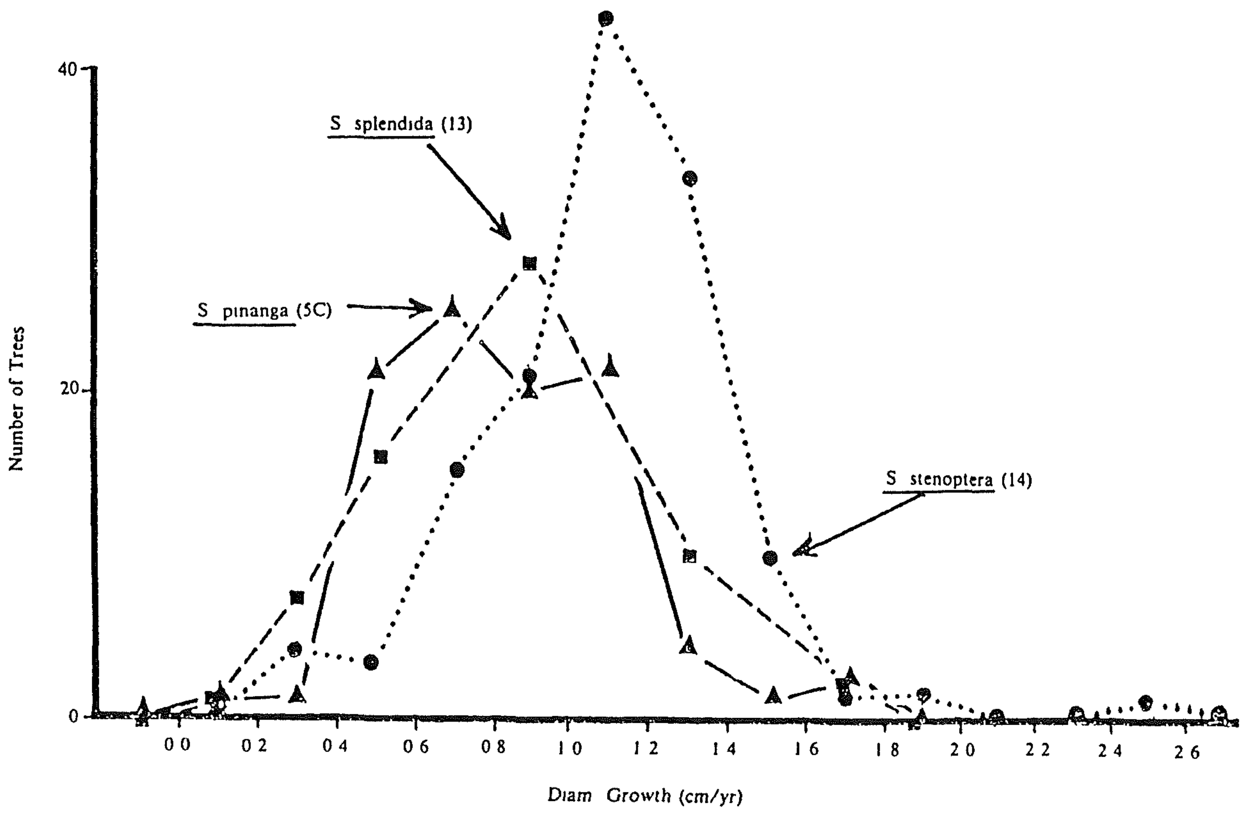


Figure 2. Mean growth rates of Red meranti, Keruing, and Selangan batu at Nyabau Forest over a five-year period beginning in 1935.



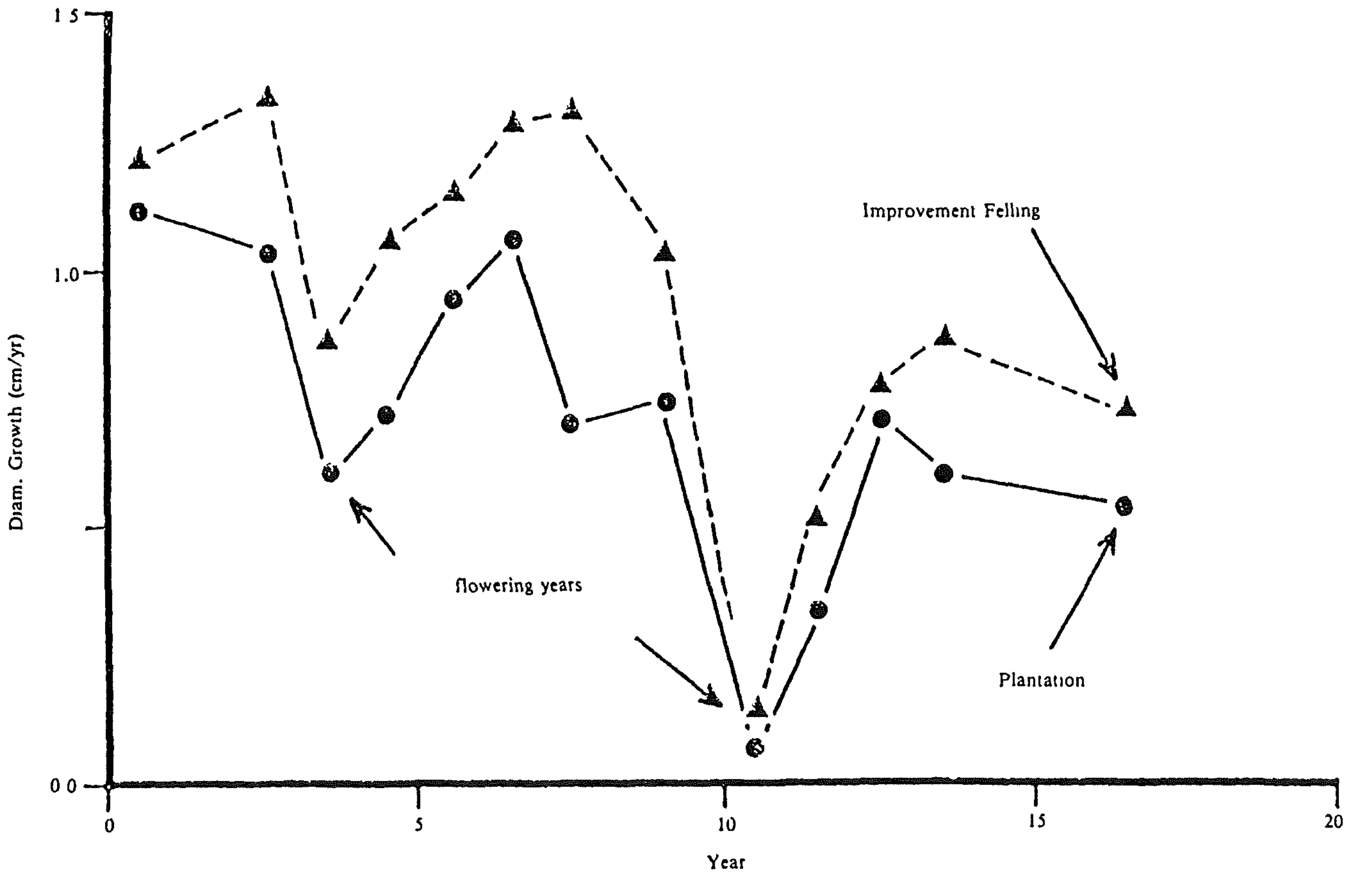


Figure 3. Mean growth rates of Engkabang (Shorea splendida) in a plantation and a primary at Semengoh Forest over a nineteen-year period beginning in 1936.

Figure 4. Mean growth rates of Red meranti and Kapur at Selang Forest over an eleven-year period beginning in 1939.

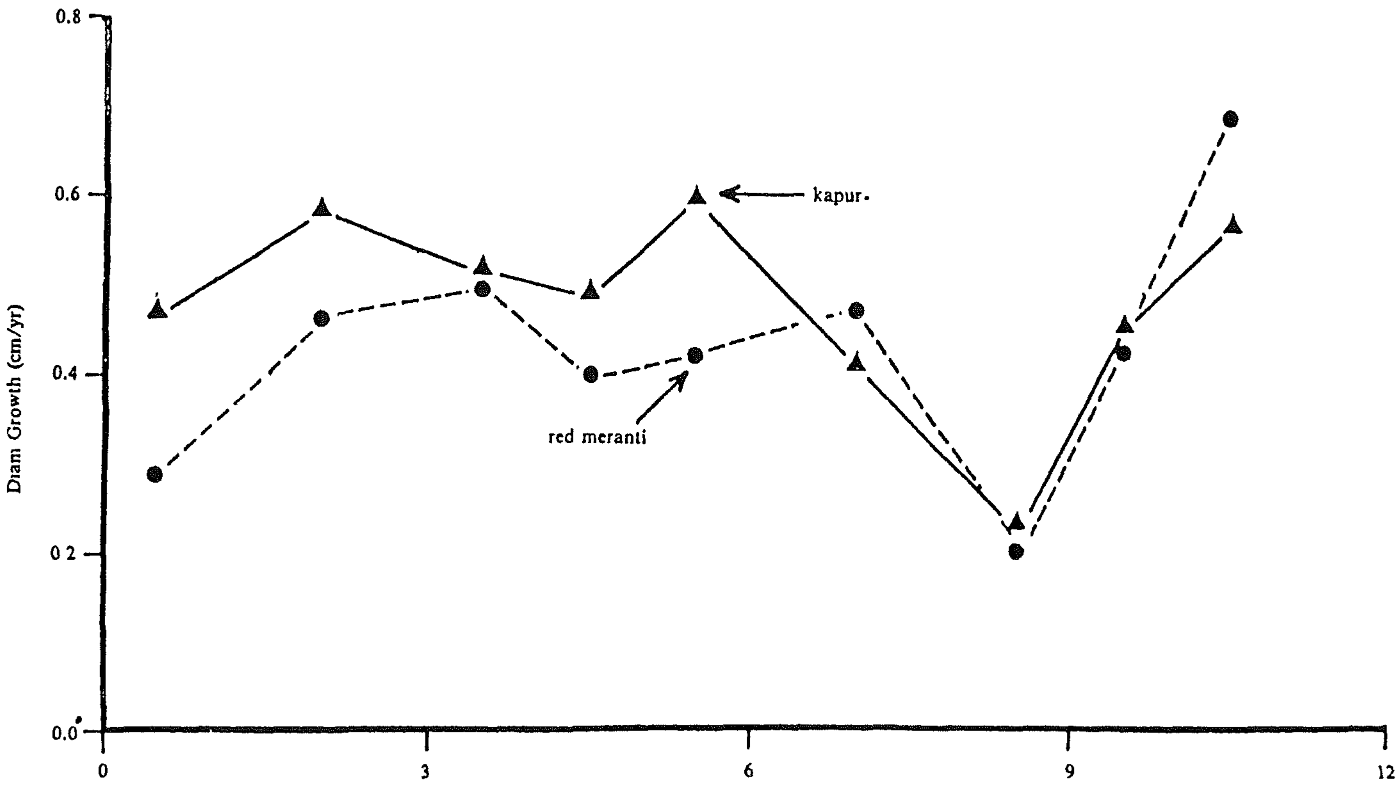


Figure 5. Mean growth rates of kapur at Setapok Forest over a nineteen-year period at Setapok Peat Swamp Forest beginning in 1952.

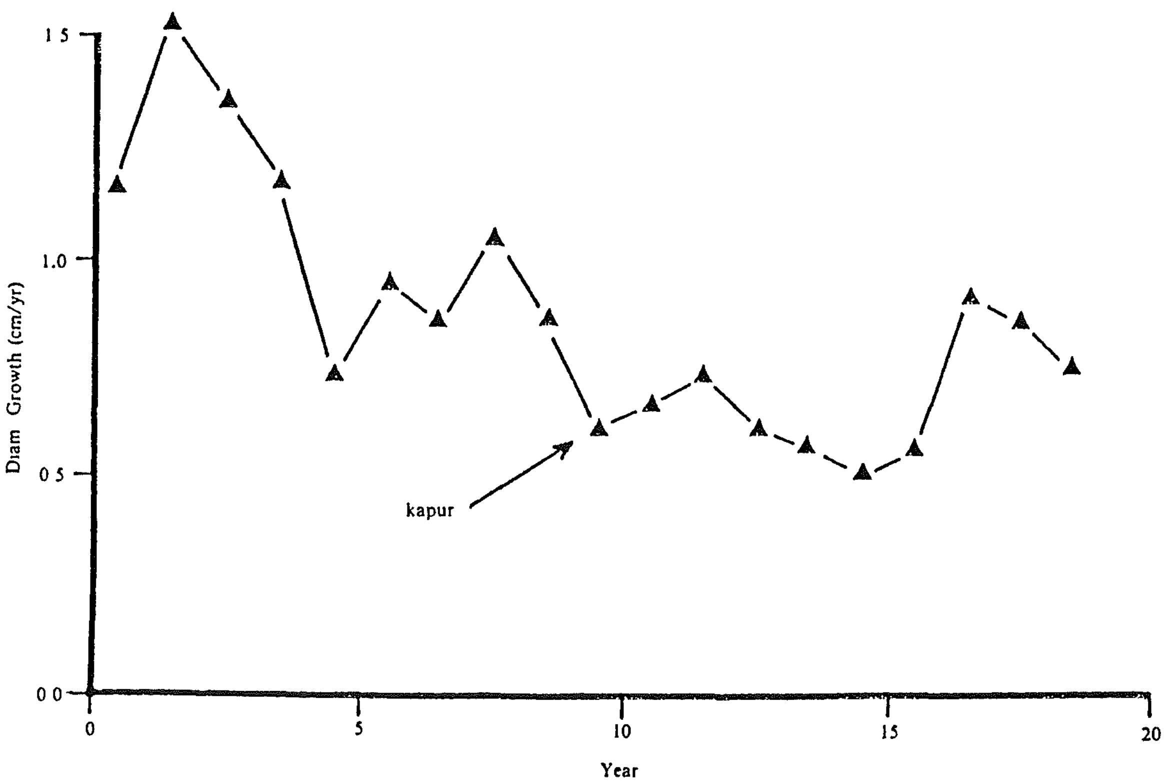
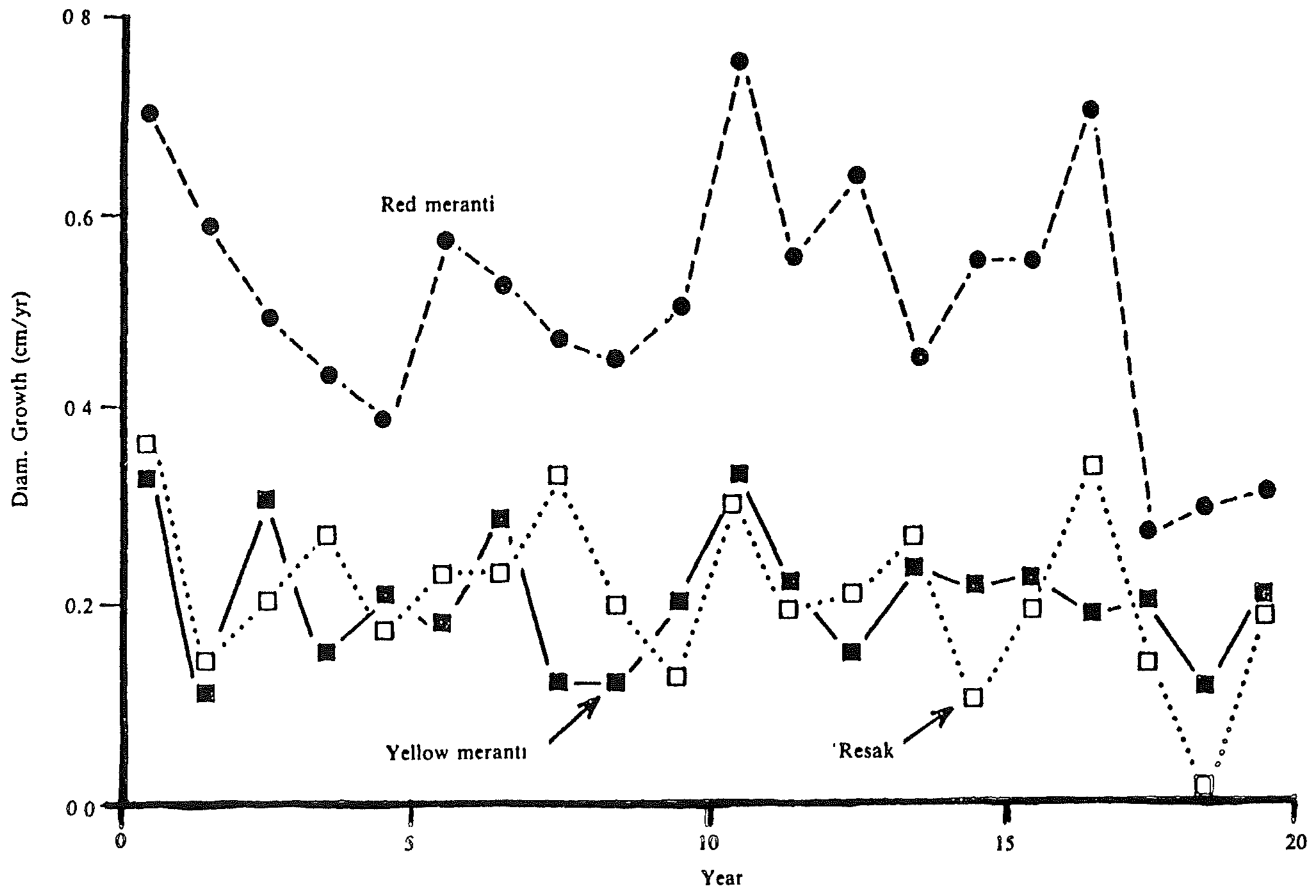


Figure 6. Mean growth rates of Red meranti, Yellow meranti, and Resak at Semengoh Forest over a twenty-year period beginning in 1953.



出典

Primack, R.B., Chai, E.O.K , Tan, S.S. and Lee, H S. (1987). The silviculture of dipterocarp trees in Sarawak, Malaysia. II. Improvement felling in primary forest stands. Malaysian Forester, Vol. 50, No. 1 : 43-61.

データ採取地の立地環境

MATERIALS AND METHODS

The Loba Kabang Protected Forest Research Plot 52 (RP52) was established in 1969/70. It covers an area of 360 *ha*. The trial consists of six treatments applied to five logging blocks with two species lists making a total of 60 plots. The tree poisoning schedules are shown in Table 1.

The list of **desirable and acceptable** species used during poisoning contained 16 species (short list) for treatments 01-06 and 25 species (long list) for treatments 11-16. The schedules suggest a sequence of treatment intensities of 5, 4, 3, 1, 2, 6 in order of decreasing intensity. Treatment 6 with no poisoning is the control. The logging blocks were treated in 1970 and measurements were made in 1970, 1971, 1972, 1974, 1975, 1981 and 1987.

Selection of basic standtable

Trees of desirable species and the 1970 and 1987 assessments are used in the basic standtable for projection of each treatment. The basic standtable used for projection of all six treatments for both the short and long lists is given in Table 2

Application of mortality and growth

The RP52 assessment data for 1970-1981 were sent to the Unit of Tropical Silviculture (UTS) in Oxford for processing. The 1987 assessment data were processed locally. Processing of these data was done using a computer program called UPDATE. The program UPDATE developed by UTS, is used to derive annual mortality rates. It also checks measurements, calculates girth/diameter increment per tree and checks whether these are within a specified allowable growth range.

Mortality rates are expressed as percent per annum per diameter class. UPDATE runs were made for the various growth periods from 1970-81 (Table 3). The mortality rates from 1987 to 2007 are assumed. It is assumed that as the developing stands mature, mortality rates would decline to only 4-5% (Revilla 1981).

Growth rates are expressed as *cm* per year per tree. From runs made through UPDATE, the diameter increment figures for the different growth periods from 1970 to 1987 are obtained (Table 4). The diameter increments for the period 1987-2007 were obtained by regression analyses.

Application of de Liocourt's Quotients

Ingrowth is estimated by using de Liocourt's Quotients (q-values) for the small size stems or stems in the lower diameter range of 5 - 20 *cm*. The q-values used for estimating ingrowth in projecting the various treatment stands from 1970 - 2007 are summarised in Table 5.

Liocourt's quotients (q-values) are also used to calculate growth indices. The q-values used for projecting the basic stands for the various treatments from 1970 - 2007 are summarised in Table 6.

Program STANDPRO

- The inputs required for the STANDPRO program are
- Initial standtable
- Diameter class interval (10 *cm*), minimum diameter, dividing diameter (30 *cm*) and upper diameter class (90 *cm*)
- Growth rates per diameter class

- Mortality rates per diameter class
- Liocourt's quotient for diameter range 5 - 30 *cm* and 30 - 80 *cm*
- Period length (number of years)

The outputs are·

For every period of projection

- All inputs, whether changed or not
- Surviving stand
- Projected stand
- Basal Area and q-values for initial, surviving and projected stand
- Coefficients of correlation for all q-values

Table 1. Treatment schedules

Treatment	Poison Sound and Well-shaped Trees: Ramin & Jongkong	Poison Sound and Well-shaped Trees: Other Desirables & Acceptables	Poison Undesirables plus unsound, damaged & badly shaped trees of any species
1(01 & 11)	over 60 cm dbh	over 40 cm dbh	over 30 cm dbh
2(02 & 12)	-	-	over 30 cm dbh
3(03 & 13)	-	-	over 20 cm dbh
4(04 & 14)	-	-	over 10 cm dbh
5(05 & 15)	-	-	over 3.0 m tall
6(06 & 16)	-	-	

成長・収穫に関する表，図，式など

Table 10. CAI and MAI of basal area (per ha) of actual stands

Treatment	0	5		11		17		MAI	
	BA (m^2)	BA (m^2)	CAI (m^2/yr)	BA (m^2)	CAI (m^2/yr)	BA (m^2)	CAI (m^2/yr)	Value (m^2/yr)	Rank
01	7.95	10.52	0.51	15.86	0.89	19.33	0.58	0.67	5
02	5.39	9.08	0.74	16.53	1.24	21.89	0.89	0.97	3
03	5.62	8.64	0.60	15.27	1.11	20 17	0.82	0.86	4
04	5.55	11.09	1.11	18.69	1.27	24.56	0.98	1.12	2
05	5.64	9.49	0.77	20.75	1.88	26 37	0.94	1.22	1
06	9.53	10.66	0.23	14.94	0.71	18 45	0.59	0.52	6
11	5.00	6.77	0.35	14.13	1.23	19 53	0 90	0.85	5
12	4.80	7.52	0.54	14.59	1.18	20.14	0 93	0.90	4
13	2.08	6.44	0.87	14.20	1.29	20 43	1.04	1.08	3
14	3.52	8.42	0.98	18.04	1.60	25.10	1.18	1.27	2
15	2.69	6.37	0.74	18.55	2.03	26.27	1.29	1.39	1
16	8.27	9.17	0.18	13.36	0.70	17.55	0.70	0.55	6

Year after poison treatment: 0, 5, 11, 17

Table 11. CAI and MAI of yields (per ha) of actual stands

Treatment	0 Vol (m^3)	5 Vol (m^3)	5 CAI (m^3/yr)	11 Vol (m^3)	11 CAI (m^3/yr)	11 MAI (m^3/yr)	17 Vol (m^3)	17 CAI (m^3/yr)	17 MAI (m^3/yr)	Rank
01	39.2	44.7	1.1	79.5	5.8	3.7	103.2	4.0	3.8	5
02	26.6	30.3	0.7	81.7	8.6	5.0	119.9	6.4	5.5	3
03	27.4	25.3	-0.4	73.9	8.1	4.2	111.5	6.3	5.0	4
04	28.7	38.4	1.9	92.5	9.0	5 8	137.1	7.4	6.4	2
05	28.8	25.6	-0.6	98.2	12.1	6.3	149.6	8.6	7.1	1
06	57.4	50.2	-1.4	79.1	4.8	2.0	104.0	4.2	2.7	6
11	22.9	23.8	0.2	67.7	7.3	4.1	106.3	6.4	4.9	5
12	22.1	27.2	1.0	63.0	7.6	4.6	108.7	6.0	5.1	4
13	9.2	20.4	2.2	71.7	8.6	5.7	111.5	6.6	6.0	3
14	20.1	37.9	3.6	98.1	10.0	7.1	146.7	8.1	7.4	2
15	14.6	14.9	0.1	87.0	12.0	6.8	141.9	9.2	7.5	1
16	45.8	42.4	-0.7	63.3	3.5	1.6	91.3	4.7	2.7	6

Year after poison treatment

Table 12. MAI of basal area (per ha) of projected stands

Treatment	0a BA (m^2)	17a BA (m^2)	27b BA (m^2)	27b MAI (m^2/yr)	Rank	37b BA (m^2)	37b MAI (m^2/yr)	Rank
01	7.95	19.33	25.22	0.64	5	30.25	0.60	5
02	5.39	21.89	29.27	0.88	3	35.82	0.82	3
03	5.62	20.17	27.38	0.81	4	32.92	0.74	4
04	5.55	24.56	34.04	1.06	2	41.76	0.98	2
05	5.60	26.37	35.12	1.09	1	42.04	0.99	1
06	9.53	18.45	23.76	0.53	6	28.27	0.51	6
11	5.00	19.53	27.14	0.82	5	33.79	0.78	5
12	4.80	20.14	29.77	0.92	4	38.69	0.92	4
13	2.08	20.43	31.30	1.08	3	40.78	1.05	3
14	3.52	25.10	35.06	1.17	2	44.91	1.12	2
15	2.69	26.27	43.54	1.51	1	56.95	1.47	1
16	8.27	17.55	24.86	0.61	6	31.56	0.63	6

Year after poison treatment

Table 13. MAI of yields (per ha) of projected stands

Treatment	Year after poison treatment							
	0a	17a	27b			37b		
	Vol (m^3)	Vol (m^3)	Vol (m^3)	MAI (m^3/yr)	Rank	Vol (m^3)	MAI (m^3/yr)	Rank
01	39.2	103.2	134.6	3.5	5	159.3	3.3	5
02	26.6	119.9	159.7	4.9	3	190.5	4.4	3
03	27.4	111.5	149.2	4.5	4	174.0	4.0	4
04	28.7	137.1	188.0	5.9	2	224.1	5.3	2
05	28.8	149.6	197.2	6.2	1	227.1	5.4	1
06	57.4	124.0	133.6	2.8	6	156.7	2.7	6
11	22.9	106.3	145.5	4.5	5	176.9	4.2	5
12	22.1	108.7	157.7	5.0	4	198.4	4.8	4
13	9.2	111.5	165.5	5.8	3	205.3	5.3	3
14	20.1	146.7	193.3	6.4	2	235.6	5.8	2
15	14.6	141.9	229.0	7.9	1	285.8	7.3	1
16	45.8	91.3	130.3	3.1	6	163.5	3.2	6

a - Actual stand figures
b - Projected stand figures based on actual stands 17 years after poison treatments

出典

Chai, Francis Y.C and P C. Sia (1989) Standtable projection for a mixed swamp forest of Sarawak. Growth and yield in tropical mixed/moist forests (1989). Kuala lumpur, Malaysia.

天然林・アジア　マレーシア（4）（サラワク）

フタバガキ科について、natural forest、managed forest、logged forest及びplantationにグルーピングして成長を比較。

データ採取地の立地環境

PRIMARY FOREST

In 1965, three forests, selected to represent the range of mixed dipterocarp forest structure and soils found in Sarawak (Table 1), were chosen for an intensive comparative study (Figure 1). Each site is a relatively uniform example of a particular community type in primary forest that has never been cut by man. These sites have been investigated for species composition, productivity, physiognomy, soils, topography and meteorology (Ashton 1973, 1976, Baillie 1978, Jamaluddin 1978). The following is a brief description of each forest type:

- Bukit Mersing is a tall forest (average canopy height 60 *m*) on generally moderate slopes with a relatively low mean density of massive trees and relatively few sub-canopy trees. The mature phase canopy is dense and fairly uniform with little light penetration through the canopy. Many large trees are found in groves. The loamy soil has a comparatively high nutrient content and water-holding capacity (Table 1). Trees are relatively shallowly rooted and large canopy gaps are created when trees fall
- Bako is a relatively low forest (average canopy height 30 - 40 *m*) with a high density of small trees and an abundance of saplings. The canopy is not dense and there is considerable light penetration to the sub-canopy layer and lower. The sandy soil has a low nutrient content and water-holding capacity. The trees are relatively deeply rooted and generally remain standing after they die. When the trees finally die, relatively little canopy damage occurs
- Lambir is intermediate between Bako and Mersing in soil characteristics, tree density and stature. The average canopy height is 50 *m*. In contrast with Bako and Mersing, much of the forest is on steep topography (greater than 35^{o}) and subject to landslips

In 1965 and 1966, four to five permanent plots, totalling 2.4 - 3 *ha*, were set up at each of these three forests. In these plots every tree with a diameter at breast height (dbh) of over 9.7 *cm* was permanently tagged, identified to species and measured for height and girth at breast height. In 1975, a ring was painted around each tree at the point of girth measurement to increase the accuracy of growth measurements. At five-year intervals (1970-71, 1975-76, 1980-81, 1985-86), the Sarawak Forest Department has remeasured these trees for girth.

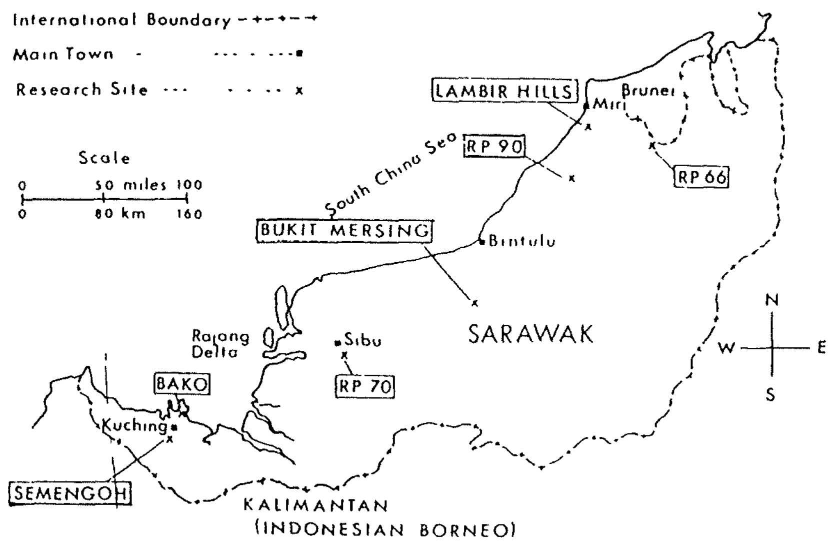


Figure 1. Localities of field sites in Sarawak

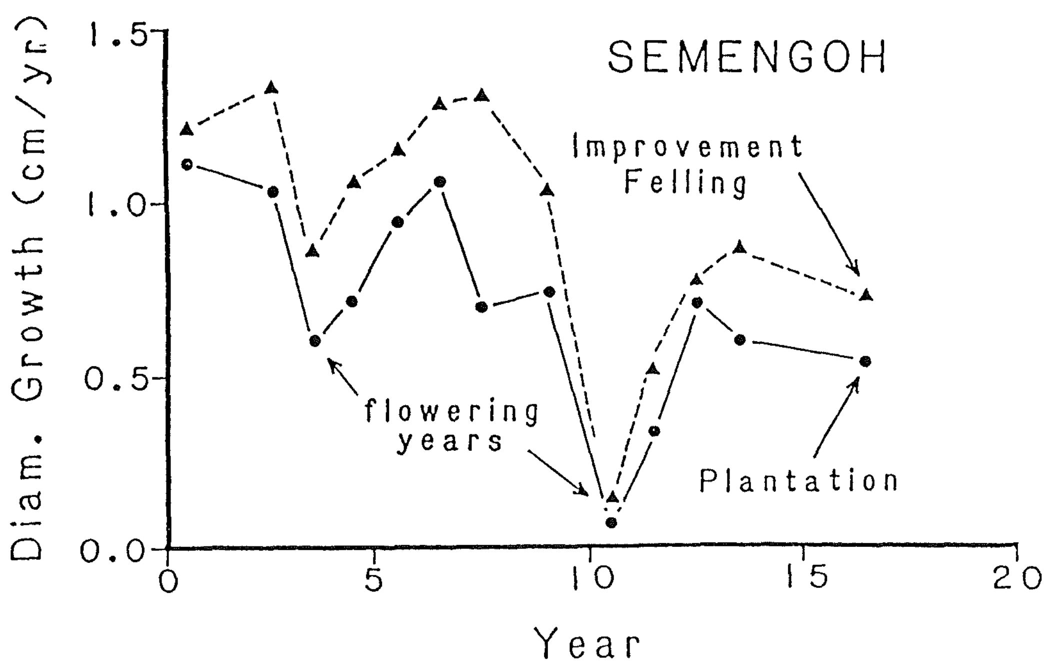


Figure 2. Mean growth rates of engkabang (*Shorea splendida*) in a plantation and a primary forest at Semengoh Forest over a nineteen-year period beginning in 1936

Table 1. Summary of characteristics of the three primary forest research sites in Sarawak, East Malaysia from Ashton (1973) and Baillee (1978) (Extensive site descriptions, including detailed soil descriptions, physiognomy, environmental monitoring and species lists, are contained in these documents)

Characteristic	Bako	Lambir	Mersing
Mean mineral soil characteristics at 22cm*			
pH	4.5	4.2	5.1
P	31	83	1325
Ca	112	160	1717
Mg	Ca.100	715	4692
Fe + A1	1.1	5.1	35
K	700	2502	5292
Soil type	Podsolic	Sandy loam	latosolic loam
Humus layer	Ca. 15 cm deep	intermediate	patchy
Canopy height+	30-40 cm	50 m	60 m
Canopy structure of mature phase	Even, many subcanopy trees	Irregular	Even
Number of hectares	2.4	2.4	3
Total number of trees	2083	1962	1628
Volume of trees (m^3)	419	895	928
Number of tree species	354	437	246
Nature of gap formation	Death of standing individuals	Uprooting of emergents	Uprooting of emergents
Relative Frequency of environmental perturbations	Moderate	High	Low

* Mean based on 12 samples. Nutrients expressed as total parts per million following the methods developed for high weathered Borneo soils by Bailey (1967). Nitrogen was also sampled extensively but was found to be so variable within a site and so variable over time that it was not considered a useful indicator of comparative soil fertility. Within the next two years, Dr. I. Baillie, is planning to re-survey the soils of these three forests using current methods.

\+ The canopy height refers to the approximate height of most canopy trees. The actual canopv layer is uneven with gaps between trees and occasional emergent trees which are higher than the other trees.

Table 2. Annual diameter increments (cm/year) for trees at three contrasting forests (Values reported are mean, standard deviation and sample size for genera having a sample size of at least 10 individuals. For each genus having at least 20 trees, the mean growth rate of the five fastest growing trees is also presented)

	Bako				Lambir				Mersing			
	x	s.d.	N	fast trees	x	s.d.	N	fast trees	x	s.d.	N	fast trees
All dipterocarps	0.30	0.26	385	---	0.23	0.20	374	---	0.41	0.40	279	---
Cotylelobium	0.20	0.12	62	0.45	----	----	---	---	----	----	---	---
Dipterocarpus	----	----	---	----	0.16	0.12	66	0.40	0.29	0.28	60	0.67
Dryobalanops	0.47	0.29	70	1.02	0.30	0.17	28	0.58	0.36	0.30	106	1.10
Hopea	0.30	0.18	65	0.69	----	----	---	----	0.38	0.48	60	0.82
Parashorea	----	----	---	----	----	----	---	----	0.54	0.48	12	----
Shorea	0.26	0.30	136	0.96	0.25	0.20	218	0.80	0.67	0.53	41	1.10
Vatica	0.23	0.20	39	0.62	0.14	0.13	47	0.42	----	----	---	----

Table 3. Annual diameter increments (cm/year) of individual Shorea species at three primary forests over a 15 year period (Values presented are the mean, standard deviation, and sample size)

Timber	Bako				Lambir				Mersing			
	Species	x	s.d.	N	Species	x	s.d.	N	Species	x	s.d.	N
Red meranti	S. beccariana	0.42	0.34	18	S. acuta	0.24	0.18	32	S. roxburghii	0.42	0.32	10
					S. beccariana	0.21	0.14	38				
					S. kunstleri	0.14	0.10	11				
					S. macroptera	0.16	0.21	10				
					S. ovata	0.30	0.29	11				
					S. rubella	0.40	0.24	11				
					S. smithiana	0.31	0.26	12				
Yellow meranti	S. cuspidata	0.13	0.14	33	S. laxa	0.29	0.13	26	S. hopeifolia	0.82	0.69	17
Selangan batu	S. falcifera	0.32	0.43	33								

Table 4. Diameters (cm) and annual diameter increments (cm/year) for the fastest growing three individuals at each primary forest sites

Forest		Diameter (cm) 1965	Annual Diameter Increments (cm/year) 1965-70	1970-85	1975-80
Bako	Shorea scaberrima	31.9	1.1	1.0	1.2
	Dryobalanops beccarii	20.8	2.3	0.7	0.8
	Shorea beccariana	51.9	1.6	1.0	1.1
Lambir	Shorea fallax	68.8	1.1	0.7	1.1
	Hopea beccariana	53.5	0.6	0.7	0.8
	Parashorea smythiesii	62.3	1.4	1.1	2.9
Mersing	Dryobalanops lanceolata	33.5	1.1	1.2	2.0
	Parashorea macrophylla	52.9	1.6	1.6	1.3
	Shorea hopeifolia	36.8	1.3	1.4	2.0

Table 5. Mean annual diameter increment (cm/year) of six common species by size class (diameter at breast height) (Data presented are mean, standard deviation, sample size, and percent distribution in each size class)

Forest	Species	DBH (cm)	x	s.d.	N	% in each size class
Bako	Cotylelobium melanoxylon	10-19	0.19	0.11	41	73
		20-29	0.23	0.14	11	20
		30-39	0.23	0.06	3	5
		>40	0.21	0.00	1	2
	Dryobalanops beccarii	10-19	0.29	0.19	31	44
		20-29	0.58	0.31	25	36
		30-39	0.61	0.14	9	13
		>40	0.80	0.20	5	7
Lambir	Dipterocarpus globosus	10-19	0.07	0.06	18	31
		20-29	0.17	0.10	11	19
		30-39	0.17	0.08	5	9
		>40	0.23	0.12	24	41
Mersing	Dipterocarpus caudiferus	10-19	0.16	0.10	10	17
		20-29	0.26	0.10	9	16
		30-39	0.24	0.20	6	10
		>40	0.36	0.35	33	57
	Dryobalanops lanceolata	10-19	0.18	0.19	33	31
		20-29	0.30	0.18	17	16
		30-39	0.53	0.40	13	12
		>40	0.48	0.31	43	41
	Hopea andersoni	10-19	0.06	0.30	17	30
		20-29	0.38	0.35	9	16
		30-39	0.35	0.21	4	7
		>40	0.60	0.55	26	46

Table 6. Annual diameter increments (cm/year) of dipterocarp species given an Improvement Felling. Data is also presented for a plantation (Data given are mean initial tree diameter in cm [mean ± standard deviation], mean annual diameter increment, sample size, number of year of the study, and the maximum growth rate [based on the five fastest growing trees])

Species	Silvicultural type		Initial size	Mean growth rate	N	#Years	Max.
Shorea macroptera	red meranti	Nyabau Forest, Bintulu	16.0 ± 8.3	0.28	49	5	0.63
Shorea splendida	red meranti	Semengoh Forest, Kuching[1]	1.1 ± 0.4	0.68	36	19	1.16
Shorea splendida	red meranti	Semengoh Forest, Kuching	20.7 ± 10.5	0.93	31	19	1.51
Shorea parvifolia	red meranti	Selang, Kuching	20.6 ± 13.0	0.43	32	11	0.97
Shorea sp.	red meranti	Semengoh Forest, Kuching	32.9 ± 12.9	0.52	15	20	0.76
Shorea multiflora	yellow meranti	Semengoh Forest, Kuching	27.1 ± 8.4	0.21	10	20	0.28
Shorea scrobiculata	selangan batu	Nyabau Forest, Bintulu	27.8 ± 14.6	0.16	36	5	0.34
Dryobalanops beccarii	kapur	Selang, Kuching	14.7 ± 10.9	0.47	54	11	0.92
Dryobalanops beccarii	kapur	Gunung Ngili, Sadong	6.7 ± 9.1	0.67	12	21	0.96
Dryobalanops oblongifolia	kapur	Gunung Ngili, Sadong	7.6 ± 3.5	0.60	23	21	0.81
Dryobanalops rappa	kapur	Setapok Forest, Kuching[2]	4.3 ± 2.2	0.87	17	19	0.23
Dipterocarpus rigidus	keruing	Nyabau Forest, Bintulu	49.2 ± 18.6	0.27	40	5	0.65
Vatica sp.	resak	Semengoh Forest, Kuching	26.9 ± 8.4	0.22	18	20	0.28

[1] Plantation Forest [2] Peat Swamp Forest

Table 7. The mean annual diameter increment for the minimal, maximal and median growth rates (cm/year) of <u>Shorea</u> species for primary forests*, Improvement Felling primary forests+ and plantations

Mean annual diameter increment (cm/year)	Primary Forest (spp. beneath)	Improvement Felling Primary Forest (spp. beneath)	Plantation (spp. beneath)
Minimum	0.13 *S. cuspidata*	0.16 *S. scrobiculata*	0.80 *S. pinanga*
Maximum	0.82 *S. hopeifolia*	0.93 *S. splendida*	1.22 *S. macrophylla*
Median	0.30 *S. ovata*	0.43 *S. parvifolia*	0.86 *S. splendida*

* Data from Primack et al., a. + data from Primack et al., b.

Table 8. Mean diameter increments (cm/year) of reserve <u>Shorea</u> trees at four selectively logged forests, R.P. 68A, R.P. 90, R.P. 102 and R.P. 106, that have been left as controls or given additional silvicultural treatment (from Chai 1984, 1985)

	RP 68A	RP 90	RP 102	RP 106
Control	0.87	0.72	0.56	0.52
Removal of Relicts:	-	0.90	-	0.88
Liberation Thinning:				
Light	-	1.23	-	-
Medium	-	1.20	1.18	-
Heavy	-	0.98	1.23	1.12
Modified Malaysian Uniform System:				
Light	1.14	-	1.52	1.23
Medium	0.99	-	-	-
Heavy	1.11	-	1.21	-

Table 9. Summary of plantation data on <u>Shorea</u> species growing at Semengoh Plantation Reserve (Listed are plot number and species, number of stems per hectare, decimal year of plot establishment, decimal year of last assessment, decimal age of last assessment, sample size (number of trees measured), mean annual diameter increment (MADI) from establishment to the last assessment, average diameter at the last assessment for all of the trees, the five largest trees and the five smallest trees, and the basal area of trees (m^2/ha) at the date of last assessment. The average growth rate for each size category of trees can be obtained by dividing average diameter by their decimal age)

Plot	Species	No. of stems per ha	Deci. yr. of Estab.	Deci. yr. last Assessm.	Deci. age last Assessm.	Sample size	MADI (cm)	Establishment to last Assessment: Overall	5 largest	5 smallest	Basal Area (m^2/ha)
4B	*S. splendida*	272.7	1926.25	1974.87	48.62	30	0.72	34.86	45.54	25.24	26.03
9	*S. splendida*	88.8	1936.88	1973.88	37.00	120	0.86	31.62	51.60	19.60	6.97
13	*S. splendida*	137.0	1940.50	1974.86	34.36	111	1.01	34.75	50.42	21.17	12.99
4C	*S. hemsleyana*	40.2	1935.50	1974.87	39.37	85	0.83	32.71	45.59	22.94	3.38
5C	*S. pinanga*	119.8	1935.50	1974.87	39.37	96	0.80	31.35	48.99	19.21	9.25
7C	*S. macrophylla*	74.1	1936.29	1974.15	37.86	120	1.22	46.10	74.82	21.79	12.37
12	*S. palembanica*	76.5	1940.50	1974.86	34.36	60	0.95	32.56	48.44	38.62	6.37
14	*S. stenoptera*	139.2	1940.50	1974.87	34.37	132	0.87	29.78	40.47	19.67	9.70

出典

Prımack, R B , Ernest O.K., Chaı, S.S. Tan and H.S Lee (1989). Relatıve performance of dipterocarp trees in natural forest, managed forest, logged forest and plantation throughout Sarawak, East Malaysia Growth and yield in tropical mixed/moist forests (1989). Kuala lumpur, Malaysia.

天然林　アジア　マレーシア（5）（サバ）
プロット調査による伐採跡地と未開発林との林分構造解析。

データ採取地の立地環境

Table 1. Details of YS growth & yield plots

Particulars	Sandakan	Tawau
1. Forest reserve	Kuamut	Kalabakan
2. Status of forest land	Virgin	Logged
3. Location	Malubuk VJR	Block T4/84/B13A
4. Size of block (ha)00	212	1619
5. Elevation (m)	68-170	76-380
6. Land capability class	IV	IV
7. Soil association	Labau	Mawing/Lokan
8. Geology	Labang Formation	Kalabakan Formation
9. Parent material	Alluvium	Mudstone & Sandstone
10. Landform	Valley floor & terraces	Moderate to high hills
11. 10% Pre-F inventory (trees >60 cm dbh)	Not applicable	
a. trees/ha		19
b. volume/ha		
- gross		203m^3/ha
- net		122m^3/ha
c. dominant species		<u>Parashoreas</u> spp (white seraya)
12. Extraction (trees >60 cm dbh)	Not applicable	
a. trees/ha		11
b. volume/ha		79.85m^3/ha
c. dominant species		<u>Parashorea</u> spp (white seraya)
13. Preliminary closing inspection	Not applicable	
a. trees/ha		1
b. volume/ha		9.7m^3/ha
14. 5% Linear regeneration sampling	Not applicable	
a. stocking (10<60cm dbh size class)		37%
b. dominant class		<u>Dryobalanops</u> spp (Kapur)
c. trees/ha (>60cm dbh)		3.5
d. volume/ha (>60cm dbh)		
- gross		32m^3/ha
- net		19m^3/ha

Table 2. Details of plot layout and data collection

1. Plot size	100m x 100m	(1 ha)
- sub-plots	20m x 20m	(0.04 ha)
- quadrats	10m x 10m	(0.01 ha)
- sub-quadrats	2m x 2m	(0.000 ha)
2. Plot location	a. ridge top b. mid slope c. bottom valley	
3. Within every 10 x 10 m (chosen tree - 10<60 cm dbh & additional tree 10+ cm)	a. species b. diameter at breast height c. crown position - dominant (1) - codominant (2) - suppressed (3) d. crown form - very good (1) - good (2) - poor (3) - very poor (4)	
4. Within every 2m x 2m (up to 20 commercial seedlings <10cm dbh)	a. species b. height	

Table 3. Cost and mandays required for the establishment and remeasurement of YS-growth and yield plots

Measurement	Particular	Tawau	Sandakan
1st	a. Total mandays	218	282
	- mandays/plot	73	84
	b. Total cost	M$20,610.00	M$18,994.00
	-cost/plot	M$ 6,870.00	M$ 6,331.00
2nd	a. Total mandays	74	132
	- mandays/plot	25	44
	b. Total cost	M$ 8,757.00	M$ 9,784.00
	-cost/plot	M$ 2,919.00	M$ 3,261.00

Table 4. Summary of results from growth and yield plots

Particulars	Tawau (logged forest) Plot 1 (ridge top	Plot 2 (mid slope	Plot 3 (valley bottom	Mean	Sandakan (VJR) Plot 1 (ridge top	Plot 2 (mid slope	Plot 3 valley bottom	Mean
Stocking/ha	357	280	172	269	428	542	459	476
Basal area (m^2/ha)	16.09	11.87	10.23	12.73	60.75	95.72	79.34	78.60
Ave. annual diameter increment (cm) of all trees	0.36	0.71	0.71	0.56	0.99	0.60	0.59	0.71
Ingrowth (no. of trees)	12	7	12	10	20	21	9	16
% Mortality	0.28	0	0	0.09	1.17	1.29	1.31	1.26

Table 5. Details of ingrowth (number of trees) by size class in Sandakan and Tawau

LOCATION	PLOT	10<20	20<30	30<40	40<50	50<60	60<70	70<80	80<90	90<100	100<110	>110	TOTAL
Sandakan	1	0	10	3	4	0	0	0	2	1	0	0	20
(primary)	2	1	3	3	1	2	0	7	0	1	0	3	21
	3	1	4	4	0	0	0	0	0	0	0	0	9
	Total:	2	17	10	5	2	0	7	2	2	0	3	50
Tawau	1	5	3	1	1	2	0	0	0	0	0	0	12
(logged)	2	3	3	0	0	1	0	0	0	0	0	0	7
	3	3	3	3	1	0	1	0	1	0	0	0	12
	Total:	11	9	4	2	3	1	0	1	0	0	0	31

Table 6. Summary of mean diameter increment (cm) in Sandakan

MAIN SPECIES GROUP		PLOT 1 (ridge top)		PLOT 2 (mid-slope)		PLOT 3 (bottom valley)		TOTAL	
Vernacular name	Botanical name	No. of trees	Average Incre.	No of trees	Average Incre.	No. of trees	Average Incre.	No. of trees	Average Incre.
1. DIPTEROCARP SPP									
1.1 LHW									
Red Seraya	Rubroshorea spp.	53	1.78	52	0.88	86	0.91	191	1.19
White Seraya	Parashorea spp.	44	1.27	26	1.40	10	0.09	80	0.92
Yellow Seraya	Richetia spp.	21	1.34	16	0.49	7	0.55	44	0.79
Melapi	Anthoshorea spp.	2	1.30	1	0.10	1	0.38	4	0.59
Sub-total/mean		120	1.51	95	0.95	104	0.80	319	1.11
1.2 MHW									
Kapur	Dryobalanops spp.	16	0.88	13	0.57	5	0.50	34	0.65
Keruing	Dipterocarpus spp.	29	0.42	58	0.76	36	0.70	123	0.63
Sub-total/mean		45	0.58	71	0.73	41	0.68	157	0.67
1.3 HHW									
Sel. Batu	Shorea spp.	16	0.50	21	0.61	44	0.34	81	0.48
Resak	Vatica spp.	0	0.00	18	0.36	1	0.30	19	0.22
Sub-total/mean		16	0.50	39	0.49	45	0.34	100	0.43
TOTAL/MEAN DIPT		181	1.19	205	0.78	190	0.67	576	0.87
2. NON-DIPTEROCARP SPP									
2.1 LHW									
Bintangor	Calophyllum spp.	0	0.00	0	0.00	0	0.00	0	0.00
Medang	Lauraceae	0	0.00	0	0.00	1	0.60	1	0.20
Sepetir	Sindora irpicina	1	0.00	0	0.00	1	2.10	2	0.70
Pulai	Alstonia spp.	0	0.00	1	0.20	0	0.00	1	0.07
Bayur	Pterospermum spp.	3	1.58	0	0.00	1	0.00	4	0.53
Jelutong	Dyera spp.	4	0.80	0	0.00	0	0.00	4	0.27
Kayu Malam	Diospyros spp.	10	0.45	3	0.67	5	0.34	18	0.49
Durian	Durio spp.	0	0.00	0	0.00	2	0.40	2	0.13
Karai-Karai	Mezzettia leptopoda	1	0.50	2	0.00	3	0.15	6	0.22
Kembang Semangkok	Scaphium affine	0	0.00	1	1.00	0	0.00	1	0.33
Nyatoh	Sapotaceae	0	0.00	2	0.60	0	0.00	2	0.20
Pisang-Pisang	Annonaceae	1	0.50	5	0.31	5	0.15	11	0.32
Ramin	Gonystylus bancanus	2	0.00	0	0.00	1	0.30	2	0.10
Simpoh	Dilleniaceae	9	0.71	0	0.00	1	0.00	10	0.24
Sengkuang	Dracontomelon puberulum	1	0.70	0	0.00	0	0.00	1	0.23
Takalis	Pentace spp.	1	0.50	2	0.70	14	0.94	17	0.71
Kedondong	Burseraceae	1	0.30	5	0.47	0	0.00	6	0.26
Sub-total/mean		34	0.63	21	0.46	34	0.58	89	0.57

2.2 MHW									
Mengaris	*Koompassia excelsa*	1	0.50	0	0.00	0	0.00	1	0.17
Terentang	*Campnosperma auriculata*	2	0.25	4	0.33	2	0.70	8	0.43
Perupok	Celastraceae	0	0.00	1	0.80	0	0.00	1	0.27
Bawang Hutan	*Scorodocarpus borneensis*	0	0.00	2	1.00	2	0.55	4	0.52
Kembang	*Heritiera simplicifolia*	2	4.40	6	1.38	1	0.50	9	2.09
Obah	*Eugenia* spp.	3	1.10	4	0.25	13	0.62	20	0.66
Ranggu	*Koordersiodendron pinnatum*	0	0.00	4	0.65	0	0.00	4	0.22
Rengas	Anacardiaceae	1	1.70	1	0.10	0	0.00	2	0.60
Sub-total/mean		9	1.64	22	0.73	18	0.61	49	0.86
2.3 HHW									
Keranji	*Santiria laevigata*	0	0.00	1	0.80	0	0.00	1	0.80
Belian	*Eusideroxylon zwageri*	7	0.87	2	0.95	3	0.10	12	0.69
Sub-total/mean		7	0.87	3	0.90	3	0.10	13	0.70
TOTAL/MEAN NON-DIPT		50	0.84	46	0.62	55	0.57	151	0.68
3. OTHERS		197	0.85	291	0.46	214	0.53	702	0.50
4 TOTAL/MEAN ALL SPP		428	0.99	542	0.60	459	0.59	1429	0.71

Table 7. Summary of mean diameter increment (cm) in Tawau

MAIN SPECIES GROUP		PLOT 1 (ridge top)		PLOT 2 (mid-slope)		PLOT 3 (bottom valley)		TOTAL	
Vernacular name	Botanical name	No. of trees	Average Incre.	No of trees	Average Incre.	No. of trees	Average Incre.	No. of trees	Average Incre.
1. DIPTEROCARP SPP									
1.1 LHW									
Red Seraya	*Shorea* spp	19	0.69	6	1.28	6	0.54	31	0.77
White Seraya	*Parashorea* spp.	17	0.49	31	0.88	15	0.97	63	0.79
Yellow Seraya	*Shorea* spp.	2	0.31	9	1.36	2	0.05	13	1.00
Melapi	*Anthoshorea* spp.	4	0.06	1	0.97	1	0.38	5	0.93
Sub-total/mean		42	0.63	47	1.02	24	0.76	113	0.82
1.2 MHW									
Kapur	*Dryobalanops* spp.	13	0.35	38	0.75	23	0.69	74	0.66
Keruing	*Dipterocarpus* spp.	2	0.91	4	0.40	19	0.57	25	0.57
Sub-total/mean		15	0.42	42	0.72	42	0.64	99	0.64
1.3 HHW									
Sel. Batu	*Shorea* spp.	5	0.48	2	0.35	0	0.00	7	0.45
Resak	*Vatica* spp.	0	0.00	2	0.60	0	0.00	2	0.60
Sub-total/mean		5	0.48	4	0.47	0	0.00	9	0.48
TOTAL/MEAN DIPT		62	0.57	93	0.86	66	0.68	221	0.73

2. NON-DIPTEROCARP SPP									
2.1 LHW									
Bintangoh	Calophyllum spp.	0	0.00	1	0.20	0	0.00	1	0.20
Magas	Duabanga moluccana	0	0.00	0	0.00	2	0.00	2	0.00
Kayu Malam	Diospyros spp.	6	0.25	0	0.00	3	0.32	9	0.27
Binuang	Octomeles sumatrana	0	0.00	0	0.00	5	1.79	5	1.79
Sepetir	Sindora irpicina	0	0.00	0	0.00	1	0.48	1	0.48
Medang	Lauraceae	0	0.00	5	0.00	2	1.81	2	1.81
Darah-Darah	Horsfeldia spp.	10	0.56	1	0.94	2	0.53	17	0.67
Durian	Durio spp.	2	0.30	2	0.50	0	0.00	3	0.37
Karai	Mezzetia leptopoda	2	0.00	7	0.35	0	0.00	4	0.18
Laran	Anthocephalus chinensis	0	0.00	7	3.71	7	2.08	14	2.90
Nyatoh	Sapotaceae	12	0.42	5	0.37	3	0.19	22	0.37
Pisang-Pisang	Annonaceae	0	0.00	2	0.37	1	0.48	6	0.39
Ramin	Gonystylus bancanus	4	0.18	1	0.69	1	0.38	7	0.35
Simpoh	Dilleniaceae	0	0.00	1	0.10	1	0.19	2	0.15
Terap	Parartocarpus spp.	4	0.38	2	0.00	1	0.00	6	0.25
Kedondong	Burseraceae	0	0.00		0.74	5	0.53	7	0.59
Sub-total/mean		40	0.37	34	1.16	34	1.00	108	0.82
2.2 MHW									
Obah	Eugenia spp.	2	0.05	5	0.38	0	0.00	7	0.28
Perupok	Celastraceae	1	0.10	0	0.00	0	0.00	1	0.10
Mempening	Quercus spp.	2	0.31	0	0.00	0	0.00	2	0.31
Kembang	Heritiera simplicifolia	4	0.46	0	0.00	1	0.29	5	0.42
Ranggu	Koordersiodendron pinnatum	1	0.10	1	1.65	0	0.00	2	0.88
Rengas	Melanorrhoea wallichii	9	0.25	4	0.52	2	1.05	15	0.43
Sub-total/mean		19	0.26	10	0.56	3	0.79	32	0.40
2.3 HHW									
Belian	Eusideroxylon zwageri	4	0.81	17	0.19	7	0.46	28	0.35
Merbau	Intsia palembanica	1	0.00	0	0.00	0	0.00	1	0.00
Sub-total/mean		5	0.65	17	0.19	7	0.46	29	0.33
TOTAL/MEAN NON-DIPT		64	0.36	61	0.79	44	0.90	169	0.66
3. OTHERS		231	0.32	126	0.58	62	0.61	419	0.43
4 TOTAL/MEAN ALL SPP		357	0.37	280	0.71	172	0.71	809	0.56

出典

Chiew, K Y. and A. Garcia (1989). Growth and yield studies in Yayasan Sabah forest concession area Growth and yield in tropical mixed/moist forests (1989) Kuala lumpur, Malaysia

天然林　アジア　　マレーシア　（6）（半島マレーシア）

伐採の程度と関連づけ、フタバガキ科グループと非フタバガキ科グループの森林タイプ別、直径階等にグループ区分した天然林の成長。

データ採取地の立地環境

Table 1. Summary of background information on growth and yield study areas in Peninsular Malaysia

STUDY AREA	LOCATION	TOPOGRAPHY	TYPE OF VEGETATION	HISTORY	NO. OF MEASURE-MENTS
Gunung Tebu Forest Reserve Bukit Bintang Terengganu	District: Besut Compartment: 4, 5, 6 Situated next to the trunk road from Kuala Terengganu to Jerteh	Elevation between 15m and 340 m. Slopes get steeper towards western side, where Bukit Bintang 543 m is located.	Good quality forest, mainly of Diptero-carps spp., pole-sized trees of emergent species are also present with young seed-lings evenly distributed.	*Pre F 1973 Set up 1974	9
Labis Forest Reserve, Segamat, Johor Darul Takzim.	District: Segamat Compartment: 142 and 144, 7.2 km north-east from Bekok, and 18.4 km south-east from Labis, Johore.	Elevation between 92 m to 396 m. Slopes get steeper towards the north-eastern boundary but gentle over the greater part of the area.	All spp. of vegeta-tion; form residual trees, pole-sized advance growth, saplings, seedlings and regeneration.	Pre F 1976 Set up 1977	8

Table 2. Types of treatment and replications of the major cutting limits

Location	Type of Treatment (cutting limits)	No. of replications
Gunung Tebu Forest Reserve, Bukit Bintang, Terengganu	A. Cut all tree dbh 15" (38 cm) and above	3
	B. Cut all non-meranti dbh 15" (38 cm) and above Cut all meranti dbh 18" (46 cm) and above	3
Tekam Forest Reserve, Jerantut, Pahang Darul Makmur	C. Cut all trees dbh 18" (46 cm) and above	3
	D. Cut all non-meranti dbh 18" (46 cm) and above Cut all meranti dbh 21" (53 cm) and above	3
	E. Cut all trees dbh 21" (53 cm) and above	3
Labis Forest Reserve, Segamat, Johor Darul Takzim	F. Cut all trees according to normal practices	3
	G. Cut all trees dbh 12" (30 cm) and above	) Not repli-
	H. Cut all non-meranti dbh 12" (30 cm) and above	) cated. For

	Cut all meranti dbh 15" (38 cm) and above	) demonstration
I.	Cut all trees dbh 24" (61 cm) and above	) purposes.
J.	Unharvested (control)	)

Table 3. Summary of area, plot size and number of plots

	Study area	Area (ha)	Plot Size	Total No. of plots
1.	Area Tebu Forest Reserve, Bukit Bintang, Terengganu.	153.8	80 m x 80 m	21
2.	Tekam Forest Reserve, Jerantut, Pahang Darul Makmur.	161.9	80 m x 80 m	21
3.	Labis Forest Reserve, Segamat, Johor Darul Takzim	145.8	80 m x 80 m	21

成長・収穫に関する表，図，式など

Table 4. Summary of results from the growth and yield study area at Gunung Tebu Forest Reserve, Terengganu Darul Iman

I) Diameter growth in cm/year

A) By diameter class

i)	10 - 20 cm	0.41
ii)	20 - 30 cm	0.47
iii)	30 - 40 cm	0.51
iv)	40 - 50 cm	0.61
v)	50 - 60 cm	0.83
vi)	60 - 70 cm	0.60
vii)	70+ cm	0.77

B) By species group

i)	Dipterocarp meranti	0.66
ii)	Dipterocarp non-meranti	0.64
iii)	Non-dipterocarp light hardwood species	0.49
iv)	Non-dipterocarp medium hardwood species	0.45
v)	Non-dipterocarp heavy hardwood species/miscellaneous	0.45
vi)	All species	0.48

II) Basal area growth in m^2/year/tree

i) Dipterocarp meranti	0.0035
ii) Dipterocarp non-meranti	0.0034
iii) Non-dipterocarp	0.0020

III) Mean annual mortality percent:

i) All trees 5 cm dbh and above	6.4%
ii) All trees 10 cm dbh and above	4.9%
iii) Dipterocarp meranti	6.8%
iv) Dipterocarp non-meranti	3.2%
v) Non-dipterocarp	4.8%

IV) Mean annual ingrowth percent:
(of all trees growing-in over 10 cm dbh limit) 0.93%

V) Logging Damage

A) Stem damage for trees above 5 cm dbh

i) Low logging intensity (remove <40% initial basal area(BA))	13.4%
ii) Moderate logging intensity (remove 40-55% initial BA)	21.4%
iii) High logging intensity (remove >55% initial BA)	23.2%

B) Crown damage for trees above 5 cm dbh

i) Low logging intensity	19.5%
ii) Moderate logging intensity	30.3%
iii) High logging intensity	31.8%

Table 5. Summary of results from the growth and yield study area at Labis Forest Reserve, Johor Darul Takzim

I) Diameter Growth in cm/year

A) For trees below 10 cm dbh

i) Dipterocarp meranti	0.26
ii) Dipterocarp non-meranti	0.16
iii) Non-dipterocarp light hardwood species	0.41
iv) Non-dipterocarp medium hardwood species	0.27
v) Non-dipterocarp heavy hardwood species	0.37
vi) All species	0.33

B) For trees 10 cm dbh and above

i) All dipterocarp	0.85
ii) Non-dipterocarp light hardwood species	0.72
iii) Non-dipterocarp medium hardwood species	0.65
iv) Non-dipterocarp heavy hardwood species	0.61
v) All non-dipterocarp	0.67
vi) All species	0.69

Table 6. Summary of results from the continuous inventory sample plots and experimental cutting/silvicultural treatment blocks (for trees above 30 cm dbh)

(i) Diameter growth in cm/year:	
(a) All marketable species	0.80
(b) Dark/light red meranti	1.05
(c) Medium-heavy marketable species	0,75
(d) Light non-meranti marketable species	0.80
(e) Non-marketable species	0.75
(ii) Gross volume growth in m^3/ha/year:	
(a) All marketable species	2.20
(b) All species	2.75
(iii) Gross volume growth percent:	
(a) All marketable species	2.1%
(b) All species	1.9%
(iv) Annual mortality percent: (of numbers of marketable species)	0.9%
(v) Annual ingrowth percent: (of marketable species growing-in over 30 cm dbh limit)	0.6%

出典

Thang, H.C. and T.K Yong (1989) Status of growth and yield studies in Peninsular Malaysia. Growth and yield in tropical mixed/moist forests (1989). Kuala lumpur, Malaysia.

データ採取地の立地環境

THE STUDY AREA

The forest area under study is located within compartments 142 and 144 of Labis Forest Reserve in the State of Johor, Peninsula Malaysia (Map 1). The experimental area covers 145.8ha. of rich dipterocarp forest on hilly and rugged terrain with elevations ranging from about 100m to 500m a.s.l. Before the compartments were made part of the forest management study area no logging activity had been carried out.

METHODS

Inventory

The grouping of the treatment plot into replications for purposes of future statistical analyses was based on the results of a pre-felling inventory carried out before felling in the experimental area as well as on the similarity of the forests and site conditions. Table 1 describes the 6 (six) major treatments (cutting limits) used in the experiment, each having three replications. For demonstrational and reference purposes only, three more extreme treatments were included without replications. This made it 21 treatment (cutting) blocks altogether in the study. Following the allocation of the treatments to be applied to each of the 21 cutting blocks, all trees to be cut as specified by the treatment limits, were located, marked and listed.

Felling of Trees

Marked trees were felled and extracted to the roadside landings. During logging operations, the felling of the marked trees was monitored closely and record was made of the dimensions of the felled stem, including tree number, diameter of top-end and diameter of decayed wood, log length as well as other notes and observations on tree or stem section.

Permanent Sample Plots

Immediately after the completion of all logging operations, permanent sample plots were laid out in the centre of each felling block. The plots measured 80m x 80m and consist of sixteen 20m x 20m units on which all residual trees were measured following certain guidelines and entered in the prescribed form.

Table 1. Details of the Treatments Used in the Experiment.

A: Replicated Treatments:

Treatment	Block No.	Specification for Cutting Limit.	Replication
1	5,11,21	Cut all trees DBH >37.5cm	3
2	6,10,13	Cut all non-merantis DBH >37.5cm and cut all merantis DBH >45.0cm	3
3	7,14,19	Cut all trees DBH >45.0cm	3
4	4,12,16	Cut all non-merantis DBH >45.0cm and cut all merantis DBH >52.5cm	3
5	3,8,15	Cut all trees DBH >52.5cm	3
6	2,17,18	Uncontrolled but cut all wanted trees DBH >45.0cm only	3

B: Unreplicated Treatments.

Treatment	Felling Block Nos.	Specification for Cutting Limit
7	9	Cut all trees >30.0cm DBH
8	1	Cut all non-merantis >30.0cm DBH, cut all merantis >37.5cm DBH
9	20	Cut all trees >60.0cm DBH.

成長・収穫に関する表，図，式など

Table 4. Periodic Mean Annual Incr. in Diameter of Trees <10.0cm DBH by Treatments After Felling. (4 annual growth period).

TREATMENT	Species Groups					
	MD	NMD	LHW	MHW	HHW	ALL SPP.
1	0.09	0.25	0.33	0.24	0.39	0.28
2	0.36	0.22	0.41	0.28	0.37	0.34
3	0.17	0.09	0.31	0.30	0.41	0.29
4	0.10	0.11	0.56	0.24	0.44	0.39
5	0.20	0.19	0.40	0.29	0.31	0.31
6	0.52	0.06	0.36	0.27	0.33	0.33
7	0.26	0.29	0.44	0.24	0.39	0.37
8	0.33	0.12	0.58	0.30	0.45	0.41
9	0.04	0.21	0.27	0.26	0.15	0.22
Treatment Average	0.26 (281)	0.16 (181)	0.41 (1017.3)	0.27 (913.2)	0.37 (520)	0.33 (2912.5)

MD: Meranti Dipterocarps, NMD: Nonmeranti Dipt., LHW: Light Hardwoods, MHW : Medium Hardwwods, HHW: Heavy Hardwoods.

Figures in Brackets Denote Sample Size.

Table 5. Periodic Mean Annual Increment in Diameter of Trees >10.0cm DBH by Treatments After Felling.

Treatment	Species Groups - dpmai, cm/yr					
	Dipt.	LHW	MHW	HHW	All ND.	All Sp.
1	0.96	0.73	0.68	0.69	0.69	0.71
2	1.09	0.83	0.76	0.65	0.75	0.79
3	0.82	0.74	0.71	0.71	0.72	0.73
4	0.83	0.79	0.63	0.71	0.72	0.73
5	0.84	0.68	0.62	0.54	0.63	0.65
6	0.77	0.52	0.58	0.49	0.54	0.57
7	1.11*	0.85	0.78	0.61*	0.79	0.81
8	1.35*	0.86	0.84	0.67*	0.83	0.86
9	0.43*	0.51	0.41	0.34	0.43	0.43
Avg.	0.85	0.72	0.65	0.61	0.67	0.69

*: Sample Size Less Than 30

出典

Field trip note : The growth and yield study plot in Labis Forest Reserve, Johor. Growth and yield in tropical mixed/moist forests (1988) Kuala Lumpur, Malaysia.

次ページの表の２０樹種のローカルネーム ／ 学名は下記の通り。

1. Nyatoh ／ *Palaquium maingayi*
2. Penaga ／ *Mesua ferrea*
3. Merawan ／ *Hopea intermedia*
4. Meranti Sarang Punai ／ *Shorea parvifolia*
5. Resak ／ *Shorea barbata*
6. Taban merah ／ *Palaquium gutta*
7. Seraya ／ *Shorea curtisii*
8. Kulim ／ *Scorodocarpus borneensis*
9. Bintangor ／ *Calophyllum wallichianum*
10. Meranti Pa'ang ／ *Shorea bracteolata*
11. Petaling ／ *Ochanosfachys amentacea*
12. Melantai ／ *Shorea macroptera*
13. Kapur ／ *Dryobalanops aromatica*
14. Nyatoh ／ *Palaquium rostratum*
15. Meranti Tembaga ／ *Shorea leprosula*
16. Jelutong ／ *Dyera* sp.
17. Chengal ／ *Neobalanocarpus heimii*
18. Kumus ／ *Shorea ciliata*
19. Meranti Rambai Daun ／ *Shorea acuminata*
20. Meranti Kepong ／ *Shorea sericea*

LIGHT DEMANDING & SHADE BEARING QUALITIES OF SPECIES MEASURED.

The suggestion is made that as the symbols *D* and *d* in one sense denote measures of light intensity, then the proportion of the increment for *d* trees to the increment for *D* trees would in some degree reflect the light demanding or shade bearing qualities of the species under consideration. The symbol *d*, however, is a very wide one, so far as degrees of light intensity go, moreover it is one which is liable to vary very considerably with the personal opinion of the officer using it. This method then, has not much to recommend it, but so very little is known on the subject, that the inclusion of the following table, (for what it is worth), appears justifiable.

Of the 20 species enumerated, number one is most shade bearing and number 20 most light demanding.

No.	Species	M.A.I.		Percentage *d* of *D*
		D Inches	*d* Inches	
1	Nyatoh (*P. Maingayi*)	59	49	83
2	Penaga	·40	31	78
3	Merawan	96	75	78
4	Meranti Sarang Punai	1 51	1 16	77
5	Resak	53	40	75
6	Taban Merah	1 55	1 15	74
7	Seraya	82	55	67
8	Kulim	37	·24	65
9	Bintangor (*C. Wallichianum*)	1 10	·69	63
10	Meranti Pa'ang	1 66	1·01	61
11	Petaling	48	·28	60
12	Melantai	1·08	·63	58
13	Kapur	1 45	·86	52
14	Nyatoh (*P. rostratum*)	1·04	53	51
15	Meranti Tembaga	1·55	76	49
16	Jelutong	1·41	·69	49
17	Chengal	·66	31	47
18	Kumus	81	38	47
19	Meranti Rambai Daun	1 62	69	43
20	Meranti Kepong	1 39	57	41

At first sight Meranti Sarang Punai seems completely out of place but it is significant that the remaining Merantis are on the light demanding side of the table.

Chengal, generally supposed to be a shade bearer, appears in the guise of a distinct light demander whilst Taban Merah, an accepted, and to a certain extent a known, shade bearer fills its correct place.

BINTANGOR—*Calophyllum wallichianum* Pl. and Tr.

Takes 66 years to reach 5 ft girth, and appears to put on its best increment after a girth of 4 ft. is reached Probably tolerant of shade. Measured in Selangor Sample Plots 3, 7 and 9, all in the Bangi Forest Reserve. Total measurements 291. M.A.I. all trees—all plots, ·89 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of D and Du trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins
0–12	44	93	$\frac{12}{93} = 13$	12	13	10 20	9 1— 5
12–24	97	80	$\frac{12}{80} = 15$	24	28	30 40	2— 2 2—11
24–36	32	95	$\frac{12}{.95} = 13$	36	41	50 60	3— 8 4— 4
36–48	11	84	$\frac{12}{84} = 14$	48	55	70 80	5— 1 6— 0
48–60	9 (d)	1 10	$\frac{12}{1.10} = 11$	60	66		
60–72	4 (d)	1 10	$\frac{12}{1\ 10} = 11$	72	77		

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) The smallest individual measured had a girth of 6·2 inches

(*c*) Individuals planted in belukar reached a height of only 63 in. in 3 years from seed.

(*d*) Too few measurements.

CHENGAL—*Neobalanocarpus heimii*. King.

Probably takes about 80 years to reach 5 ft. girth, whilst 7 ft. is reached at 120 years Seems slow in early youth but shows a good rate of growth after a girth of 2 ft. has been attained. Probably a distinct light demander. Measured in Negri Sembilan Sample Plot 3, Senaling Inas Forest Reserve; Pahang East Sample Plots 1 and 3 (blocks A and B) in Bukit Goh Forest Reserve; Pahang East Sample Plot 2 Baloh Forest Reserve; and Pahang West Sample Plot 1 Rotan Tunggal Forest Reserve Total measurements 5,370. M.A.I. all trees—all plots, ·40 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements.	M.A.I. of *D* and *Du* trees.	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0-12	358	.55	$\frac{12}{.55} = 22$	12	22	10	5
						20	10
12-24	64	.56	$\frac{12}{.56} = 21$	24	43	30	1— 4
						40	2— 0
24-36	22	.93	$\frac{12}{.93} = 13$	36	56	50	2— 8
						60	3— 4
36-48	13	94	$\frac{12}{.94} = 13$	48	69	70	4— 2
						80	4— 9
48-60	139	.67	$\frac{12}{.67} = 18$	60	87	90	5— 4
						100	5—10
60-72	110	82	$\frac{12}{.82} = 15$	72	102	110	6— 5
						120	7— 3
72-84	70	66	$\frac{12}{.66} = 18$	84	120		
over 84	48	53					

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) Owing to an insufficiency of data from "A" class plots, the figures for the last four girth classes are from "B" class plots.

(*c*) The smallest individual measured had a girth of 1.5 inches.

(*d*) The largest individual in recent forest planting had a height of 102 in. at 4 years from seed.

(*e*) Various individuals in the older forest planting have shown growth increments of as much as one inch in girth per year

KAPUR—*Dryobalanops aromatica* Gaertn. f

The fastest growing timber species other than Meranti. Takes 43 years to reach 5 ft. girth, and appears to continue to grow fast until 8 ft. or more. 7 ft. is reached at 66 years. A light demander. Measured in Selangor Sample Plots 1, 2, 11 and 32, all in the Kanching Forest Reserve. Total measurements 1,682. M.A.I. all trees—all plots, 1·34 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth.
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins
0-12	341	1 35	$\frac{12}{1.35} = 9$	12	9	10	1— 1
						20	2— 5
12-24	656	1 43	$\frac{12}{1.43} = 8$	24	17	30	3—10
						40	5— 0
24-36	212	1 71	$\frac{12}{1.71} = 7$	36	24	50	5—11
						60	6— 8
36-48	56	1 71	$\frac{12}{1.71} = 7$	48	31	70	7— 2
						80	7— 8
48 60	(b) 54	1 01	$\frac{12}{1.01} = 12$	60	43		
60-72	(b) 72	1 02	$\frac{12}{1.02} = 12$	72	55		
72-84	(b) 46	1 06	$\frac{12}{1.06} = 11$	84	66		
over 84	14	1 30					

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) Most of the measurements are from Sel S P 11 and are considered to be rather low (see page 34).

(*c*) The smallest individual measured had a girth of 3 0 inches.

(*d*) Sample plot 14 at Kanching showed an average height of 40·8 feet and an average girth of 12·9 inches at 13 years from seed. The largest plant had a girth of 23 inches

JELUTONG—*Dyera* sp.

Takes 46 years to reach 5 ft. girth, and 70 years to reach 7 ft. girth. A light demander. Measured in Selangor Sample Plots 3, 7 and 9, Bangi Forest Reserve; Selangor Sample Plots 26, 27, 28 and 29, Sungei Buloh Forest Reserve; and Negri Sembilan Sample Plot 2 Senawang Forest Reserve. Total measurements 1,459. M.A.I. all trees—all plots, 1·04 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0-12	195	.92	$\frac{12}{92} = 13$	12	13	10	8
						20	1— 8
12-24	187	1 26	$\frac{12}{1.26} = 10$	24	23	30	2—10
						40	4— 2
24-36	147	1.34	$\frac{12}{1\ 34} = 9$	36	32	50	5— 5
						60	6— 5
36-48	148	1 63	$\frac{12}{1.63} = 7$	48	39	70	7— 0
						80	7— 6
48-60	77	1 66	$\frac{12}{1\ 66} = 7$	60	46		
60-72	41	1 38	$\frac{12}{1.38} = 9$	72	55		
72-84	18	82	$\frac{12}{82} = 15$	84	70		
over 84	68	.85					

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) The smallest individual measured had a girth of 4 4 inches

(*c*) Some individuals planted in the open had a height of 16 ft. and a girth of 6 3 inches at 5 years from seed.

(*d*) Our two species of *Dyera* are not well understood and it remains uncertain whether more than one species has been included in the Sample Plots

Throughout these records it has been assumed that but one species was represented; but it remains uncertain whether that species is ***D. costulata*** or *D laxiflora*.

MERAWAN—*Hopea intermedia* King

Takes 68 years to reach 5 ft. girth and shows a remarkably even rate of growth throughout Probably a shade bearer. Total measurements 1,099. All from Selangor Sample Plot 10 Sungei Lallang Forest Reserve. M.A.I. all trees ·92 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
nches		inches		inches	years	years	Ft. ins
0-12	38	63	$\frac{12}{.63} = 19$	12	19	10	6
						20	1— 0
12-24	39	84	$\frac{12}{.84} = 14$	24	33	30	1—10
						40	2— 8
24-36	54	1 14	$\frac{12}{1.14} = 10$	36	43	50	3— 6
						60	4— 5
36-48	161	1 04	$\frac{12}{1\ 04} = 12$	48	55	70	5— 2
						80	5—11
48-60	164	94	$\frac{12}{94} = 13$	60	68	90	6— 8
						100	7— 3
60-72	223	93	$\frac{12}{93} = 13$	72	81		
72-84	197	91	$\frac{12}{.91} = 13$	84	94		
over 84	91	94					

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) The smallest individual measured had a girth of 4 9 inches

MERBAU—*Intsia bakeri.* Prain.

Takes 81 years to reach 5 ft. girth. Measured in Selangor Sample Plot 9 Bangi Forest Reserve; and Selangor Sample Plot 15 Sungei Lallang Forest Reserve. Total measurements 727. M.A.I. all trees—all plots, ·72 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	MAI of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0–12	(b) 4	.60	$\frac{12}{.60} = 20$	12	20	10	5
						20	1— 0
12–24	121	75	$\frac{12}{.75} = 16$	24	36	30	1— 6
						40	2— 3
24–36	98	92	$\frac{12}{.92} = 13$	36	49	50	3— 1
						60	3—10
36–48	128	.83	$\frac{12}{.83} = 14$	48	63	70	4— 6
						80	5— 1
48–60	141	.65	$\frac{12}{.65} = 18$	60	81	90	5— 7
						100	6— 1
60–72	60	81	$\frac{12}{.81} = 15$	72	96	110	6— 5
						120	6— 8
72–84	64	.42	$\frac{12}{.42} = 29$	84	125		
over 84	34	.47					

Notes:—(*a*) Nothing has been added for the time required for the establishment of the seedling.
(*b*) Too few measurements.
(*c*) The smallest individual measured had a girth of 11 inches.
(*d*) The largest individual planted in the nursery had a height of 13 ft. and a girth of 6 75 inches at 4 years from seed.

PENAGA—*Mesua ferrea.* L.

A very slow grower taking 141 years to reach 5 ft girth. Appears to be a shade bearer. Measured in Selangor Sample Plot 7, Bangi Forest Reserve; Selangor Sample Plot 12, Kuang Forest Reserve; Pahang East Sample Plot 1, Bukit Goh Forest Reserve, and Pahang East Sample Plot 2, Baloh Forest Reserve. Total measurements 1,171. M.A.I. all trees—all plots ·39 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	258	45	$\frac{12}{45} = 27$	12	27	10	4
						20	8
12–24	211	42	$\frac{12}{.42} = 29$	24	56	30	1— 0
						40	1— 6
24–36	135	.41	$\frac{12}{.41} = 29$	36	85	50	1—10
						60	2— 2
36–48	145	.42	$\frac{12}{.42} = 29$	48	114	70	2— 7
						80	3— 0
48–60	57	44	$\frac{12}{.44} = 27$	60	141	90	3— 4
						100	3— 8
60–72	30	31	$\frac{12}{31} = 39$	72	180	110	4— 0
						120	4— 4
72–84						130	4— 8
						140	5— 0
over 84						150	5— 3

Notes.—(*a*) Nothing has been added for the time required for the establishment of the seedling.
(*b*) The above figures are for all plots.
(*c*) The smallest individual measured had a girth of 3·2 inches
(*d*) Individuals planted in the open were 11 ft. high and 4 1 inches in girth at 4 years from seed.
(*e*) Certain individuals in the older forest planting have shown an average annual girth increment of one inch or more for more than ten years.

PETALING—*Ochanostachys amentacea*. Mast.

The slowest growing species measured in Malaya. Takes 153 years to reach 5 ft girth. The period of fastest growth appears to be between 1 ft and 2 ft. girth. The minimum felling girth (3 ft.) is reached at 73 years Is not tolerant of dense shade, but might grow on a double rotation under Meranti. Measured in Selangor Sample Plots 3 and 7, Bangi Forest Reserve; Pahang East Sample Plot 1, Bukit Goh Forest Reserve; and Pahang East Sample Plot 2 Baloh Forest Reserve Total measurements 1,587. M.A I all trees—all plots, ·47 in

Table V—Calculation of rate of growth in girth.
ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	438	39	$\frac{12}{39} = 31$	12	31	10	2
						20	6
12–24	543	63	$\frac{12}{63} = 19$	24	50	30	1— 0
						40	1— 5
24–36	161	53	$\frac{12}{53} = 23$	36	73	50	1—11
						60	2— 4
36–48	50	31	$\frac{12}{31} = 39$	48	112	70	2— 9
						80	3— 2
48–60	70	29	$\frac{12}{29} = 41$	60	153	90	3— 6
						100	3— 9
60–72	35	27	$\frac{12}{27} = 44$	72	197	110	4— 0
						120	4— 3
72–84	(b) 7	29	$\frac{12}{29} = 41$	84	238	130	4— 6
						140	4— 9
over 84						150	5— 0

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling

(*b*) Too few measurements

(*c*) The above figures are for all plots.

(*d*) The smallest individual measured had a girth of 2.5 inches.

(*e*) The largest individuals planted in belukar had a height of 42 in. at 3 years from seed.

TABAN MERAH—*Palaquium gutta*. Burck.

By far the fastest growing species in early life. Takes only 29 years to reach 4 ft. girth and 39 to reach 5 ft. After 6 ft. which is reached at 50 years, it would appear that growth falls off with great rapidity. A shade bearer. Measured in Selangor Sample Plot 3 Bangi Forest Reserve; Selangor Sample Plot 21 Rantau Panjang Forest Reserve; and Perak South Sample Plots 1 and 2 Trolak Forest Reserve. Total measurements 2,347. M.A.I. all trees—all plots, 1·53 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	33	1.65	$\frac{12}{1.65} = 7$	12	7	10	1—4
						20	2—10
12–24	329	1.77	$\frac{12}{1.77} = 7$	24	14	30	4—1
						40	5—2
24–36	823	1.68	$\frac{12}{1.68} = 7$	36	21	50	6—0
						60	6—5
36–48	542	1.47	$\frac{12}{1.47} = 8$	48	29		
48–60	167	1.27	$\frac{12}{1.27} = 10$	60	39		
60–72	(b) 7	1.11	$\frac{12}{1.11} = 11$	72	50		

Notes.—(*a*) Nothing has been added for the time required for the establishment of the seedling

(*b*) Too few measurements

(*c*) The smallest individual measured had a girth of 4 8 inches

(*d*) Certain individuals planted in the open were 13 ft. high at 4 years from seed.

NYATOH—*Palaquium maingayi*. K & G.

Probably takes over 100 years to reach 5 ft. girth. Very tolerant of shade. Measured in Selangor Sample Plots 3 and 7, Both in Bangi Forest Reserve Total measurements 333. M.A.I. all trees—all plots, 61 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0–12	75	1 62	$\frac{12}{62} = 19$	12	19	10 20	6 1— 1
12–24	110	72	$\frac{12}{.72} = 17$	24	36	30 40	1— 8 2— 3
24–36	64	57	$\frac{12}{57} = 21$	36	57	50 60	2— 8 3— 1
36–48	18	46	$\frac{12}{46} = 26$	48	83	70 80	3— 7 3—11
48–60						90	4— 3
						100	4— 8

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) The above figures are for all plots.

(*c*) The smallest individual measured had a girth of 5·7 inches.

NYATOH—*Palaquium rostratum.* Burck.

Reaches 5 ft. girth in 71 years. Measured only in Pahang East Sample Plot 2; data concerning this form incomplete. Total measurements 559. M.A.I. all trees—all plots, ·73 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth.	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	180	61	$\frac{12}{.61} = 20$	12	20	10 20	6 1— 0
12–24	111	1 01	$\frac{12}{1.01} = 12$	24	32	30 40	1— 9 2—11
24–36	39	1 23	$\frac{12}{1\ 23} = 9$	36	41	50 60	3—10 4— 6
36–48	24	1.01	$\frac{12}{1.01} = 12$	48	53	70 80	4—11 5— 4
48–60	11	.67	$\frac{12}{67} = 18$	60	71		

Notes:—(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) The above figures are for all plots

(*c*) The smallest individual measured had a girth of 3 2 inches.

KULIM—*Scorodocarpus borneensis* Becc.

A very slow grower, taking 149 years to reach 5 ft. girth. Growth appears uniform throughout. Measured in Pahang East Sample Plots 1 and 3 (Blocks A and B) Bukit Goh Forest Reserve Total measurements 2,092. M.A I. all trees—all plots, ·34 in.

Table V—Calculation of rate of growth in girth.
ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated.		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0-12	247	.40	$\frac{12}{.40} = 30$	12	30	10	4
						20	8
12-24	140	.45	$\frac{12}{.45} = 27$	24	57	30	1— 0
						40	1— 4
24-36	109	.41	$\frac{12}{.41} = 29$	36	86	50	1— 9
						60	2— 1
36-48	151	.43	$\frac{12}{.43} = 28$	48	114	70	2— 6
						80	2—10
48-60	183	.34	$\frac{12}{.34} = 35$	60	149	90	3— 2
						100	3— 6
60-72	95	39	$\frac{12}{.39} = 31$	72	180	110	3—10
						120	4— 2
72-84	21	.32	$\frac{12}{32} = 38$	84	218	130	4— 6
						140	4—10
over 84	6	20				150	5— 1

Notes:—(*a*) Nothing has been added for the time required for the establishment of the seedling.
(*b*) The smallest individual measured had a girth of 1·9 inches.
(*c*) Individuals planted in belukar had a height of 37 in at 3 years from seed

MERANTI RAMBAI DAUN—*Shorea acuminata.* Dyer

Like Kapur and Meranti Tembaga, takes 43 years to reach 5 ft. girth. A light demander. Measured in Selangor Sample Plot 7 Bangi Forest Reserve; and Negri Sembilan Sample Plot 2 Senawang Forest Reserve. Total measurements 510. M.A.I. all trees—all plots, 1·27 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M.A.I. of *D* and *Du* trees.	Number of years taken to pass through class	Rate of growth as calculated.		Rate of growth from curve	
				Girth	Age.	Age	Girth.
1 inches	2	3 inches	4	5 inches	6 years	7 years	8 Ft. ins.
0–12	137	1.15	$\frac{12}{1.15} = 10$	12	10	10	1— 0
						20	2— 1
12–24	183	1 24	$\frac{12}{1.24} = 10$	24	20	30	3— 5
						40	4—10
24–36	68	1.74	$\frac{12}{1.74} = 7$	36	27	50	6— 0
						60	7— 0
36–48	38	1.48	$\frac{12}{1.48} = 8$	48	35	70	7—10
						80	8— 2
48–60	(b) 15	1.42	$\frac{12}{1.42} = 8$	60	43		
60–72	(b) 2	2 65	$\frac{12}{2.65} = 5$	72	48		
72–84	(b) 1	1.40	$\frac{12}{1\ 40} = 9$	84	57		
over 84	10	1 63					

Notes·—(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) Too few measurements.

(*c*) The smallest individual measured had a girth of 6 inches.

(*d*) Some individuals planted in belukar reached a height of 19 in. in 1 year from seed.

RESAK—*Shorea barbata* Brandis.

A very few measurements in the 0—12 in. girth class show it to be a very slow grower in early youth, taking 50 years to reach 1 ft. girth. This can almost certainly be improved upon. 5 ft. girth is reached at 142 years. Probably a shade bearer. Measured only in Negri Sembilan Sample Plot 4, Senaling Inas Forest Reserve, from which plot 345 measurements are recorded. M.A.I. all trees ·47 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M.A.I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0-12	(b) 8	24	$\frac{12}{.24} = 50$	12	50	10	2
						20	4
12-24	72	.50	$\frac{12}{.50} = 24$	24	74	30	6
						40	10
24-36	58	50	$\frac{12}{50} = 24$	36	98	50	1— 1
						60	1— 6
36-48	22	61	$\frac{12}{61} = 20$	48	118	70	1—10
						80	2— 2
48-60	69	50	$\frac{12}{50} = 24$	60	142	90	2— 7
						100	3— 0
60-72	31	40	$\frac{12}{.40} = 30$	72	172	110	3— 6
						120	4— 0
72-84	10	46	$\frac{12}{.46} = 26$	84	198	130	4— 6
						140	5— 0
over 84						150	5— 6

Notes.—(*a*) Nothing has been added for the time required for the establishment of the seedling

(*b*) Too few measurements

(*c*) The smallest individual measured had a girth of 10 1 inches.

KUMUS—*Shorea ciliata* King.

Takes 88 years to reach 5 ft. girth. A light demander. Measured in Negri Sembilan Sample Plots 3 and 4, Senaling Inas Forest Reserve. Total measurements 460. M.A.I. all trees—all plots, ·68 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements.	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age.	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0–12	18	.61	$\frac{12}{.61} = 20$	12	20	10	5
						20	1— 0
12–24	71	.65	$\frac{12}{.65} = 18$	24	38	30	1— 6
						40	2— 1
24–36	69	.60	$\frac{12}{.60} = 20$	36	58	50	2— 8
						60	3— 3
36–48	67	.91	$\frac{12}{.91} = 13$	48	71	70	3—10
						80	4— 6
48–60	56	.72	$\frac{12}{.72} = 17$	60	88	90	5— 2
						100	5—11
60–72	41	.90	$\frac{12}{.90} = 13$	72	101	110	6— 6
						120	7— 1
72–84	24	80	$\frac{12}{.80} = 15$	84	116		
over 84	11	.68					

Notes:—(*a*) Nothing has been added for the time required for the establishment of the seedling

(*b*) The above figures are for all plots.

(*c*) The smallest individual measured was 6 inches in girth.

(*d*) The largest individuals in recent forest planting were only 13 in. high at 1 year from seed.

MERANTI PA'ANG—*Shorea bracteolata*. Dyer

At present appears Malaya's fastest growing timber species Takes 37 years to reach 5 ft girth Probably a light demander. Measured in Selangor Sample Plots 26, 27, 28 and 29 all in Sungei Buloh Forest Reserve Total measurements 549 M A I. all trees—all plots, 1·40 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0-12	22	1 60	$\frac{12}{1.60} = 8$	12	8	10	1— 2
						20	2— 7
12-24	92	1 59	$\frac{12}{1\ 59} = 8$	24	16	30	4— 0
						40	5— 4
24-36	81	1 67	$\frac{12}{1\ 67} = 7$	36	23	50	6— 6
						60	7— 0
36-48	67	1 66	$\frac{12}{1.66} = 7$	48	30		
48-60	53	1 70	$\frac{12}{1.70} = 7$	60	37		
60-72	29	1 50	$\frac{12}{1.50} = 8$	72	45		

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling

(*b*) The smallest individual measured had a girth of 6·5 inches.

(*c*) Individuals planted in the open and in belukar were only 4 6 inches girth and 102 inches in height at 4 years from seed.

SERAYA—*Shorea Curtisii* Dyer.

Takes 80 years to reach 5 ft. girth. Growth slow in youth. A probable shade bearer in youth Measured in Negri Sembilan Sample Plots 3 and 4 Senaling Inas Forest Reserve Total measurements 678. M.A.I. all trees—all plots, ·74 in.

Table V—Calculation of rate of growth in girth.
ALL STATES.

Girtl Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	16	55	$\frac{12}{55} = 22$	12	22	10	5
						20	10
12–24	100	71	$\frac{12}{71} = 17$	24	39	30	1— 4
						40	2— 0
24–36	140	88	$\frac{12}{88} = 14$	36	53	50	2— 9
						60	3— 6
36–48	83	80	$\frac{12}{.80} = 15$	48	68	70	4— 3
						80	5— 0
48–60	54	1 03	$\frac{12}{1\ 03} = 12$	60	80	90	5— 8
						100	6— 3
60–72	34	67	$\frac{12}{67} = 18$	72	98	110	6—10
						120	7— 2
72–84	47	82	$\frac{12}{.82} = 15$	84	113		
over 84	28	51					

Notes.—(*a*) Nothing has been added for the time required for the establishment of the seedling.
(*b*) The figures above are all from S.P N S. 4 a "B" class plot.
(*c*) The smallest individual measured had a girth of 6 1 inches
(*d*) The largest individual planted in belukar had a height of 74 in. at 2 years from seed.

MERANTI TEMBAGA—*Shorea leprosula*. Miq.

Further measurements may place this species higher in the table of fast growers. Takes 43 years to reach 5 ft., and appears to maintain a high rate of growth longer than most Merantis; 7 ft. is reached in 56 years. A light demander. Measured in Selangor Sample Plot 7 Bangi Forest Reserve; Selangor Sample Plots 26, 27, 28 and 29, Sungei Buloh Forest Reserve; Negri Sembilan Sample Plot 2 Senawang Forest Reserve; Negri Sembilan Sample Plot 6, Senaling Inas Forest Reserve; and Pahang East Sample Plot 2, Baloh Forest Reserve. Total measurements 1,388. M.A.I. all trees—all plots 1·28 in.

Table V—Calculation of rate of growth in girth.
ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft. ins.
0–12	119	1 14	$\frac{12}{1.14} = 11$	12	11	10	10
						20	2— 0
12–24	300	1 43	$\frac{12}{1\ 43} = 8$	24	19	30	3— 6
						40	4—10
24–36	182	1 54	$\frac{12}{1\ 54} = 8$	36	27	50	6— 1
						60	7— 0
36–48	157	1 52	$\frac{12}{1.52} = 8$	48	35	70	7— 8
						80	8— 0
48–60	135	1 49	$\frac{12}{1\ 49} = 8$	60	43		
60–72	48	1 70	$\frac{12}{1\ 70} = 7$	72	50		
72–84	12	1 99	$\frac{12}{1\ 99} = 6$	84	56		
over 84	11	1.27					

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.
(*b*) The smallest individual measured had a girth of 6·2 inches.
(*c*) Individuals planted in the open have reached a height of 21 ft. and a girth of 9 inches in 4 years from seed

MELANTAI-*Shorea macroptera.* Dyer

Takes 75 years to reach 5 ft girth, but there are indications that a faster rate of growth than this can be expected. Appears to be very slow in early life. Measured in Negri Sembilan Sample Plot 2, Senawang Forest Reserve; Pahang East Sample Plot 1, Bukit Goh Forest Reserve; and Pahang East Sample Plot 2 Baloh Forest Reserve. Total measurements 181. M.A.I. all trees—all plots, ·96 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1 inches	2	3 inches	4	5 inches	6 years	7 years	8 Ft. ins.
0–12	(c) 13	42	$\frac{12}{.42} = 29$	12	29	10	4
						20	8
12–24	24	93	$\frac{12}{.93} = 13$	24	42	30	1— 1
						40	1—10
24–36	60	.94	$\frac{12}{.94} = 13$	36	55	50	2— 8
						60	3— 8
36–48	30	1.46	$\frac{12}{1.46} = 8$	48	63	70	4— 8
						80	5— 6
48–60	(c) 9	1.04	$\frac{12}{1.04} = 12$	60	75	90	6— 2
						100	6— 8
60–72	(c) 6	1.00	$\frac{12}{1.00} = 12$	72	87		
72–84	—	—					
over 84	10	1.16					

Notes —(*a*) Nothing has been added for the time required for the establishment of the seedling.

(*b*) The above figures are for all plots.

(*c*) Too few measurements.

(*d*) The smallest individual measured had a girth of 8·3 inches.

(*e*) The largest individual planted in the open had a height of 138 in. and a girth of 5·5 inches at 4 years from seed.

MERANTI SARANG PUNAI—*Shorea parvifolia*. Dyer.

Another fast growing species. Takes 40 years to reach 5 ft girth. May be more of a shade bearer than is supposed. Measured in Selangor Sample Plot 7, Bangi Forest Reserve: Selangor Sample Plots 26, 27, 28 and 29, Sungei Buloh Forest Reserve; and Negri Sembilan Sample Plot 2, Senawang Forest Reserve. Total measurements 1,644. M.A.I. all trees—all plots. 1·33 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	259	1 27	$\frac{12}{1.27} = 9$	12	9	10	1— 0
						20	2— 4
12–24	424	1.43	$\frac{12}{1\ 43} = 8$	24	17	30	3—10
						40	5— 3
24–36	224	1 66	$\frac{12}{1\ 66} = 7$	36	24	50	6— 5
						60	7— 2
36–48	124	1 51	$\frac{12}{1\ 51} = 8$	48	32	70	7— 7
48–60	92	1 60	$\frac{12}{.\ 1.60} = 8$	60	40		
60–72	49	1 69	$\frac{12}{1.69} = 7$	72	47		
72–84	(b) 8	1 58	$\frac{12}{1.58} = 8$	84	55		

Notes.—(*a*) Nothing has been added for the time required for the establishment of the seedling.
(*b*) Too few measurements.
(*c*) The smallest individual measured had a girth of 5·9 inches.
(*d*) Some individuals planted in belukar had a height of 122 in. at 4 years from seed.

MERANTI KEPONG—*Shorea sericea.* Dyer.

The second fastest growing species. Takes 39 years to reach 5 ft. girth, but appears comparatively slow in early youth. A strong light demander. Measured in Selangor Sample Plots 26, 27, 28 and 29, Sungei Buloh Forest Reserve; and Pahang East Sample Plot 2, Baloh Forest Reserve. Total measurements 742. M.A.I. all trees—all plots, 1·16 in.

Table V—Calculation of rate of growth in girth.

ALL STATES.

Girth Class	Number of measurements	M A I of *D* and *Du* trees	Number of years taken to pass through class	Rate of growth as calculated		Rate of growth from curve	
				Girth	Age	Age	Girth
1	2	3	4	5	6	7	8
inches		inches		inches	years	years	Ft ins.
0–12	20	96	$\frac{12}{.96} = 13$	12	13	10	8
						20	2— 0
12–24	98	1 63	$\frac{12}{1.63} = 7$	24	20	30	3— 8
						40	5— 3
24–36	61	1 89	$\frac{12}{1\ 89} = 6$	36	26	50	6— 4
						60	6—10
36–48	61	1 75	$\frac{12}{1\ 75} = 7$	48	33		
48–60	75	1 95	$\frac{12}{1.95} = 6$	60	39		
60–72	18	2 08	$\frac{12}{2.08} = 6$	72	45		

Notes·—(*a*) Nothing has been added for the time required for the establishment of the seedling

(*b*) The smallest individual measured had a girth of 6·4 inches.

(*c*) The largest individuals planted in belukar were 120 inches high and had a girth of 2 inches at 4 years from seed

RATES OF GROWTH OF MALAYAN TREES COMPARED WITH THOSE OF OTHER COUNTRIES.

TREES OF OTHER COUNTRIES	COUNTRY	AUTHORITY	GIRTH Feet	AGE Years
Larch—*Larix europaea* -	England	Schlich	4	80
Scots Pine—*Pinus sylvestris* -	Scotland	Schlich	4½	100
Silver Fir—*Abies pectinata* -	Germany	Schlich	5	130
Oak—*Quercus* spp - -	Germany	Schlich	5	130
Beech—*Fagus sylvatica* -	Germany	Schlich	4	120
Hemlock—*Tsuga canadensis* -	U. S. A.	Woodward	4	95
Parashorea plicata - -	Philippines	Brown & Matthews	5	40
Pinus longifolia - - -	India	Troup	5	70
Dalbergia latifolia - -	India	Troup	5	120
Sal—*Shorea robusta* - -	United Provinces	Troup	5	92
Nahor—*Mesua ferrea* - -	Assam	Troup	5	70
Teak—*Tectona grandis* -	Burma	Troup	5	80
MALAYAN TREES				
Meranti Pa'ang—*Shorea bracteolata* -	Malaya		5	37
Kapur—*Dryobalanops aromatica* -	Malaya		5	43
Meranti Tembaga—*Shorea leprosula* -	Malaya		5	43
Jelutong—*Dyera* sp - -	Malaya		5	46
Merbau—*Intsia bakeri* - -	Malaya		5	81
Chengal—*Balanocarpus Heimii* -	Malaya		5	87
Resak—*Shorea barbata* -	Malaya		5	142

The figures for the European species are for first quality trees, whilst in the case of other countries the best available figures were selected. It will be seen that *chengal* and *merbau*, considered slow growers in this country, grow very much faster than oak on good sites in Europe, and are very little behind the best Burmese teak. The Philippine *Parashorea plicata* appears to grow at about the same rate as our own *meranti*.

SPECIMEN TABLE.

STATE—SELANGOR, DISTRICT—ULU LANGAT, RESERVE—BANGI, S. P. No. 9.

SPECIES—MERBAU.—*Intsia bakeri* Prain.

TABLE I—Calculation of mean annual girth increments (all trees)

Tree No.	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	REMARKS	INCREMENTS		
													Total	Num.	Mean Annual
													inches		inches
2	*D* 60.8				*D* 61.7	*D* 62.0	*D* 62.4	*D* 63 0	*D* 63.5	*D* 65 5	*D* 67.7		6 9	10	69
3	*D* 31.1	*D* 32.4	*D* 33.5	*D* 34.5	*D* 35.4	*D* 36.7	*D* 37.7	*D* 38 9	*D* 40.1	*D* 41.4	*D* 42.8		11 7	10	1 17
4	*Du* 18 9	*Du* 19 1	*Du* 20.1	*Du* 20.4	*d* 21 4	*Du* 22 1	*Du* 23 1	*Du* 23.8	*Du* 24 3	*d* 25.0	*Du* 25 9		7 0	10	70
5	*D* 21.5	*D* 22.0	*D* 23.4	*D* 24 2	*D* 24 9	*D* 25.7	*D* 26.8	*D* 27.3	*D* 27.8	*D* 29 0	*D* 29.9		8 4	10	84
6	*Du* 22.8	*Du* 23.2	*Du* 24.3	*Du* 25.7	*Du* 26.6	*Du* 27.5	*Du* 28.6	*Du* 29.3	*Du* 29.9	*d* 30.7	*Du* 31.7		8 9	10	.89
7	*Du* 20.1	*Du* 20.8	*Du* 21.4	*Du* 21.7	*Du* 22.3	*Du* 22.9	*Du* 23.6	*Du* 23.9	*Du* 24.2	*d* 24.8	*D* 25.5		5.4	10	.54
8	*d* 12 9	*d* 13 1	*Du* 13.7	*Du* 14.1	*Du* 14 3	*Du* 14 8	*Du* 15.7	*Du* 16 1	*Du* 16 5	(*s*) (16 9)	*d* 17 8	Calculated as *d*	4.9	10	.49
9	*d* 11.0	*Du* 11.5	*Du* 12.1	*Du* 12.6	*Du* 12.8	*D* 13.3	*D* 14 3						3.3	6	.55
10	*Du* 21 7	*Du* 21 9	*Du* 22 4	*Du* 23 0	*Du* 23 1	*Du* 23 3	*Du* 23 9	*Du* 24 5	*Du* 24.9	*d* 25 7	*D* 25 8		4.1	10	41
11	*Du* 20.9	*Du* 21.2	(*Du*) (22.5)	*Du* 22.2	*Du* 22 5	*d* 23.0	(*d*) (24.6)	*d* 24.0	*d* 24 5	*d* 24 9	*D* 25.6	Unreliable	4.7	10	47
12	*Du* 10.7	*Du* 11 0	*Du* 11.9	*Du* 12 5	(*D*) (12 5)	*Du* 13 6	*Du* 15.1	*Du* 16.1	*Du* 16 6	*d* 17 7	*Du* 18 8	Calculated as *Du*	8 1	10	81
13	*Du* 15 2	*Du* 15.5	*Du* 16.1	*Du* 16 3	*Du* 16.4	*Du* 16 6	*Du* 17 3	*Du* 17.3	*Du* 17 3	(*s*) (17 5)		Suppressed	2 1	8	26
49	*D* 43.9				*D* 45.0	*D* 45.0	*D* 45.6	*D* 45.7	*D* 45 9				2 0	8	25
50	*D* 48 3				*D* 50.8	*D* 51 7	*D* 52 6	*D* 53 0	*D* 53 5	*D* 54 6	*D* 55 5		7 2	10	72
51	*D* 48 8	*D* 49.0	*D* 49 1	*D* 49 8	*D* 50 1	*D* 50.5	*D* 51 3	*D* 51 6					2 8	7	40
52	*D* 45.8	*D* 46.1	*D* 46 4	*D* 47 2	*D* 47 6	*D* 48 0	*D* 49 2						3.4	6	57
53	*D* 54 5				(*D* (55 0	*D* 55 0	*D*) 55 4)					Injured	—	—	—
54	*D* 39.9	*D* 40 3	*D* 41.1	*D* 41.5	*D* 42 3	*D* 43 0	*D* 44 0	*D* 44 2	*D* 44 4	*D* 45.0	*D* 45 3		5.4	10	54
												Totals	96.3	155	

Final M.A.I. $= \dfrac{96.3}{155} = 62$

SPECIMEN TABLE.

STATE—SELANGOR, DISTRICT—ULU LANGAT, RESERVE—BANGI, S. P. No. 9.

SPECIES—MERBAU.—*Intsia bakeri* Prain.

TABLE II—Calculation of mean annual girth increments by classes.

No. Tree	*D* TREES			*Du* TREES			*D* AND *Du* TREES COMBINED			*d* TREES			REMARKS
	INCREMENTS			INCREMENTS			INCREMENTS			INCREMENTS			
	Total	Num	Mean Annual	Total	Num	Mean Annual	Total	Num	Mean Annual	Total	Num.	Mean Annual	
	inches		inches	inches		inches	inches		inches	inches		inches	
2	6 9	10	.69				6 9	10	69				
3	11 7	10	1.17				11 7	10	1 17				
4				3 7	6	.62	3 7	6	62				
5	8 4	10	.84				8 4	10	.84				
6				7 1	8	89	7.1	8	89				
7				4 1	8	51	4 1	8	51				
8				2 8	6	47	2 8	6	47	1 1	2	55	
9	1.0	1	1 00	1 3	3	43	2 8	5	56				
10				3 2	8	40	3 2	8	40				
11				1 6	4	40	1 6	4	40	1 9	4	48	
12				5 9	8	.74	5 9	8	.74				
13				2 1	8	26	2 1	8	.26				
49	2 0	8	25				2 0	8	25				
50	7 2	10	72				7 2	10	.72				
51	2 8	7	.40				2 8	7	40				
52	3 4	6	57				3 4	6	57				
54	5 4	10	54				5 4	10	54				
	48 8	72		31.8	59		81 1	132		3 0	6		Totals
	M A I $= \dfrac{48\ 8}{72} = .68$			M A I $= \dfrac{31\ 8}{59} = .54$			M A I $= \dfrac{81\ 1}{132} = 62$			M.A I $= \dfrac{3\ 0}{6} = .50$			

SPECIMEN TABLE

STATE—SELANGOR, DISTRICT—ULU LANGAT, RESERVE—BANGI, S. P. No. 9.

SPECIES—MERBAU.—*Intsia bakeri* Prain

TABLE III—Allotment of increments to girth classes. (All trees)

0"—12" Increments		12"—24" Increments		24"—36" Increments		36"—48" Increments		48"—60" Increments		60"—72" Increments		72"—84" Increments		Over 84" Increments					
Total	Num.	Total	Num	Total	Num	Total	Num.	Total	Num.	Total	Num	Total	Num	Total	Num				
inches		inches		inches		inches		inches		inches		inches		inches					
1 1	2	5 4	8	5 6	5	6 1	5	7 2	10	6 9	10								
1.8	3	2 7	3	1 6	2	2 0	8	2.8	7										
		1 5	2	5 7	7	2 2	5	1.2	1										
		4 1	8	7 4	8	5 4	10												
		4 9	10	1 3	2														
		2 2	4	1 3	3														
		2 8	7	1 6	3														
		3 1	7																
		6 3	7																
		2 1	8																
2 9	5	35 1	64	24 5	30	15 7	28	11 2	18	6 9	10								
M.A.I = 2 9 / 5 = 58		M A.I = 35 1 / 64 = 55		M A.I = 24 5 / 30 = 82		M.A.I = 15 7 / 28 = 56		M A I = 11 2 / 18 = 62		M A.I = 6 9 / 10 = .69		M A I=		M A I=					

SPECIMEN TABLE.

STATE—SELANGOR, DISTRICT—ULU LANGAT, RESERVE—BANGI, S. P. No. 9.

SPECIES—MERBAU.—*Intsia bakeri* Prain.

TABLE IV—Allotment of increments to girth classes. (D and Du trees combined)

0"—12" Increments		12"—24" Increments		24"—36" Increments		36"—48" Increments		48"—60" Increments		60"—72" Increments		72"—84" Increments		Over 84" Increments					
Total	Num	Total	Num.	Total	Num	Total	Num	Total	Num	Total	Num	Total	Num.	Total	Num				
inches		inches		inches		inches		inches		inches		inches		inches					
6	1	3 7	6	5 6	5	6 1	5	7.2	10	6 9	10								
1 8	3	2 7	3	5 7	7	2 0	8	2.8	7										
		1 5	2	5 6	6	2 2	5	1.2	1										
		4 1	8	4	1	5 4	10												
		2 8	6																
		2 2	4																
		2 8	7																
		1 6	4																
		4 1	5																
		2.1	8																
2 4	4	27 6	53	17 3	19	15 7	28	11 2	18	6 9	10								
M.A I = 2 4 / 4 = 60		M.A I = 27.6 / 53 = 52		M.A.I = 17 3 / 19 = 91		M.A.I = 15.7 / 28 = 56		M.A I = 11 2 / 18 = 62		M.A.I = 6 9 / 10 = .69		M.A.I=		M A.I=					

NUMBER OF INCREMENTS INCLUDED IN SAMPLE PLOT MEASUREMENTS AND RECORD OF SMALLEST AND LARGEST TREES MEASURED

KIND OF TREE	Smallest Tree Girth Inches	1 0"–12"	2 12"–24"	3 24"–36"	4 36"–48"	5 48"–60"	6 60"–72"	7 72"–84"	8 Over 84"	Largest Tree Girth Inches
Bintangor Labu—*Calophyllum wallichianum*	6 2	70	138	48	20	10	4	—	—	64 8
Chengal-*Neobalanocarpus heimii*	1 5	3257	978	451	276	165	125	71	48	113 9
Jelutong—*Dyera* sp	4.4	327	472	242	163	78	41	21	68	124.1
Kapur—*Dryobalanops aromatica*	3 0	400	692	245	108	75	94	49	14	94 7
Kelat Merah—*Gordonia concentricicatrix*	31 0	—	—	38	56	44	31	6	11	109 0
Kulim—*Scorodocarpus borneensis*	1 9	693	379	253	294	317	126	21	6	86.2
Kumus—*Shorea ciliata*	6 0	32	96	87	73	58	41	24	11	109 1
Melantai—*Shorea macroptera*	8 3	13	27	63	52	9	6	—	10	121 9
Meranti Kepong—*Shorea sericea*	6.4	77	267	221	79	75	18	—	—	71 5
Meranti Pa'ang—*Shorea bracteolata*	6 5	54	221	121	67	53	29	—	—	73 0
Meranti Rambai Daun—*Shorea acuminata*	6 0	163	212	69	38	15	2	1	10	100 7
Meranti Sarang Punai—*Shorea parvifolia*	5 9	339	628	358	137	100	51	8	—	82 1
Meranti Tembaga—*Shorea leprosula*	6 2	194	512	261	175	161	50	12	11	94 4
Merawan—*Hopea intermedia*	4 9	56	105	75	184	166	231	197	91	96 0
Merbau—*Intsia bakeri*	11 0	5	166	107	139	141	60	64	34	99 5
Nyatoh—*Palaquium maingayi*	5 7	102	147	64	20	—	—	—	—	45 0
Nyatoh—*P rostratum*	3 2	233	205	73	34	14	—	—	—	53 2
Penaga—*Mesua ferrea*	3 2	394	308	206	158	75	30	—	—	66 7
Petaling—*Ochanostachys amentacea*	2 5	616	625	168	51	79	35	7	—	74 0
Seraya—*Shorea curtisii*	6.1	58	190	162	89	58	37	47	28	116 1
Taban Merah—*Palaquium gutta*	4 8	105	592	911	561	169	7	—	—	61 3
Resak—*Shorea barbata*	10 1	8	101	92	22	69	33	10	—	76 9

SUMMARY I.
SUMMARY OF M.A.I.s IN INCHES BY SPECIES AND TREE DOMINANCE CLASSES.

Position (See Table IV)	SPECIES	"A" Class Plots					"B" Class Plots					All Plots				
		D	*Du*	*D* & *Du*	*d*	All Trees	*D*	*Du*	*D* & *Du*	*d*	All Trees	*D*	*Du*	*D* & *Du*	*d*	All Trees
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Meranti Pa'ang	1 68	1 44	1 63	1 42	1 62	*1 01	88	90	.64	85	1 66	1 15	1.45	1 01	1 40
2	Meranti Kepong	1 86	1 29	1 70	1 13	1 67	* 81	.51	72	35	63	1 39	91	1.26	57	1 16
3	Taban Merah	1 55	1 69	1 60	1 29	1.58	1 48	1 22	1 29	93	1 23	1 55	1 57	1 57	1 15	1 53
4	Meranti S Punai	1 53	1 38	1 44	1 24	1 40	81	89	85	81	83	1 51	1 33	1 38	1 16	1 33
5	Kapur	1 45	1.39	1 42	86	1 34	—	—	—	—	—	1 45	1 39	1 42	86	1 34
	Meranti Tembaga	1 59	1 29	1 45	81	1.36	1 23	74	94	62	85	1 55	1 19	1.38	.76	1 28
6	Meranti R Daun	1 62	1 23	1 33	.69	1 27	—	—	—	—	—	1 62	1 23	1 33	69	1 27
7	Jelutong	1 41	1 12	1 27	.71	1 08	—	73	75	47	50	1 41	1 09	1 25	69	1 04
8	Bintangor	1 05	.80	88	57	83	1 27	1 15	1 20	1 30	1 20	1.10	87	93	69	89
9	Merawan	96	75	94	75	92	—	—	—	—	—	96	.75	94	75	92
10	Nyatoh (*P rostratum*)	—	—	—	—	—	1 04	77	83	53	73	1 04	77	83	53	73
11	Melantai	1 65	—	1 65	66	1 29	84	73	81	* 30	79	1 08	73	1 02	63	.96
12	Seraya	—	—	—	—	*1 05	82	72	79	55	74	82	72	.79	55	74
13	Merbau	76	62	.73	54	72	—	—	—	—	—	76	.62	73	54	72
14	Chengal	* 84	57	58	64	58	66	35	42	30	39	66	38	44	31	40
15	Kumus	—	* .74	* 74	—	* 74	81	57	73	38	68	81	58	73	38	68
16	Nyatoh (*P. maingayi*)	57	69	68	43	66	63	50	52	50	51	59	65	64	49	61
17	Penaga	* 58	61	61	48	58	42	34	37	27	34	40	44	.42	31	39
18	Resak	—	—	—	—	—	53	44	49	40	47	53	44	49	40	47
19	Kulim	.38	41	40	39	40	31	33	32	20	29	37	37	36	24	34
20	Petaling	49	63	60	32	58	47	38	41	28	38	48	50	50	28	47
21	Kelat (*Gordonia*)	—	—	—	—	—	52	70	53	25	49	52	.70	.53	25	49
*22																

*Information too scanty for results to be accurate; figures should be used with caution.

SUMMARY II

SUMMARY OF M A.I.s IN INCHES BY SPECIES AND GIRTH CLASSES (ALL TREES)

POSITION (See Table IV)	SPECIES	"A" CLASS PLOTS								"B" CLASS PLOTS								ALL PLOTS							
		0" to 12"	12" to 24"	24" to 36"	36' to 48"	48" to 60"	60" to 72"	72" to 84"	Over 84"	0" to 12"	12" to 24"	24" to 36"	36" to 48"	48" to 60"	60" to 72"	72" to 84"	Over 84"	0" to 12"	12' to 24"	24" to 36"	36" to 48"	48" to 60'	60" to 72'	72" to 84"	Over 84"
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Meranti Pa'ang	1 46	1 62	1 66	1 66	1 70	1 50			60	87	95						1 08	1 28	1 48	1 66	1 70	1 50		
2	Meranti Kepong	96	1 50	1 81	1 75	1 95	2 07			39	52	81	62					61	98	1 14	1 50	1 95	2 07		
3	Taban Merah	1 65	1 66	1 67	1 67	1 26	*1 11			1 10	1 23	1 38	*1 37					1 27	1 54	1 65	1 47	1 26	*1 11		
4	Meranti S Punai	1 19	1 35	1 49	1 52	1 63	1 70	*1 58		78	1 02	.78	* 58					1 14	1 31	1 37	1 49	1 63	1 70	*1 58	
5	Kapur	1 29	1 40	1 59	1 41	96	94	1 03	1 30									1 29	1 40	1 59	1 41	96	94	1 03	1 30
6	Meranti Tembaga	99	1 27	1 52	1 51	1 46	1 66	*1 99	1 27	55	82	89	1 46	1 19				91	1 18	1 42	1 50	1 44	1 66	*1 99	1 27
7	Meranti R Daun	1 05	1 19	1 76	1 48	1 42	*2 65	*1 40	1 63									1 05	1 19	1 76	1 48	1 42	*2 65	*1 40	1 63
8	Jelutong	80	99	1 26	1 56	1 65	1 38	80	85	53	52	53						76	95	1 20	1 56	1 65	1 38	80	85
9	Bintangor	81	79	1 00	* 72	*1 08	*1 10			* 83	*1 37	*1 27	* 70					81	88	1 08	* 72	*1 08	*1 10		
10	Merawan	61	77	1 16	97	94	91	91	94									61	77	1 16	97	94	91	91	94
11	Nyatoh (*P rostratum*)									57	77	1 02	92	63				57	77	1 02	92	63			
12	Melantai		*2 13	*1 96	99	*1 20	*1 00		1 16	42	63	70	1 25	* 97				* 42	86	92	1 12	*1 04	1 00		1 16
13	Seraya	*1 05								49	62	88	82	1 02	70	82	51	51	62	88	82	1 02	70	82	51
14	Merbau	* 58	71	97	81	65	81	42	47									58	71	97	81	65	81	42	47
15	Chengal	55	56	89	* 94	* 90				29	43	49	64	70	83	67	53	32	44	52	66	70	83	67	53
16	Kumus	* 73								.45	62	57	91	72	90	80	68	53	62	57	91	72	90	80	68
17	Nyatoh (*P maingayi*)	62	77	63	* 10					62	40	47	* 82					62	65	56	* 50				
18	Penaga	57	59	61						30	32	33	41	42	31			40	38	37	41	42	31		
19	Resak									* 24	52	44	61	50	40	46		24	52	44	61	50	40	46	
20	Kulim	39	46	41	44	34	39	32	20	25	34	30	36	25	36			31	39	35	40	30	38	32	20
21	Petaling	57	65	49	38	.41	* 17			32	54	59	28	18	32	* 29		36	61	53	32	28	27	* 29	
*22	Kelat (*Gordonia*)											41	45	50	51	1 00	69			41	45	50	51	1 00	69

*Information too scanty for results to be accurate, figures should be used with caution

SUMMARY III

SUMMARY OF M A I.s IN INCHES BY SPECIES AND GIRTH CLASSES (*D* AND *Du* TREES COMBINED.)

POSITION (See Table IV)	SPECIES	"A" CLASS PLOTS								"B" CLASS PLOTS								ALL PLOTS							
		0" to 12"	12" to 24"	24' to 36"	36" to 48"	48" to 60"	60" to 72"	72" to 84"	Over 84"	0" to 12"	12" to 24"	24" to 36"	36" to 48"	48" to 60"	60" to 72"	72" to 84"	Over 84"	0" to 12'	12' to 24"	24' to 36"	36 to 48"	48" to 60	60" to 72"	72" to 84"	Over 84'
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Meranti Pa'ang	1 60	1 59	1 67	1 66	1 70	1 50			61	89	1 05						1 27	1 27	1 54	1 66	1 70	1 50		
2	Meranti Kepong	96	1 63	1 89	1 75	1 95	2 08			52	58	83	73					76	1 10	1 10	1 59	1 95	2 08		
3	Taban Merah	1 65	1 77	1 68	1 47	1 27	*1 11			1 36	1 22	1 38	*1 37					1 50	1 62	1 66	1 47	1 27	*1 11		
4	Meranti S Punai	1 27	1 43	1 66	1 51	1 60	1 69	*1 58		78	1 18	74	* 47					1 21	1 41	1 50	1 50	1 60	1 69	*1 58	
5	Kapur	1 35	1 43	1 71	1 71	*1 01	*1 02	*1 06	1 30									1 35	1 43	1 71	1 71	*1 01	*1 02	*1 06	1 30
6	Meranti Tembaga	1 14	1 43	1 54	1 52	1 49	1 70	*1 99	1 27	66	90	1 42	1 46	*1 19				1 05	1 33	1 47	1 52	1 46	1 70	*1 99	1 27
7	Meranti R Daun	1 15	1 24	1 74	1 48	1 42	*2 65	*1 40	1 63									1 15	1 24	1 74	1 48	1 42	*2 65	*1 40	1 63
8	Jelutong	92	1 26	1 34	1 63	1 65	1 38	82	85	93	67	72						92	1 20	1 29	1 63	1 65	1 38	82	85
9	Bintangor	93	80	95	84	*1 10	*1 10			* 80	*1 38	*1 34	* 70					91	88	1 07	80	*1 10	*1 10		
10	Merawan	63	84	1 14	1 04	94	93	91	94									63	84	1 14	1 04	94	93	91	94
11	Nyatoh (*P rostratum*)									61	1 01	1 23	*1 01	* 67				61	1 01	1 23	1 01	* 67			
12	Melantai		*2 13	*1 96	*2 33	*1 20	*1 00		1 16	42	69	71	1 25	* 97				42	93	94	1 46	*1 04	*1 00		1 16
13	Seraya									55	71	88	80	1 03	67	82	51	55	71	88	80	1 03	67	82	51
14	Merbau	* 60	75	92	83	65	81	42	.47									* 60	75	92	83	65	81	42	47
15	Chengal	55	56	93	* 94	* 90				32	.47	57	67	67	82	66	53	35	48	60	68	67	82	66	53
16	Kumus	* 73								* 48	65	60	91	72	90	80	68	61	65	60	91	72	90	80	68
17	Nyatoh (*P maingayi*)	62	78	66	* 10					63	30	46	* 81					62	72	57	* 46				
18	Penaga	69	60	61						33	35	37	42	44	31			45	42	41	42	44	31		
19	Resak									* 24	50	50	61	50	40	* 46		* 24	50	50	61	50	40	* 46	
20	Kulim	40	45	41	43	34	39	32	20	30	38	32	36	27	36			35	41	36	40	31	38	32	20
21	Petaling	65	66	49	36	41	* 17			33	58	58	25	17	32	* 29		39	63	53	31	29	27	* 29	
*22	Kelat (*Gordonia*)											44	46	50	51	1 00	69			44	46	50	51	1 00	69

*Information too scanty for results to be accurate, figures should be used with caution

SUMMARY IV.

SUMMARY OF RATE OF GROWTH AS CALCULATED FROM ACTUAL MEASUREMENTS.

Position	Species	Number of years taken to reach						
		12" girth	24" girth	36" girth	48" girth	60" girth	72" girth	84" girth
1	Meranti Pa'ang	8	16	23	30	37	45	—
2	Meranti Kepong	13	20	26	33	39	45	—
3	Taban Merah	7	14	21	29	39	*50	—
4	Meranti Sarang Punai	9	17	24	32	40	47	*55
5	Kapur	9	17	24	31	*43	*55	*66
6	Meranti Tembaga	11	19	27	35	43	50	56
7	Meranti Rambai Daun	10	20	27	35	*43	*48	*57
8	Jelutong	13	23	32	39	46	55	70
9	Bintangor	13	28	41	55	66	77	—
10	Merawan	19	33	43	55	68	81	94
11	Nyatoh (*P. rostratum*)	20	32	41	53	71	—	—
12	Melantai	*29	42	55	63	*75	*87	—
13	Seraya	22	39	53	68	80	*98	113
14	Merbau	20	36	49	63	81	86	125
15	Chengal	22	43	56	69	87	102	120
16	Kumus	20	38	58	71	88	101	116
17	Nyatoh (*P. maingayi*)	19	36	57	83	110†	—	—
18	Penaga	27	56	85	114	141	180	—
19	Resak	50	74	98	118	142	172	198
20	Kulim	30	57	86	114	149	180	218
21	Petaling	31	50	73	112	153	197	*238

*Information too scanty for results to be accurate, figures should be used with caution †From curve—no actual measurements

Note —Nothing has been added for the time required for the establishment of the seedling

SUMMARY V.

SUMMARY OF RATE OF GROWTH FROM CURVE FOR D AND Du TREES "A" CLASS PLOTS.

Position (See Table IV).	Species.	Girth at years in feet and inches.														
		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
1	Meranti Pa'ang	1–2	2–7	4–0	5–4	6–6	7–0	—	—	—	—	—	—	—	—	—
2	Meranti Kepong	–8	2–0	3–8	5–3	6–4	6–10	—	—	—	—	—	—	—	—	—
3	Taban Merah	1–4	2–10	4–1	5–2	6–0	6–5	—	—	—	—	—	—	—	—	—
4	Meranti Sarang Punai	1–0	2–4	3–10	5–3	6–5	7–2	7–7	—	—	—	—	—	—	—	—
5	Kapur	1–1	2–5	3–10	5–0	5–11	6–8	7–2	7–8	—	—	—	—	—	—	—
6	Meranti Tembaga	–10	2–0	3–6	4–10	6–1	7–0	7–8	8–0	—	—	—	—	—	—	—
7	Meranti Rambai Daun	1–0	2–1	3–5	4–10	6–0	7–0	7–10	8–2	—	—	—	—	—	—	—
8	Jelutong	–8	1–8	2–10	4–2	5–5	6–5	7–0	7–6	—	—	—	—	—	—	—
9	Bintangor	–8	1–5	2–2	2–11	3–8	4–5	5–3	6–3	7–3	7–10	—	—	—	—	—
10	Merawan	–6	1–0	1–10	2–8	3–6	4–5	5–2	5–11	6–8	7–3	—	—	—	—	—
11	Nyatoh (*P rostratum*) (*c*)	–5	1–0	1–11	2–11	3–9	4–5	5–0	5–5	5–8	—	—	—	—	—	—
12	Melantai (*b*)	–4	–8	1–1	1–10	2–8	3–8	4–8	5–6	6–2	6–8	—	—	—	—	—
13	Seraya (*c*)	–5	–10	1–4	2–0	2–9	3–6	4–3	5–0	5–8	6–3	6–10	7–2	—	—	—
14	Merbau	–5	1–0	1–6	2–3	3–1	3–10	4–6	5–1	5–7	6–1	6–5	6–8	—	—	—
15	Chengal	–5	–10	1–4	2–0	2–8	3–4	4–2	4–10	5–6	6–2	—	—	—	—	—
	Chengal (*d*)	—	—	—	—	—	—	—	4–9	5–4	5–10	6–5	7–3	—	—	—
16	Kumus (*b*)	–5	1–0	1–6	2–1	2–8	3–3	3–10	4–6	5–2	5–11	6–6	7–1	—	—	—
17	Nyatoh (*P maingayi*) (*b*)	–6	1–1	1–8	2–2	2–8	3–1	3–7	3–11	4–3	4–8	5–0	—	—	—	—
18	Penaga (*b*)	–4	–8	1–0	1–6	1–10	2–2	2–7	3–0	3–4	3–8	4–0	4–4	4–8	5–0	5–3
19	Resak (*c*)	–2	–4	–6	–10	1–1	1–6	1–10	2–2	2–7	3–0	3–6	4–0	4–6	5–0	5–6
20	Kulim	–4	–8	1–0	1–4	1–9	2–1	2–6	2–10	3–2	3–6	3–10	4–2	4–6	4–10	5–1
21	Petaling (*b*)	–2	–6	1–0	1–5	1–11	2–4	2–9	3–2	3–6	3–9	4–0	4–3	4–6	4–9	5–0

NOTES—(*a*). Nothing has been added for the time required for the establishment of the seedling.
(*b*) Owing to lack of data from "A" class plots the figures represent the rate of growth of *D* and *Du* trees in all plots
(*c*) No data from "A" class plots—The figures are for "B" class plots.
(*d*) From data from "B" class plots.

SUMMARY VI.

SHOWING INCHES GIRTH GROWN PER DECADE.

Position (See Table IV)	SPECIES	DECADE														
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
1	Meranti Pa'ang	14	17	17	16	14	6	—	—	—	—	—	—	—	—	—
2	Meranti Kepong	8	16	20	19	13	5	—	—	—	—	—	—	—	—	—
3	Taban Merah	16	18	15	13	10	5	—	—	—	—	—	—	—	—	—
4	Meranti Sarang Punai	12	16	18	17	14	9	5	—	—	—	—	—	—	—	—
5	Kapur	13	16	17	14	11	9	6	6	—	—	—	—	—	—	—
6	Meranti Tembaga	10	14	18	16	15	11	8	4	—	—	—	—	—	—	—
7	Meranti Rambai Daun	12	13	16	17	14	12	10	4	—	—	—	—	—	—	—
8	Jelutong	8	12	14	16	15	12	7	6	—	—	—	—	—	—	—
9	Bintangor	8	9	9	9	9	9	10	12	12	7	—	—	—	—	—
10	Merawan	6	6	10	10	10	11	9	9	9	7	—	—	—	—	—
11	Nyatoh (*P. rostratum*)	5	7	11	12	10	8	7	5	—	—	—	—	—	—	—
12	Melantai	4	4	5	9	10	12	12	10	8	6	—	—	—	—	—
13	Seraya	5	5	6	8	9	9	9	9	8	7	7	4	—	—	—
14	Merbau	5	7	6	9	10	9	8	7	6	6	4	3	—	—	—
15	Chengal	5	5	6	8	8	8	10	7	7	6	7	10	—	—	—
16	Kumus	5	7	6	7	7	7	7	7	8	8	9	7	7	—	—
17	Nyatoh (*P maingayi*)	6	7	7	6	6	5	6	4	4	5	4	—	—	—	—
18	Penaga	4	4	4	6	4	4	5	5	4	4	4	4	4	4	3
19	Resak	2	2	2	4	3	5	4	4	5	5	6	6	6	6	6
20	Kulim	4	4	4	4	5	4	5	4	4	4	4	4	4	4	3
21	Petaling	2	4	6	5	6	5	5	5	4	3	3	3	3	3	3

Note.—Nothing has been added for the time required for the establishment of the seedling, therefore the 1st decade is from establishment to 10 years after establishment. The second, 11 years to 20 years after establishment; the third, from 21 to 30 years after establishment, and so on.

LIST SHOWING LARGEST M.A.I. PUT ON BY INDIVIDUAL TREE OF EACH SPECIES.

Position	Species	Sample Plot	Tree Number	M.A I.
1	Jelutong	Sel. 29	191	4 18
2	Meranti Kepong	,,	105	4 05
3	Meranti S. Punai	,,	136	4 03
4	Meranti Tembaga	N S. 6	7	4 00
5	Taban Merah	Pk S. 1	50	3 22
6	Meranti Pa'ang	Sel 29	30	3 08
7	Melantai	Pa E 1	164	3·00
8	Kapur	Sel 32	34	2 80
9	Meranti R Daun	Sel 7	167	2 26
10	Bintangor	Sel 3	16	1 93
11	Nyatoh (*P. rostratum*)	Pa E 2	25	1·81
12	Merbau	Sel 15	64	1 74
13	Chengal	Pa. E. 3 (B)	493	1 63
14	Merawan	Sel. 10	3	1 58
15	Nyatoh (*P maingayi*)	Sel. 7	198	1 55
16	Seraya	N S 4	64	1 52
17	Kumus	N. S 4	40	1 45
18	Penaga	Sel 7	210	1 35
19	Petaling	Sel 7	193	1 30
20	Kulim	Pa. E 3 (B)	336	1 27
21	Resak	N. S 4	187	1 04
22	Kelat (*Gordonia* sp.)	Sel 16	56	91

RECORD OF INDIVIDUAL TREES SHOWING A MEAN ANNUAL INCREMENT OF 2½" AND OVER.

No	Position	Species	Sample Plot	Tree Number	M A.I.
1	1	Jelutong	Sel 29	191	4 18
2	2	Meranti Kepong	„	105	4 05
3	3	Meranti Sarang Punai	„	136	4 03
4	4	Meranti Tembaga	N' S 6	7	*4 00
5	5	„	„	1	*3 70
6	6	Meranti Kepong	Sel 29	72	3 48
7	7	Meranti Tembaga	N' S 6	47	*3 40
8	8	Taban Merah	Pk S 1	50	3 22
9	9	Meranti Tembaga	N' S 6	49	*3 20
10	10	Meranti Pa'ang	Sel 29	30	3 08
11	11	Taban Merah	Pk S 1	83	3 07
12	12	Meranti Tembaga	N S 2	3	3 04
13		„	N' S 6	2	*3 00
14	13 eq	Melantai	Pa E 1	164	3 00
15		Meranti Tembaga	N' S 6	12	*3 00
16	14	Meranti Sarang Punai	Sel. 29	118	2 95
17	15	„	Sel 26	77	2 94
18	16	Meranti Kepong	Sel 29	187	2 93
19	17 eq	„	Sel. 26	252	2 92
20		Taban Merah	Pk S 1	29	2 92
21	18	Jelutong	Sel 7	232	*2 90
22		Kapui	Sel 32	34	2 80
23		Meranti Kepong	Sel 26	134	2 80
24	19 eq	Meranti Tembaga	N' S 6	3	2 80
25		„	„	29	2 80
26		„	„	45	2 80
27	20	Meranti Sarang Punai	Sel. 26	60	2 78
28	21	Meranti Kepong	Sel 29	10	2 75
29	22	Taban Merah	Pk. S. 1	22	2 71
30	23	Meranti Kepong	Sel. 26	35	2 70
31	24	Jelutong	Sel 29	100	2 68
32	25	Meranti Pa'ang	Sel 26	293	2 66
33	26	Meranti Sarang Punai	Sel 29	114	2 65
34	27 eq	Taban Merah	Pk S 1	5	2 62
35		„	„	41	2 62
36		Meranti Sarang Punai	Sel 7	234	*2 60
37		Meranti Tembaga	N' S 6	8	*2 60
38	28 eq	,	„	10	*2 60
39		„	„	14	*2 60
40		Jelutong	Sel 9	42	2 60
41		Meranti Pa'ang	Sel 26	245	2 58
42		Meranti Tembaga	„	183	2 58
43	29 eq	Meranti Kepong	„	259	2 58
44		Taban Merah	Pk S 1	1	2 58
45		„	„	40	2 58
46	30 eq	Taban Merah	Pk S 1	94	2 56
47		Meranti Sarang Punai	Sel 26	25	2 56
48		Kapui	Sel 32	70	2 55
49	31 eq	Jelutong	Sel 29	78	2 55
50		„	„	198	2 55
51		Meranti Tembaga	N S 2	89	2 54
52	32 eq	Taban Merah	Pk S 1	6	2 54
53		„	„	12	2 54
54	33	Meranti Tembaga	Sel 26	271	2 53
55	34 eq	Meranti Sarang Punai	Sel 26	272	2 52
56		„	N S 2	2	2 52
57		„	Sel 26	271	2 50
58	35 eq	Meranti Tembaga	N' S 6	5	*2 50
59			„	17	*2 50

*One Increment Only

出典

Edwards, J P Mead, J P Growth of Malayan Forest Trees, Sample Plot Recorde, 1915-1928

Singapore, 1930

天然林　アジア　　フィリピン　(1)
　フタバガキ科グループと非フタバガキ科グループに森林タイプ区分し、climatic type別の択伐跡地の種組成と再生産の解析データ。

データ採取地の立地環境

Methodology

A *Data Selection*

The data for the study were taken from the reproduction plots available at the Forest Regulation and Utilization Division of the Ecosystems Research and Development Bureau

The study made use of four climatic types with their representative concessions

(a) Climatic type I (Two pronounced seasons dry from November to April, wet during the rest of the year) - three concessions
  (1) Palawan Wood Enterprises
  (2) ILCOPHIL
  (3) Zambales Timber Company

(b) Climatic type II (No dry season with a very pronounced maximum rainfall from November to January) – Five concessions
  (1) Elias Dacudao
  (2) Aras-asan Timber Co
  (3) San Jose Timber
  (4) Manuel Nieto Corp.
  (5) Sta Ines Melale Plywood and Veneer

(c) Climatic type III (Seasons not very pronounced relatively dry from November to April, wet during the rest of the year) -Five concessions

  (1) FCA
  (2) P and Roa Enterprises
  (3) T. H Valderrama and Sons
  (4) La Villa de Manila
  (5) Pan Oriental Lumber, Co.

(d) Climatic type IV (Rainfall more or less evenly distributed throughout the year) - Two concessions

  (1) C Alcantara and Sons
  (2) Mindoro Timberland

Selection was based on the availability of complete reproduction data. The differences in the number of concessions and eventually in the number of plots per climatic type were considered. To get more reliable data, average on a per hectare basis was used.

B. *Data collection and preliminary calculations*

In determining the reproductions, the following steps were taken

(1) Reproductions were counted on each of the four reproduction plots with each plot having a one-meter radius.
(2) These plots are located along the four cardinal directions, that is due North, due South, due East and due West and are five meters from the center of the permanent growth plots
(3) All species inside the reproduction plots were counted, then recorded and classified as small and large seedlings, and small and large poles

Thus, for each permanent growth plot, there are four reproduction plots with a total area of 12,5664 m^2 To determine the average number of reproductions per hectare (NRH), the following formula was used

NRH = Average number of reproductions per plot or *795 77285

$$NRH = \frac{\text{Total count}}{\text{Area sample}}$$

where

795.77285 is the number of 12 5664 m^2 plots in one hectare (10000 m^2)

$$= \text{average number of reproduction per plot} = \frac{\text{Total reproductions}}{\text{number of permanent growth plots involved}}$$

All the reproduction data were compiled and collated.

Graphs showing the relationship of total number of reproductions per hectare at plot establishment and five years after logging for the different climatic types were made

Species composition and distribution, mortality and growth were also determined and compared by climatic types

成長・収穫に関する表，図，式など

Table 1. Average species composition and periodic development of reproduction for Climatic Type 1

SPECIES	At establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
A DIPTEROCARP														
Guisok guisok	4536	1485	6021	955	80	1035	7056	8064	2653	10717	1910	504	2414	13131
Red Lauan	239	239	478	451	53	504	982	875	716	1591	716	610	1326	2917
Tangile	7666	769	8435	928	186	1114	9549	5623	3130	8753	1061	265	1326	10079
Almon	1141	531	1672	27	–	27	1699	4881	1857	6738	690	186	876	7614
Apitong	1963	690	2653	292	212	504	3157	2255	1326	3581	716	531	1247	4828
W Lauan	1035	822	1857	80	27	107	1964	1459	1088	2547	106	–	106	2653
Mayapis	–	–	–	27	27	54	54	80	–	80	27	–	27	107
Dalingdingan	398	133	531	53	–	53	584	27	398	425	80	–	80	505
Palosapis	106	27	133	–	–	–	133	27	–	27	80	–	80	107
Narig	1008	424	1432	53	–	53	1485	451	637	1088	106	27	133	1221
Yakal	1353	159	1512	27	–	27	1539	1061	345	1406	80	–	80	1486
Sub-total	19445	5279	24724	2893	585	3478	28202	24803	12150	36953	5572	2123	7695	44648
B NON-DIPTEROCARP														
Malasaging	–	–	–	27	–	27	27	80	–	80	27	–	27	107
Malaruhat	–	–	–	53	–	53	53	–	–	–	53	–	53	53
Balakat gubat	–	–	–	53	–	53	53	–	–	–	53	–	53	53
Banuyo	2727	27	54	27	–	27	81	106	80	186	–	–	–	186
Bitanghol	1061	637	1698	292	27	319	2017	769	849	1618	451	106	557	2175
Bolong-eta	27	186	213	80	–	80	293	371	265	636	159	133	292	928
Piling-liitan	27	27	54	–	–	–	54	106	–	106	27	27	54	160
Malak-malak	27	265	292	133	27	160	452	928	265	1193	212	27	239	1432
Tamayuan	–	27	27	27	27	54	81	–	27	27	–	53	53	80
Anubing	133	318	451	159	–	159	610	186	371	557	292	27	319	876
Magabuyo	–	53	53	–	–	–	53	–	80	80	53		53	133
Ligas	–	–	–	27	–	27	27	–	–	–	27	53	80	80
Katap	318	27	345	53	106	159	504	212	106	318	133	–	133	451

Table 1a. Average species composition and periodic development of reproduction for Climatic Type 1

SPECIES	At establishment (No of trees per hectare) SEEDLINGS Small	Large	Sub total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
Makaasim		27	27	53		53	80	265	796	1061	637		637	1698
Kalingag	133		133	80		80	213	80	80	160		27	27	187
Lago		27	27				27				27		27	27
Bokbok	133		133	53		53	186	53	80	133		27	27	160
Kamagong					27	27	27					27	27	27
Binunga	106	27	133	27		27	160					53	53	53
Balinghasai	292	133	425	53		53	478	133	186	319	27	80	107	426
Alupag	133	27	160	133		133	293	133		133	80	106	186	319
Paitan	451	106	567	292	106	398	955	292	80	372	531	80	611	983
Balobo	27	53	80	106	80	186	266	106		106	186	53	239	345
Katmon	80	80	160		27	27	187		133	133		27	27	160
Pahutan	743	186	929	186		186	1155	637	292	929	80	106	186	1115
Miscellaneous	2414	3369	5783	1618	849	2467	8250	4722	2891	7613	1654	1141	2786	10399
Sub-total	6132	5602	11734	3532	1276	4808	16542	9179	6581	15760	4700	2153	6853	22613

Table 2. Average species composition and periodic development of reproduction for Climatic Type 2

SPECIES	At establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
A DIPTEROCARP														
Yakal				27	93	120	120		27	27	53	13	66	93
Mayapis	225	119	344	279	239	518	862	172	305	477	292	212	504	981
Guisok-guisok	93	119	212	146	40	186	398	172	187	359	80	133	213	572
Tangile	265	305	570	252	53	305	875	53	332	385	212	199	411	796
White Lauan	13	27	40	53	13	66	106	40	13	53	66	13	79	132
Red Lauan	40	186	226	172	106	278	504	53	265	318	225	186	411	729
Bagtikan	239	239	478	212	13	225	703	40	53	93	305	199	504	597
Almon				13		13	13				40		40	40
Dalingdingan	27	106	133	80		80	213	40	146	186	66	27	93	279
Apitong	27	106	133	133		133	266		133	133	66	66	132	265
Guijo	13		13		13	13	26		13	13		13	13	26
Dangula	40	53	93	133	80	213	306	27	66	93	119	53	172	265
Narig				40	13	53	53				13		13	13
Palosapis				13	13	26	26		13	13	27		27	40
Sub-total	982	1260	2242	1553	676	2229	4471	597	1553	2150	1564	1114	2678	4828
B NON-DIPTEROCARP														
Bitanghol	345	93	438	119	66	185	623	411	332	743	411	159	570	1313
Apanang	93	40	133	53	66	119	252	146	40	186	53	66	119	305
Paitan	40	40	80		53	53	133	27	66	93	27	40	67	160
Balinghasai		40	40	66		66	106				13	80	93	93
Putian	27	40	67	40	66	106	173		13	13		27	27	40
Malak-malak				13		13	13				13		13	13
Bayok				93		93	93				93		93	93
Bagotambis	93	66	159	53	40	93	252		27	27	13		13	40
Taingang Baboi				13	80	93	93		13	13	40	27	67	80
Ulaian	146	53	199	199	66	265	464	13	186	199	212	239	451	650

Table 2a. Average species composition and periodic development of reproduction for Climatic Type 2

SPECIES	At establishment (No of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-Total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
Piling Liitan	13	40	53	66	53	119	172	27	13	40	27	27	54	94
Himbabao	13		13				13	27	27	54				54
Tibig	40	13	53	40	13	53	106	27	40	67	93	40	133	200
Katmon	106	13	119	53	27	80	199	13	13	26	66	80	146	172
Bolon	13		13				13	13		13	13		13	26
Duguan	66		66				66	27		27	13	13	26	53
Malatibig	13		13				13					13	13	13
Pahutan	27	199	226	133	13	146	372	13	13	26	187	133	320	346
Balobo		80	80	80	40	120	200		13	13	80	106	186	199
Bolong-eta	13	13	20	53		53	79				13	27	40	40
Miscellaneous	3475	2838	6313	5173	2520	7693	14006	2931	3104	6035	4151	2825	6976	13011
Sub-total	4523	3568	8091	6247	3103	9350	17441	3675	3900	7575	5518	3902	9420	16995

Table 3. Average species composition and periodic development of reproduction for Climatic Type 3

SPECIES	At establishment (No of trees per hectare) SEEDLING Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
A DIPTEROCARP														
Red Lauan	568	1080	1648	1592	171	1763	3411	872	1023	1895	928	777	1705	3600
Almon	114	114	228	76		76	304	19	57	76	57	227	284	360
Tangile	398	587	985	891	208	1099	2084	531	379	910	644	663	1307	2217
Bagtikan	1080	398	1478	95	19	114	1592	853	606	1459	133	171	304	1763
Apitong	57	57	114	114		114	228	341	114	455	171	114	285	740
Guisok-guisok	19	19	38				38		37	37				37
Mayapis	189	246	435	152	38	190	625	76	189	265	246	133	379	644
White Lauan	947	19	966	265	57	322	1288	19	57	76	133	227	360	436
Palosapis		13	13		13	13	26					13	13	13
Panau	38	76	114	76		76	190		57	57	57	38	95	152
Dangula	227	38	265	19	19	38	303		227	227	76	38	114	341
Guijo					19	19	19							
Yakal	38		38		57	57	95		19	19				19
Narek				19		19	19							
Malaanonang		19	19	19	19	38	57							
Sub total	3675	2666	6341	3318	620	3938	10279	2711	2765	5476	2445	2401	4846	10322
B NON DIPTEROCARP														
Malak-malak	57	38	95				95		38	38	19	38	57	95
Bitanghol	512	171	683	171	76	247	930	493	171	664	76	133	209	873
Putian	284	265	549	284	38	322	871	436	171	607	265	152	417	1024
Salinggugon		38	38	19		19	57	38		38	19		19	57
Apanang	208	57	265				265	455	227	682	152	95	247	929
Himbabao				19	208	227	227					171	171	171

Table 3a. Average species composition and periodic development of reproduction for Climatic Type 3

SPECIES	At establishment (No of trees per hectare) SEEDLING Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
Yellow lanutan	38	19	57	19		19	76	19	19	38		38	38	76
Bayanti	95	38	133				133	38	38	76	19		19	95
Piling liitan				57		57	57				57		57	57
Binunga	38		38	19	76	95	133				38	19	57	57
Kalingag	19	19	38	114	19	133	171		57	57	227	265	492	549
Makaasim				57	38	95	95				38	38	76	76
Pili		57	57	152	19	171	228				19	57	76	76
Palomaria				19	19	38	38	19	38	57	57	38	95	152
Tagpo				19		19	19				19		19	19
Amian	19		19				19	57		57				57
Balobo	19	57	76	19		19	95	152	57	208				209
Nato				19		19	19	57	19	76	19		19	95
Malaikmo	76	76	152				152	76	57	133	19		19	152
Bolong-eta	38		38				38	19		19	19		19	38
Miscellaneous	2634	2937	5571	2255	4074	6329	11900	2539	1800	4339	2330	1989	4319	8658
Sub total	4037	3772	7809	3242	4567	7809	15618	4398	2692	7090	3392	3033	6425	13515

Table 4. Average species composition and periodic development of reproduction for Climatic Type 4

SPECIES	At establishment (No of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL	At 5th establishment (No. of trees per hectare) SEEDLINGS Small	Large	Sub-total	SAPLINGS Small	Large	Sub-total	GRAND TOTAL
A DIPTEROCARPS														
Yakal								328		328		187	187	515
White lauan	2060		2060	187	234	421	2481	1123	421	1544	374	421	795	2339
Mayapis	1077	1404	2481	515	47	562	3043	421	281	702		47	47	749
Red lauan	2341	140	2481		47	47	2528	843	234	1077	140	234	374	1451
Apitong	562	47	609				609	234	47	281		94	94	375
Tangile	1592	94	1686	94	47	141	1827	562	187	749	374		374	1123
Bagtikan	515	421	936	94		94	1030	889	187	1076	187		187	1263
Almon	328	47	375	94		94	469	374		374				374
Manggachapui	374	796	1170	140	281	421	1591	374	749	1123	140	281	421	1544
Guisok	47	140	187	94	94	188	375				187		187	187
Narig		94	94				94							
Palosapis	47		47				47		47	47				47
Sub-total	8943	3183	12126	1218	750	1968	14094	5148	2153	7301	1402	1264	2666	9967
B NON-DIPTEROCARPS														
Ulaian					47	47	47					47	47	47
Balobo	328	374	702		47		749	47		47				47
Nato	234	140	374	47		47	421		187	187				187
Apanang	374	140	514		47		561		94	94	47		47	141
Bitanghol	843	281	1124	94	94	188	1312	655	94	749	140		140	889
Taratara								47		47	47		47	94
Amugis	187	47	234	47		47	281		47	47	47		47	94
Ilang-ilang								140	94	234		140	140	374
Malugai	1077	328	1405	47	94	141	1546	374	421	795	421	47	468	1263

Table 4 a. Average species composition and periodic development of reproduction for Climatic Type 4

	At establishment (No of trees per hectare)							At 5th establishment (No. of trees per hectare)						
	SEEDLINGS		Sub-	SAPLINGS		Sub-	GRAND	SEEDLINGS		Sub-	SAPLINGS		Sub-	GRAND
	Small	Large	total	Small	Large	total	TOTAL	Small	Large	total	Small	Large	total	TOTAL
Antipolo	47	187	234				234							
Tibig	140	47	187	247	187	234	421							
Putian	702	514	1216	187	187	374	1590	328	374	702	234	47	281	983
Bolong-eta	234	47	281	94		94	375		120	120	187		187	307
Magabuyo	47		47				47							
Balete	94		94				94							
Malaikmo	234		234				234		47	47	47		47	94
Agosip	749		749				749	140	234	374				374
Kaliantan	281	94	375	94		94	469	94	187	281	94		94	375
Kalimutain	47		47	47		47	144		47	47	47		47	94
Miscellaneous	2762	2809	5571	983	3604	4587	10158	2902	1357	4259	468	1217	1685	5944
Sub-total	8380	5008	13388	1687	4307	5994	19382	4727	3303	8030	1779	1498	3277	11307

Table 5. Average species composition and periodic development of reproduction for Climatic Types

	At establishment (No of trees per hectare)							At 5th establishment (No. of trees per hectare)						
	SEEDLINGS		Sub-	SAPLINGS		Sub-	GRAND	SEEDLINGS		Sub-	SAPLINGS		Sub-	GRAND
	Small	Large	total	Small	Large	total	TOTAL	Small	Large	total	Small	Large	total	TOTAL
A CLIMATIC TYPE 1														
Dipterocarp	19446	5279	24724	2893	585	3478	28202	14803	12150	36953	5572	2123	7695	44648
Non-dipterocarp	6132	5602	11734	3532	1276	4808	16542	9179	6581	15760	4700	2153	6853	22613
Sub-total	15577	10881	36458	6425	1861	8286	44744	33982	18731	52713	10272	4276	14548	67261
B CLIMATIC TYPE 2														
Dipterocarp	982	1260	2242	1553	676	2229	4471	597	1553	2150	1564	1114	2678	4828
Non-dipterocarp	4523	3568	8091	6247	3103	9350	17441	3675	3900	7575	5518	3902	9420	16695
Sub-total	5505	4828	10333	7800	3779	11579	21912	4272	5433	9725	7082	5016	12098	21823
C CLIMATIC TYPE 3														
Dipterocarp	3675	2666	6341	3314	620	3938	10279	2711	2765	5476	2445	2401	4846	10322
Non-dipterocarp	4037	3772	7809	3242	4867	7809	15618	4398	2692	7090	3392	3033	6425	13515
Sub-total	7712	6438	14150	6560	5187	11747	25897	7109	5457	12566	5837	5434	11271	23837
D CLIMATIC TYPE 4														
Dipterocarp	8943	3183	12126	1218	750	1968	14094	5148	2153	7301	1402	1264	2666	9967
Non-dipterocarp	8380	5008	13388	1687	4307	5994	19382	4727	3303	8030	1779	1498	3277	11307
Sub-total	17323	8191	25514	2905	5057	7962	33476	9875	5456	15331	3181	2762	5943	21274

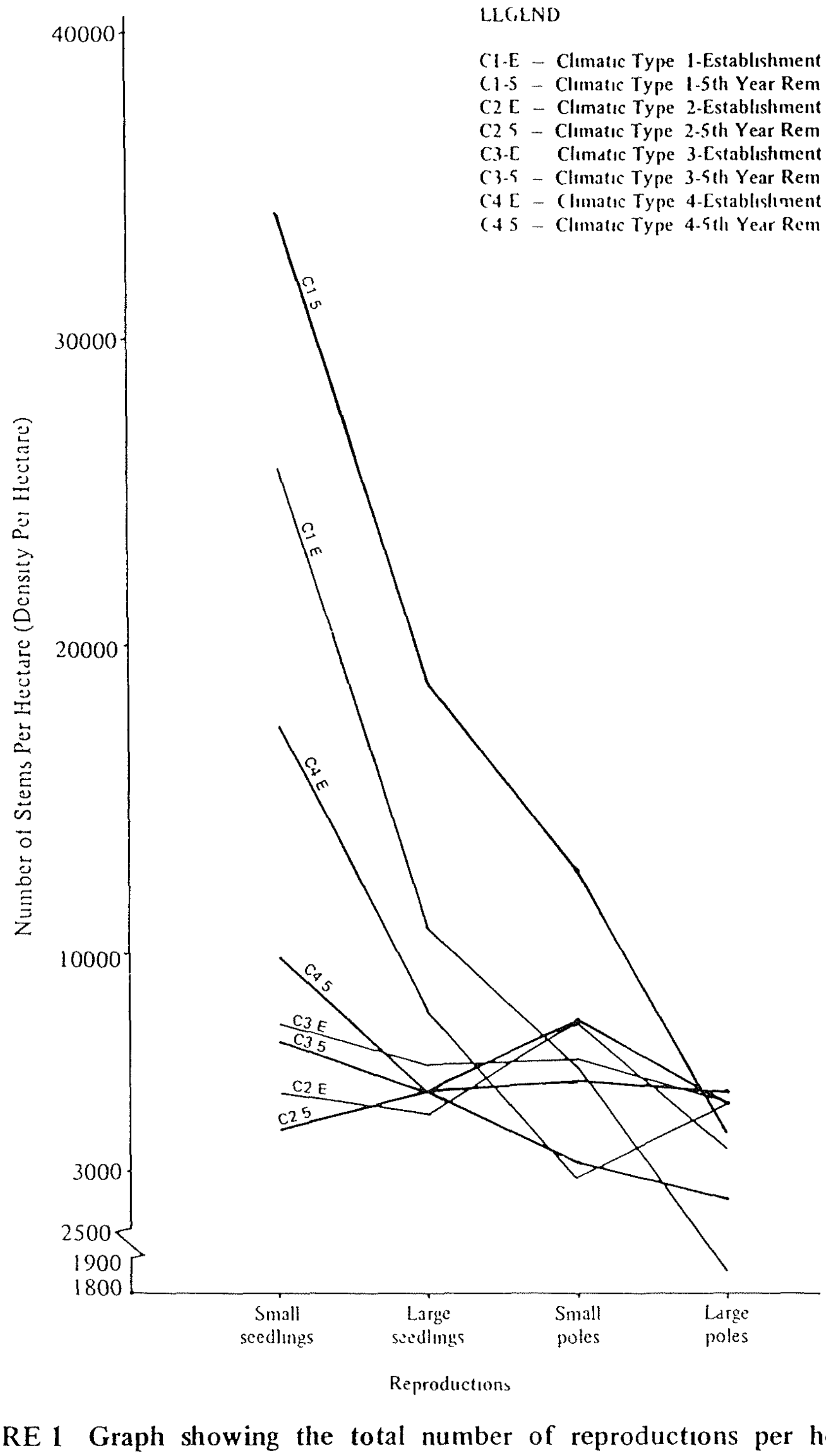


FIGURE 1 Graph showing the total number of reproductions per hectare at plot establishment and five years after logging for the different climatic types

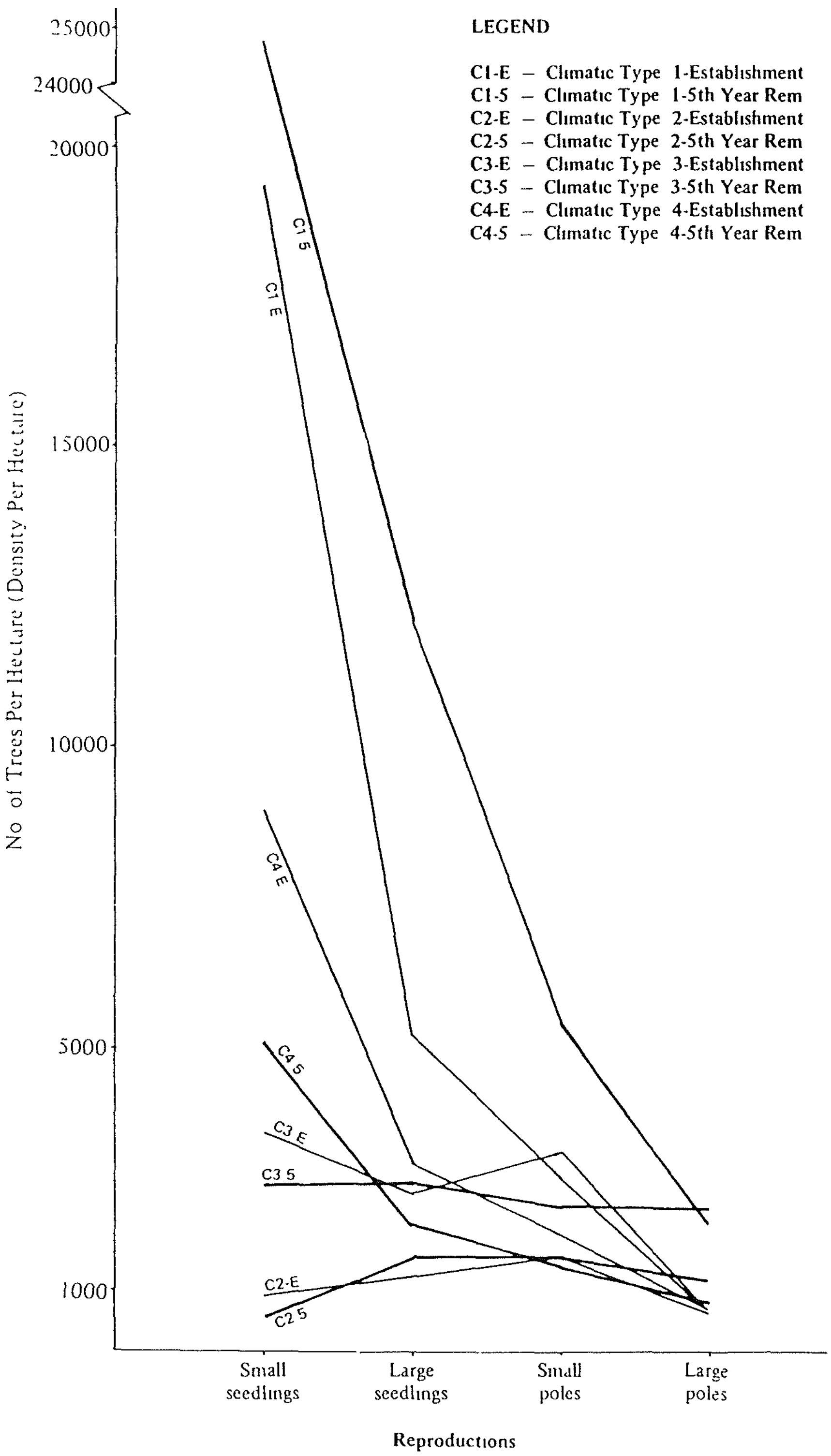


FIGURE 2 Graph showing the number of dipterocarp reproductions per hectare at plot establishment and five years after logging for the different climatic types

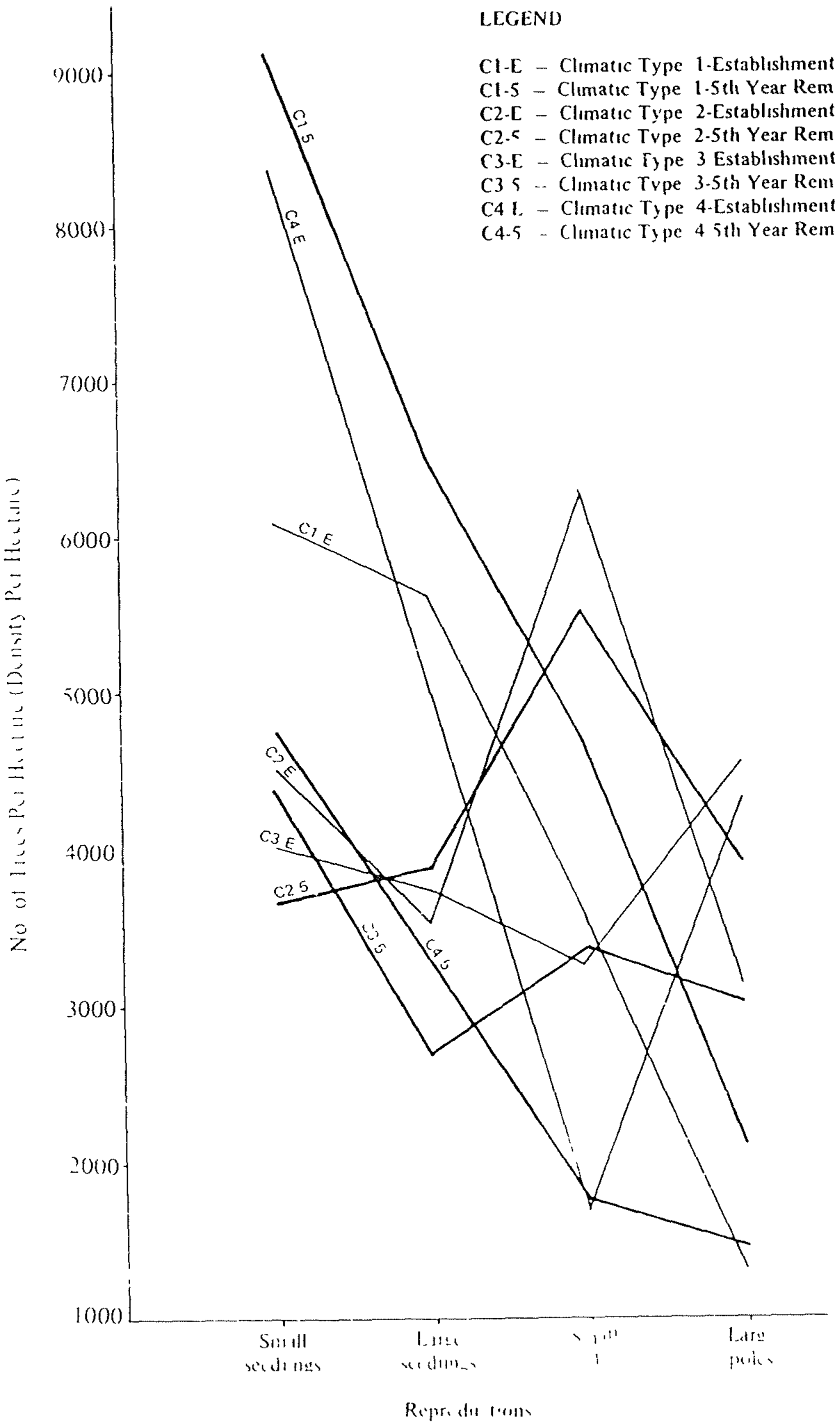


FIGURE 3 Graph showing the number of non-dipterocarp reproductions per hectare at plot establishment and five years after logging for the different climatic types

出典

Uriarte, M T and Virtucio, F.D (1988). Reproductions in logged-over dipterocarp forests following selective logging in four climatic types Occasional Paper No.4. Ecosystems Research and Development Bureau, DENR Collage Laguna.

天然林　アジア　　フィリピン　(2)
フタバガキ科グループと非フタバガキ科グループに森林タイプ区分し、region毎の
climatic type、location type別に整理したＣＦＩによる林分構造解析データ。

データ採取地の立地環境

Procedure for CFI plot establishment

In 1959, the procedure developed by Eulogio Tagudar was used as a guide by the Bureau of Forestry. The procedure was similar to that practiced by the US Forest Service except for some modifications to suit Philippine conditions (Sulit 1962).

It was conceived that the total area to be covered by the system shall be the whole forest of the license area. To determine the necessary number of permanent plots to be established in the logged over areas, preliminary sampling has to be done. As a starter, 30 or more temporary circular plots (18 m radius or 0.1 ha) distributed throughout the logged over areas are established either by line plot or simple random sampling to determine coefficient of determination and the desired level of accuracy.

After the number of sample plots for a working unit are determined the distances between plots are calculated and plot centers are indicated in a control map. Bearings and distances from known permanent points on the ground serve as guides in locating plot centers and are described in tally sheets.

In taking reproduction count, plots with radius of 1 m each are located at points due north, south , east and west lines 5 m from the center of the plot.

It was planned that when all the plots for the logged over areas in any license area are established, the number of plots to be established at the end of the year should correspond to the proportion of cut–over areas in the working circle, that is, if a working unit is 1/3 cut–over, the number of permanent plots would be 1/3 of the total number of plots to be established in the entire area.

Trees within the plot are scheduled for measurement on the 3rd year and once in every five years beginning from the 5th year up to the 10th or 15th year after establishment.

Materials and methods

The study made use of CFI plots established in logged–over forests all over the Philippines. Observations based on initial and five –year measurements were obtained from a total of 891 permanent growth plots as shown in Appendix 1.

In all the analyses, species were grouped as dipterocarps and non–dipterocarps.

The diameter at breast height (dbh) was classified into different classes with an equal class interval of 5 cm. Trees with dbh less than or equal to 12.5 were categorized under diameter class of 10 cm. Trees with dbh of 15 ± 2.5 belong to diameter class of 15 cm; and the same follows for the other diameter classes (15, 20 25, etc).

For each region/climatic type, species composition and stand structure were determined.

The basal area and volume per hectare were also assessed. Volumes were determined with the use of the regional volume equations as shown in Appendix 2.

Table 8. Basal area (m^2/ha) by region

REGION		DIPTEROCARP BA	%	NON-DIPTEROCARP BA	%	TOTAL BA	%
1	Est	15.56	64	8.74	36	24.30	100
	5th	11.38	52	10.51	48	21.89	100
2	Est	9.74	55	7.84	45	17.58	100
	5th	12.34	66	6.29	34	18.63	100
3	Est	6.42	40	9.77	60	16.19	100
	5th	5.21	34	10.34	66	15.55	100
4	Est	6.85	45	8.48	55	15.33	100
	5th	4.85	31	11.02	69	15.87	100
6	Est	9.11	64	5.08	36	14.19	100
	5th	7.90	50	7.92	50	15.82	100
7	Est	13.18	46	15.52	54	28.70	100
	5th	13.02	43	16.97	57	29.99	100
8	Est	11.79	47	13.49	53	25.28	100
	5th	16.17	46	18.61	54	34.78	100
10	Est	8.35	48	9.02	52	17.37	100
	5th	8.98	52	8.37	48	17.35	100
11	Est	9.60	53	8.51	47	18.11	100
	5th	12.22	60	8.21	40	20.43	100

Table 9. Basal area (m^2/ha) by climatic type

Climatic type		DIPTEROCARP BA	%	NON-DIPTEROCARP BA	%	TOTAL BA	%
1	Est	10.43	55	8.45	45	18.88	100
	5th	10.12	50	10.13	50	20.25	100
2	Est	9.48	45	11.36	55	20.84	100
	5th	11.07	49	11.58	51	22.65	100
3	Est	9.92	55	8.16	45	18.08	100
	5th	10.02	54	8.56	46	18.58	100
4	Est	11.50	57	8.68	43	20.18	100
	5th	9.75	57	7.48	43	17.23	100

Table 10. Basal area per hectare by region

DBH	Region 1		Region 2		Region 3		Region 4		Region 6		Region 7		Region 8		Region 10		Region 11	
Class	Est	5th	Est	5th	Est	5th	Est	5th	Est	5th	Est	5th	Est	5th	Est	5th	Est	5th
10	2 97	3 12	0 57	0 37	0 57	0 24	0 43	0 59	1 40	1 25	2 08	2 19	2 24	2 78	1 27	0 83	0 87	0 70
15	2 65	2 24	1 12	1 23	1 17	0 94	0 65	1 31	0 40	1 63	2 78	2 98	2 11	3 00	1 23	1 38	1 78	1 04
20	2 51	2 09	1 39	1 61	1 56	1 21	0 93	1 39	1 54	1 61	2 49	2 55	2 08	2 84	1 29	1 40	1 26	1 29
25	2 62	2 29	1 53	1 93	1 92	1 80	1 11	1 28	1 57	1 60	2 50	3 08	1 93	2 89	1 19	1 22	1 38	1 49
30	2 59	2 36	1 63	1 91	1 75	1 39	1 42	1 50	1 53	1 31	2 66	2 59	1 89	3 29	1 33	1 27	1 08	1 41
35	1 60	0 96	1 33	1 83	1 64	1 48	1 43	1 34	1 64	1 46	1 99	2 33	1 76	3 20	1 32	1 04	1 15	1 30
40	3 35	2 11	1 71	1 90	1 71	1 71	1 47	1 92	1 55	1 41	2 04	2 27	1 54	2 75	1 36	1 43	1 25	1 43
45	2 65	1 59	1 38	1 33	1 14	1 46	1 57	1 29	0 80	0 86	2 09	2 14	2 14	3 09	1 21	1 07	1 38	1 39
50	1 31	1 96	1 38	1 21	1 57	1 94	1 62	1 66	0 03	1 60	2 14	1 32	1 48	2 29	1 27	1 24	1 44	1 53
55	–	0 79	1 26	1 40	1 04	1 45	1 43	1 40	0 78	0 77	1 33	1 56	1 44	1 22	1 58	1 20	1 03	1 61
60	0 94	–	1 40	1 00	0 63	0 51	1 02	0 92	0 97	0 91	1 50	1 91	1 50	1 34	0 98	1 16	1 15	1 81
65	1 11	1 10	0 98	1 31	0 23	0 20	0 50	0 34	0 81	0 55	1 13	1 72	1 92	1 87	0 91	1 53	1 43	1 82
70	–	1 28	1 04	0 79	0 69	0 69	0 79	0 42	0 67	0 40	2 63	2 27	1 52	2 14	0 45	1 65	2 07	2 05
75	–	–	0 86	0 81	0 57	0 53	0 96	0 51	0 50	0 46	1 35	1 08	1 73	2 08	1 98	0 93	0 84	1 56
TOTAL	24 30	21 89	17 58	18 63	16 19	15 55	15 33	15 87	14 19	15 82	28 71	29 99	25 28	34 78	17 37	17 35	17 24	20 43

Table 11. Basal area per hectare by climatic type

DBH	Climatic Type 1		Climatic Type 2		Climatic Type 3		Climatic Type 4	
Class	Est	5th	Est	5th	Est	5th	Est	5th
10	1 35	1.67	1.31	1.27	0.97	0.85	0.68	0.35
15	1 42	1.81	1.40	1.54	1.27	0.62	1.12	0.50
20	1.62	1.64	1.49	1.62	1.48	1.72	1.25	1.44
25	1.76	1.89	1.54	1 78	1.56	1.66	1 36	1 29
30	1 89	1.73	1.46	1.62	1.62	2.37	1.27	1.04
35	1.60	1.18	1.35	1.59	1.59	1.59	0.84	1.06
40	2.02	1.91	1.42	1.75	1.58	1.69	1.50	1.16
45	1.84	1.55	1.40	1.60	1.48	1.22	1.13	1.00
50	1.64	1.57	1.59	1.56	1.50	1.28	1.21	1.66
55	0.87	1.49	1 24	2.12	1 22	1.00	0.98	1.29
60	1.02	0.94	2.55	1.61	1.27	1.05	1.59	1 56
65	0.65	1 05	1.61	1.47	0.73	1.79	1.18	1.83
70	0.63	0.80	1.19	1.94	1.02	1.02	2.41	0 27
75	0.59	1.02	1.31	1.37	0.79	0 72	3.66	2.78
TOTAL	18.90	20.25	20.86	22 84	18.08	18.58	20.18	17.23

Table 12. Basal area per hectare by diameter class

Region	DBH Class	Establishment D	Establishment ND	5th yr. remeasurement D	5th yr. remeasurement ND
1	5 – 15	1.9307	.9819	1.9530	3.4098
	20 – 35	5.5285	2.6649	3.0488	4.6514
	40 – 55	4.1218	3.0539	3.9900	2.4526
	60+	3.9803	2.0489	2.3865	–
	TOTAL	15.5600	8.7400	11.3800	10.5100
2	5 – 15	.7008	.9848	.5801	1.0200
	20 – 35	3.0510	2.8318	3.7282	3.5577
	40 – 55	3.7218	2.0077	4.3450	1.4953
	60+	2.2681	2.0165	3.6887	–
	TOTAL	9.7400	7.8400	12.3400	6.2900
3	5 – 15	.4472	1.2844	.1657	1.0110
	20 – 35	2.0470	4.6446	1.1761	4.6984
	40 – 55	2.4017	3.0686	2.9558	3.7683
	60+	1.5279	.7424	.9124	.8693
	TOTAL	6.4200	9.7400	5.2100	10.3400
4	5 – 15	.1800	.8901	.3667	1.5308
	20 – 35	1.4498	3.4323	1.1147	4.4109
	40 – 55	3.0192	3.0668	2.7528	3.5157
	60+	2.1932	1.0883	.6166	1.5591
	TOTAL	6.8500	8.4800	4.8500	11.0200
6	5 – 15	.7921	.5021	.6843	2.1910
	20 – 35	2.8688	2.9165	2.4762	3.5086
	40 – 55	2.9370	1.2279	2.7701	1.8724
	60+	2.5088	.4434	1.9699	.3505
	TOTAL	9.1100	5.0800	7.9000	7.9200
7	5 – 15	1.2027	3.6501	1.0746	4.0945
	20 – 35	3.6204	5.5746	3.7388	6.8248
	40 – 55	4.4240	3.1755	3.7396	3.5439
	60+	3.9346	3.1198	4.4695	2.5037
	TOTAL	13.1800	15.5200	13.0225	16.9669
8	5 – 15	1.1540	3.4956	0.9897	4.7832
	20 – 35	3.2565	4.9692	4.3267	7.8935
	40 – 55	3.6268	2.7238	6.1304	3.2158
	60+	3.7575	2.3003	4.7150	2.7130
	TOTAL	11.7900	13.4889	16.1618	18.6055
10	5 – 15	0.4946	2.0082	0.4497	1.7630
	20 – 35	1.7829	3.3544	1.6739	3.2552
	40 – 55	3.0495	2.3650	2.8124	2.1200
	60+	3.0262	1.3015	4.0440	1.2276
	TOTAL	8.3532	9.0200	8.9800	8.3658
11	5 – 15	1.9605	0.4377	0.4714	1.2684
	20 – 35	3.6082	1.7313	2.9307	2.5634
	40 – 55	2.0591	3.0893	3.5612	2.3930
	60+	1.9122	3.2517	5.2567	1.9852
	TOTAL	9.6000	8.5100	12.2200	8.2100

Table 13. Basal area per hectare by diameter class

Climatic Type	DBH Class	Establishment D	Establishment ND	5th yr remeasurement D	5th yr remeasurement ND
1	5 – 15	.9776	.7983	1.1920	2.2793
	20 – 35	3.1556	3.7072	2.2898	4.1536
	40 – 55	3.9846	2.3832	3.6895	2.8240
	60+	2.3266	.5586	2.9292	.8763
	TOTAL	10.4444	8.4473	10.1035	10.1332
2	5 – 15	.6053	2.1027	.6002	2.2109
	20 – 35	2.1716	3.6864	2.3217	4.2842
	40 – 55	3.3529	2.3037	3.7239	3.1162
	60+	3.3520	3.3124	4.4206	1.9685
	TOTAL	9.4819	11.4051	11.0664	11.5798
3	5 – 15	.6572	1.5813	.5587	.9153
	20 – 35	2.8928	3.3622	2.8043	4.5254
	40 – 55	3.4826	2.2992	3.3487	1.8369
	60+	2.8838	.9254	3.3050	1.2792
	TOTAL	9.9184	8.1681	10.0167	8.5568
4	5 – 15	.4595	1.3389	.3077	.5476
	20 – 35	1.9882	2.7184	1.7342	3.0926
	40 – 55	2.9761	1.8380	2.7170	2.3913
	60+	6.0616	2.7873	4.9950	1.9531
	TOTAL	11.4954	8.6826	9.7540	7.9846

Table 14. Volume (m^3/ha) by region

REGION		DIPTEROCARP Volume	%	NON-DIPTEROCARP Volume	%	TOTAL Volume	%
1	Est	114.47	68	53.55	32	168.02	100
	5th	81.02	50	81.71	50	162.73	100
2	Est	101.20	71	42.16	29	143.36	100
	5th	99.78	68	47.64	32	147.42	100
3	Est	57.73	44	72.03	56	129.76	100
	5th	56.50	40	85.59	60	142.09	100
4	Est	53.43	46	63.76	54	117.19	100
	5th	49.46	35	89.93	65	139.39	100
6	Est	95.27	66	48.47	34	143.74	100
	5th	84.24	59	58.58	41	142.82	100
7	Est	99.62	55	80.29	45	179.91	100
	5th	130.73	57	100.10	43	230.83	100
8	Est	107.68	61	69.53	39	177.21	100
	5th	119.72	58	86.44	42	206.16	100
10	Est	109.79	55	90.54	45	200.33	100
	5th	151.42	62	92.00	38	243.42	100
11	Est	69.67	40	102.94	60	172.61	100
	5th	194.63	68	92.29	32	286.92	100

Table 15. Volume (m^3/ha) by climatic type

CLIMATIC TYPE		DIPTEROCARP Volume	%	NON-DIPTEROCARP Volume	%	TOTA Volume	%
1	Est	96.81	60	64.85	40	161.16	100
	5th	98.01	52	89.49	48	187.50	100
2	Est	101.88	59	69.35	41	171.23	100
	5th	135.48	60	90.40	40	225.88	100
3	Est	103.12	63	61.01	37	164.13	100
	5th	123.81	64	69.90	36	193.71	100
4	Est	128.59	64	71.87	36	200.46	100
	5th	141.06	65	76.33	35	217.39	100

Table 16. Volume per hectare by region

DBH	Region 1		Region 2		Region 3		Region 4		Region 6		Region 7		Region 8		Region 10		Region 11	
Class	Est.	5th	Est.	5th	Est	5th	Est.	5th	Est	5th	Est	5th	Est	5th	Est	5th	Est	5th
10	10.88	9.21	6 05	7 25	2 86	1.37	1.84	2.36	6 47	6 45	7.06	16 28	7.83	9 12	5 76	5 97	3 97	5 16
15	13 23	12 62	8 26	9.57	6.54	6 70	3.61	6.70	7.83	9.21	11 67	12.39	10.25	10 47	8 70	10 13	5 61	6 68
20	14 36	10 08	11 84	11 48	10 29	8 60	5 75	8 27	9.37	9.90	11 02	14 79	10 63	11 41	9.96	10 72	7.96	9 36
25	16 58	13.31	17 15	10 82	15 87	14 49	6.98	9.78	11 18	12 14	14.24	19.91	22 91	14 44	10.22	10 66	9 93	13 37
30	13 95	14.77	11 70	12 21	9 26	12 66	9 45	12.11	11.05	9.96	16 22	18 75	16 72	15 32	12 89	12 92	8 97	11 77
35	12 51	7 62	8 64	5 82	12 40	12 68	10 74	11 33	13 28	13 55	12.39	17 82	11 41	18 14	14 37	13 03	11 25	13 53
40	39 87	15.24	10.30	9 61	14 77	16 22	12.59	18 43	14 80	12 17	12 28	16 57	11 18	15 41	14 53	19 59	12 80	24 96
45	23 53	41.92	7 66	10 73	9 67	13 39	13 84	12.73	12.55	9.45	15.22	18 32	10 41	20 78	15 74	17 93	12 81	17 75
50	12 14	16 31	13 32	11 77	16 45	20.84	14 52	17 82	14.47	18 14	13 61	11 52	21.13	35.85	17.87	19 20	13 08	56 29
55	–	7.35	11 46	13 78	9 16	13 55	12 07	16 08	8.33	9 17	11 40	15 81	12 05	9.12	17 60	18 91	14 04	19 30
60	4 38	–	11.59	9 40	7 11	4 94	8 68	9.37	10.02	11 62	12.15	15 87	11 63	6 84	13 87	24 83	23 24	27 60
65	6.59	5 81	6 11	15.05	2 56	2 33	4 21	4 11	9 75	7 16	11.26	16 62	10 12	13 67	13 90	19.92	15 03	29 33
70	–	8 50	10 03	10.35	5 78	7 94	6 77	3.35	8 01	6.20	17 70	23 58	11 45	11.71	21 76	39 93	17 24	25 84
75	–	–	9.25	9 58	7.04	6.38	6 14	6.95	6 63	7 70	13 69	12 60	9 49	13.88	23 16	19 67	16 69	26 98
TOTAL	168 02	162 74	143 36	147 42	129 76	142.09	117 19	139 39	143 74	142 82	179 91	230 83	177 21	206 16	200.33	243 42	172 62	286 92

Table 17. Volume per hectare by climatic type

DBH	Climatic Type 1		Climatic Type 2		Climatic Type 3		Climatic Type 4	
Class	Est	5th	Est	5th	Est	5th	Est	5th
10	8.80	5.61	5.98	7.67	6.34	6.05	3.11	1.62
15	7.78	13.18	6.84	8.23	8.38	9.87	6.40	2.36
20	17.04	10.23	8.64	11.27	11.31	11.40	8.82	9.35
25	16.74	13.50	11.05	12.92	13.90	11.87	10.55	9.59
30	12.74	13.13	11.83	12.90	7.88	13.77	10.20	10.26
35	13.23	10.27	10.97	13.61	13.87	14.58	8.32	10.45
40	16.13	15.35	12.51	15.95	14.70	16.62	13.50	11.40
45	20.28	23.77	12.73	15.98	14.27	12.38	13.58	10.17
50	13.12	15.40	11.61	20.98	15.20	16.09	12.01	12.84
55	5.74	15.36	20.06	19.18	13.75	11.23	10.56	16.85
60	15.09	11.39	15.74	20.29	12.19	14.08	16.96	20.12
65	5.33	17.60	13.98	21.41	9.06	16.40	12.64	26.54
70	4.52	7.85	13.71	23.95	13.55	27.27	28.38	28.79
75	4.62	14.86	15.58	21.54	9.73	12.10	45.43	47.05
TOTAL	161.16	187.50	171.23	225.88	164.13	193.71	200.46	217.39

Table 18. Volume per hectare by diameter class

Region	DBH Class	Establishment D	Establishment ND	5th yr. measurement D	5th yr. measurement ND
1	5 – 15	9.1999	12.0716	8.1552	13.6819
	20 – 35	39.4900	15.0725	21.7028	24.0168
	40 – 55	39.9178	14.3473	36.8069	44.0159
	60+	25.8583	12.0606	14.3603	–
	TOTAL	114.4700	53.5500	81.0252	81.7100
2	5 – 15	8.7109	5.6047	7.5715	9.2476
	20 – 35	34.4659	14.8613	17.5383	22.7943
	40 – 55	34.5689	8.1601	33.5687	12.3170
	60+	23.4506	13.5386	41.7015	3.2761
	TOTAL	101.20	42.1600	99.7800	47.6400
3	5 – 15	2.5233	6.4260	1.1636	6.9065
	20 – 35	15.0001	31.9188	11.7993	36.6303
	40 – 55	23.6439	25.0825	30.7623	33.2412
	60+	16.5629	8.6027	12.7796	8.8080
	TOTAL	57.7300	72.0300	56.5000	85.5900
4	5 – 15	.8515	4.5979	1.8442	7.2057
	20 – 35	10.2026	22.7251	9.3479	32.1203
	40 – 55	26.7835	26.2500	31.7509	33.3122
	60+	15.5933	10.1852	6.5188	17.2879
	TOTAL	53.4300	63.7600	49.4600	89.9300
6	5 – 15	5.4742	8.8268	4.0078	11.6474
	20 – 35	22.7089	22.1729	20.7385	24.8109
	40 – 55	35.9972	14.1598	29.9098	19.0210
	60+	31.0891	3.3113	29.5936	3.1023
	TOTAL	95.2700	48.4700	84.2447	58.5800
7	5 – 15	6.0072	12.7072	13.4263	15.2451
	20 – 35	25.2072	26.6114	29.1674	42.1038
	40 – 55	35.2458	17.1646	40.3269	21.8849
	60+	33.1643	23.8068	47.8064	20.8640
	TOTAL	99.6200	80.2900	130.7300	100.1000
8	5 – 15	4.8719	13.2134	3.5457	16.0437
	20 – 35	28.3049	25.2646	25.9640	33.3467
	40 – 55	45.1245	17.7334	45.7929	35.3644
	60+	29.3758	13.3188	44.4177	1.6850
	TOTAL	107.68	69.53	119.72	86.44
10	5 – 15	3.0248	11.4331	3.8276	12.2741
	20 – 35	18.5914	28.8471	18.8773	28.4542
	40 – 55	42.2431	23.5164	44.3425	31.2806
	60+	45.9337	26.7396	84.3777	19.9878
	TOTAL	109.7900	90.5362	151.4300	92.0000
11	5 – 15	6.8337	2.7939	2.7595	9.0868
	20 – 35	20.6792	17.4300	20.7908	27.1626
	40 – 55	19.9948	32.7230	89.4905	28.8436
	60+	22.1605	49.9931	81.5891	27.1970
	TOTAL	69.6700	102.9400	194.6299	92.2900

Table 19. Volume per hectare by diameter class

Climatic Type	DBH Class	Establishment D	Establishment ND	5th yr. remeasurement D	5th yr. remeasurement ND
1	5 – 15	4.8186	11.8226	5.4752	13.3215
	20 – 35	23.7732	36.1818	18.3856	28.7453
	40 – 55	33.5526	21.7182	37.4791	32.4080
	60+	25.4334	4.1298	34.3310	17.3684
	TOTAL	87.7780	73.8524	95.6709	91.8430
2	5 – 15	4.2011	8.6219	4.4398	11.4677
	20 – 35	20.1376	22.3588	20.7743	29.9317
	40 – 55	37.1971	19.7004	45.4919	26.5889
	60+	40.3457	18.6588	64.7763	22.4038
	TOTAL	101.8815	69.3399	135.4823	90.3921
3	5 – 15	6.1550	8.5732	5.2417	10.6736
	20 – 35	24.6596	22.8020	23.0652	28.5478
	40 – 55	37.3327	20.5804	36.3819	19.9436
	60+	34.9781	9.5442	59.1215	10.7035
	TOTAL	103.1254	61.4998	123.8103	69.8885
4	5 – 15	2.7712	6.7346	1.4774	2.2420
	20 – 35	19.3191	18.5540	16.4771	23.1879
	40 – 55	33.9222	15.7134	41.6120	25.6051
	60+	72.5735	36.8356	81.4910	25.0474
	TOTAL	128.5860	71.8376	141.0575	76.0824

Appendix 1. Volume table equations

Region	Species group	Volume equation
Northern Luzon	Non-dipterocarp	VOL (m^3) = .00005109 (D^2H)
	Dipterocarp	VOL (m^3) = .00005203 (D^2H)
Southern Luzon	Non-dipterocarp	VOL (m^3) = .00005204 (D^2H)
	Dipterocarp	VOL (m^3) = .00005171 (D^2H)
Eastern Visayas	Non-dipterocarp*	______________
	Dipterocarp	VOL (m^3) – .00005231 (D^2H)
Western Visayas	Non-dipterocarp	VOL (m^3) – .00004874 (D^2H)
	Dipterocarp	VOL (m^3) = .00004649 (D^2H)
Eastern Mindanao	Non-dipterocarp	VOL (m^3) – .00004961 (D^2H)
	Dipterocarp	VOL (m^3) = .00005087 (D^2H)
Central Mindanao	Non-dipterocarp	VOL (m^3) – .00005039 (D^2H)
	Dipterocarp	VOL (m^3) = .00005019 (D^2H)
Western Mindanao	Non-dipterocarp	VOL (m^3) = .00004840 (D^2H)
	Dipterocarp	VOL (m^3) = .00004668 (D^2H)

*No sample measurements were collected for the species group in the region.

Appendix 2. Representative concessions used in the study

REGION		CT	No. of plots
1			
(a)	Ilocos Consolidated Timber	1	10
2			
(a)	North Luzon Timber Inc.	3	4
(b)	FCA Timber	3	18
(c)	Associated Wood Industries	3	16
(d)	Luzon Loggers	4	27
(e)	North Luzon Mahogany Inc.	3	12
(f)	Isabela Sierra	3	20
(g)	La Villa de Manila	3	15
(h)	Taggat Industries, Inc.	3	201
			301
3			
(a)	Zambales Timber Corporation	1	16
4			
(a)	Mindoro Timberland	4	13
(b)	Dingalan Forest Product Inc.	2	18
(c)	Western Palawan Timber	3	9
(d)	Pagdanan Timber	1	17
			57
6			
(a)	Negros Investment Development Co.	2	5
(b)	Jose Fernandez Timber Company	3	4
(c)	Victorino Mapa	3	7
(d)	Phil. American Timber Company	3	3
(e)	Insular Lumber Co. of the Phil.	1	27
(f)	Negros Timber Company Inc.	3	4
(g)	Pan Oriental Logging Lumber Co.	3	6
(h)	Basay Lumber Corporation	2	8
(i)	Northern Negros Logging Corporation	2	5
(j)	Modesto Chua	3	5
			74
8			
(a)	Basey Wood Industries, Inc.,	2	10
(b)	German B. Aranez Inc.	2	18
(c)	San Joaquin Lumber Mills Inc.	2	7
(d)	Pava Logging Corporation	2	4
			39

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(a)	Maco Stevedoring	2	6
(b)	Silago Timber Corporation	2	8
(c)	Looc Bay Lumber	2	10
(d)	United Timber Export Company	2	2
(e)	Lauan Dev't. Corporation	2	5
(f)	San Jose Timber Corporation	2	14
(g)	Leyté Asia Lumber Company	2	15
(h)	Northern Leyte Timber Company	2	13
			73

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(a)	T. H. Valderrama and Sons Inc.	3	9
(b)	Talakag Timber Inc.	3	6
(c)	Anakan Lumber Company	3	9
(d)	Nasipit Lumber Company	2	52
(e)	Caridad Almendras Enterprises	3	1
(f)	P. N. Roa Enterprises	3	8
(g)	Del Rosario and Sons Log. Ent. Inc.	2	7
(h)	Sta. Inés Melale Veneer	2	21
(i)	Butuan Logs Inc.	2	4
			117

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(a)	Aras–asan Timber Company	2	11
(b)	Anchorage Wood Industries	2	5
(c)	Lianga Bay Lumber Company	2	4
(d)	Surigao Development Corporation	2	10
(e)	Davao Timber Corporation	2	13
(f)	Valderrama Lumber Corporation	2	20
(g)	L.S Sarmiento Company, Inc.	2	6
(h)	Bislig Lumber Company Inc.	2	10
(i)	Manuel Nieto Co. Inc.	2	9
(j)	B.F Cantillan Lumber Corp.	2	7
(k)	Paper Industries Corp. of the Phil.	2	32
(l)	Davao Stevedore Terminal Co. Inc.	2	2
(m)	North Camarines Lumber Company	2	8
(n)	Elias Dacudao Ent.	2	5
(o)	Pahamotang Logging Entr.	2	7
(p)	Aguinaldo Devt. Corp.	2	6
(q)	Gonzalo Puyat & Sons Inc.	2	22
(r)	Alcantara And Sons, Inc.	4	5
			182

Summary by Climatic Type

Climatic Type	1	=	70 plots
	2	=	409 plots
	3	=	357 plots
	4	=	45 plots
TOTAL			881 plots

出典

Uriarte, M T , Virtucio, F D (1988) Growth, Composition and Structure of Logged-over Dipterocarp Forests, Occasional Paper No 2 (1988), College Laguna 1-28

天然林　アジア　　フィリピン　（３）
フタバガキ科グループと非フタバガキ科グループに森林タイプ区分したＰＡＩ。
region毎のclimatic type、location type別の収穫予想表。
regionは天然林フィリピン（２）を、climatic typeは同（１）を参照。

成長・収穫に関する表，図，式など

Making use of the set of data gathered from research plots originally established in Basilan in 1950 which were remeasured in 1954, Reyes (1958) analyzed the growth of commercial dipterocarps in the area. He calculated the average periodic annual increment in diameter for each diameter class as follows:

$$\text{PAI} = \frac{\text{Total increment of trees in diameter class}}{(\text{no. of trees}) \times (\text{no. of years between measurements})}$$

The calculated values of PAI were adjusted afterwards through the use of free hand curves.The derived PAI were used to determine the diameter reached after years by trees belonging to a particular diameter class and the number of years needed by trees in a diameter class to reach a given class.

On a graphing paper, the periodic annual increment was plotted using diameter classes as abscissa and diameter PAI as ordinate. Smooth curves were then drawn.

Later, Canonizado (1969) developed a mathematical model for the average periodic annual increment which allows the use of regression analysis and electronic computers in deriving growth tables. Diameter growth projection tables were generated with the formula later refined by Canonizado as follows:

1) Tabulation of the periodic annual growth. The actual data were fitted to either of the following equations:

(a) Linear equation

$$\text{PAI} = a + a_1 \text{DBH}$$

(b) Parabolic equation

$$\text{PAI} = a + a_1 \text{ DBH} + a_2 \text{DBH}^2$$

where:

PAI is the periodic annual increment

DBH is the diameter at breast height

a_0, a_1 and a_3 are constants

PAI per dbh is calculated with the use of the following formula:

$$\text{PAI} = \frac{t\,(\text{diameter increment})}{(\text{no. of trees involved}) \times (\text{years elapsed after logging})}$$

(2) The tabulation of the years in class was:

$$\text{Years in class} = \frac{\text{Diameter class interval}}{\text{PAI}}$$

(3) Computation of the projected values by adding consecutively the years in class from initial diameter class until the sum approximates the number of years of interest.

Generally, PAI for the different regions showed some variations. This may be due to variations in growth of species within species group and also to some errors. In the computation there are trees which have pulled the PAI within the diameter class (Uriarte

1980). This development was considered a significant achievement in predicting the growth of Philippine dipterocarps.

Results of the study were used not only in improving the management plans in Basilan but also in the preparation of management plans in other similar forest areas particularly where there are no available growth data (del Castillo 1973).

Methodology

Eight-hundred eighty-one (881) continuous forest inventory (CFI) plots established in the logged-over areas of different working units in the different provinces and remeasured five years after establishment were used. These were classified according to regions and climatic types. All regions except Regions 5, 9 and 12 were represented. Most of the CFI plots in Region 5 were disturbed by kaingin making and those in Regions 9 and 12 were affected by the critical peace and order condition, thus, no remeasurement was done.

All the tree species found in each plot were broadly grouped as dipterocarps and non–dipterocarps.

Diameter growth projection equations were generated based on the equation derived from the functional relationships between periodic annual increment as the dependent variable with dbh as the independent variable. All equations derived were quadratic.

Diameter growth projection tables were generated using the regression procedure. The projected volume after 30, 35, 40 and 45 years were also computed.

Table 1. Periodic annual increment (PAI) equation for dipterocarps by climatic type/region

Climatic type	Equation
1	PAI = 0 13813 + 0 03058 (DBH) – 0 00035 $(DBH)^2$, R^2 = 0.89
2	PAI = 0 17980 + 0 02654 (DBH) – 0 00033 $(DBH)^2$, R^2 = 0 89
3	PAI = 0.18747 + 0 02276 (DBH) – 0.00029 $(DBH)^2$, R^2 = 0 90
4	PAI = 0 12769 + 0.02820 (DBH) – 0 00034 $(DBH)^2$, R^2 = 0 87
Region	
1	PAI = 0 04274 + 0 03058 (DBH) – 0 00030 $(DBH)^2$, R^2 = 0 85
2	PAI = 0.18432 + 0 02546 (DBH) – 0 00031 $(DBH)^2$, R^2 = 0 89
3	PAI = 0.03415 + 0 02835 (DBH) – 0 00033 $(DBH)^2$, R^2 = 0 84
4	PAI = 0 11632 + 0 02872 (DBH) – 0 00034 $(DBH)^2$, R^2 = 0.84
6	PAI = 0.20369 + 0.02386 (DBH) – 0 00031 $(DBH)^2$, R^2 = 0 89
7	PAI = 0.17127 + 0.02382 (DBH) – 0.00031 $(DBH)^2$, R^2 = 0 86
8	PAI = 0 20318 + 0 02290 (DBH) – 0 00030 $(DBH)^2$, R^2 = 0.90
10	PAI = 0 24041 + 0 02311 (DBH) – 0.00031 $(DBH)^2$, R^2 = 0.91
11	PAI = 0 24156 + 0.2352 (DBH) – 0.00029 $(DBH)^2$, R^2 = 0 92

Table 2. Periodic annual increment (PAI) equation for non-dipterocarps by climatic type/region

Climatic type	Equation
1	$PAI = 0\ 22527 + 0.0274\ (DBH) - 0.00034\ (DBH)^2,\ R^2 = 0\ 89$
2	$PAI = 0.18204 + 0.02158\ (DBH) - 0.00027\ (DBH)^2,\ R^2 = 0.90$
3	$PAI = 0\ 14923 + 0.02491\ (DBH) - 0\ 00034\ (DBH)^2,\ R^2 = 0.95$
4	$PAI = 0.20424 + 0\ 02482\ (DBH) - 0\ 00034\ (DBH)^2,\ R^2 = 0\ 90$
Region	
1	$PAI = 0\ 26597 + 0\ 02717\ (DBH) - 0\ 00037\ (DBH)^2,\ R^2 = 0\ 89$
2	$PAI = 0\ 20156 + 0\ 02309\ (DBH) - 0\ 00031\ (DBH)^2,\ R^2 = 0\ 86$
3	$PAI = 0.02243 + 0\ 02226\ (DBH) - 0.00024\ (DBH)^2,\ R^2 = 0\ 84$
4	$PAI = 0.12002 + 0\ 03128\ (DBH) - 0.00038\ (DBH)^2,\ R^2 = 0\ 90$
6	$PAI = 0.16314 + 0.02478\ (DBH) - 0.00032\ (DBH)^2,\ R^2 = 0\ 89$
7	$PAI = 0\ 17815 + 0.02203\ (DBH) - 0.00030\ (DBH)^2,\ R^2 = 0\ 91$
8	$PAI = 0\ 12004 + 0\ 02373\ (DBH) - 0.00030\ (DBH)^2,\ R^2 = 0\ 91$
10	$PAI = 0\ 19573 + 0\ 02373\ (DBH) - 0.00031\ (DBH)^2,\ R^2 = 0\ 89$
11	$PAI = 0\ 17406 + 0\ 02083\ (DBH) - 0\ 00024\ (DBH)^2,\ R^2 = 0\ 90$

Table 3. Periodic annual increment of dipterocarps by region

DBH	PERIODIC ANNUAL INCREMENT — REGION 1	2	3	4	6	7	8	10	11	Average
5	0.18	0.30	0.17	0.25	0.32	0.28	0.31	0.33	0.35	0.27
10	0.32	0.41	0.20	0.37	0.41	0.38	0.40	0.44	0.45	0.37
15	0.43	0.50	0.38	0.47	0.49	0.46	0.48	0.52	0.53	0.46
20	0.53	0.57	0.47	0.55	0.56	0.52	0.54	0.58	0.59	0.53
25	0.62	0.62	0.53	0.62	0.60	0.57	0.58	0.62	0.64	0.53
30	0.69	0.66	0.58	0.67	0.64	0.60	0.61	0.65	0.68	0.63
35	0.75	0.69	0.61	0.70	0.65	0.62	0.63	0.67	0.70	0.65
40	0.79	0.70	0.63	0.71	0.65	0.62	0.63	0.66	0.71	0.66
45	0.81	0.69	0.62	0.71	0.64	0.60	0.61	0.65	0.70	0.65
50	0.82	0.67	0.60	0.69	0.61	0.57	0.58	0.61	0.68	0.63
55	0.82	0.63	0.57	0.65	0.56	0.53	0.53	0.56	0.64	0.59
60	0.80	0.58	0.51	0.60	0.50	0.46	0.47	0.50	0.59	0.54
65	0.76	0.51	0.44	0.52	0.43	0.39	0.39	0.42	0.52	0.47
70	0.71	0.42	0.36	0.43	0.33	0.29	0.30	0.32	0.44	0.38
75	0.65	0.32	0.25	0.33	0.22	0.18	0.19	0.21	0.34	0.28
Average	9.69	0.55	0.47	0.55	0.51	0.47	0.48	0.52	0.57	0.51

Table 4. Periodic annual increment of dipterocarps by climatic type

DBH	CLIMATIC TYPE				
	1	2	3	4	Average
5	0.28	0.30	0.29	0.28	0.28
10	0.41	0.41	0.39	0 38	0.40
15	0.52	0.50	0.48	0.47	0.49
20	0.61	0.58	0.53	0.55	0.57
25	0.68	0.63	0.57	0.62	0.63
30	0.74.	0.67	0.61	0.66	0.67
35	0.77	0.69	0.63	0.69	0.70
40	0.79	0.70	0.63	0.70	0.71
45	0.79	0.69	0.62	0.69	0.70
50	0.78	0.66	0.59	0.67	0.68
55	0.74	0.62	0.55	0.63	0.63
60	0.69	0.55	0.50	0.57	0.58
65	0.62	0.47	0.43	0.49	0.50
70	0.54	0.38	0.35	0.40	0.42
75	0.43	0.27	0.25	0.29	0.31
Average	0.63	0.54	0.49	0 54	0.55

Table 5. Periodic annual increment of non-dipterocarps by region

DBH	PERIODIC ANNUAL INCREMENT REGION											
	1	2	3	4	5	6	7	8	9	10	11	Average
5	0.39	0.31	0.13	0.27	0.35	0.28	0.28	0.23	0.31	0.31	0.27	0.28
10	0.50	0.40	0.22	0.39	0.40	0.38	0.37	0.33	0.43	0.40	0.36	0.38
15	0.59	0.48	0.30	0.50	0.45	0.46	0.44	0.41	0.53	0.48	0.43	0.46
20	0.66	0.54	0.37	0.59	0.49	0.53	0.50	0.47	0.61	0.54	0.49	0 53
25	0.71	0.59	0.43	0.66	0.52	0.58	0.54	0.52	0.68	0.59	0.54	0.58
30	0.75	0.62	0.47	0.71	0.54	0.62	0.57	0.56	0.73	0.62	0.58	0.61
35	0.77	0.63	0.51	0.74	0.56	0.64	0.58	0.58	0.76	0.64	0.60	0.64
40	0.76	0.63	0.53	0.75	0.57	0.64	0.59	0.58	0.77	0.64	0.60	0.64
45	0.74	0.61	0.54	0.74	0.57	0.63	0.56	0.57	0.76	0.62	0.61	0.63
50	0.70	0.58	0.53	0.71	0.56	0.60	0.53	0.55	0.74	0.59	0.59	0.61
55	0.64	0.53	0.52	0.66	0.54	0.55	0.48	0.51	0.69	0.54	0.57	0.56
60	0.56	0.47	0.49	0.60	0.52	0.49	0.42	0.45	0.63	0.48	0.53	0.51
65	0.47	0.39	0.45	0.51	0.49	0.41	0.34	0.38	0.55	0.40	0.48	0.44
70	0.36	0.30	0.40	0.40	0.45	0.32	0.25	0.29	0.46	0.30	0.42	0.35
75	0.22	0.19	0.34	0.28	0.40	0.21	0.14	0.19	0.34	0.19	0.34	0 25
Average	8.82	0.48	0.42	0.57	0.49	0.49	0.44	0.44	0.60	0.49	0.49	0 50

Table 6. Periodic annual increment of non-dipterocarps by climatic type

DBH	CLIMATIC TYPE 1	2	3	4	Average
5	0.36	0.28	0.27	0.32	0.31
10	0.47	0.37	0.37	0.42	0.41
15	0.56	0.44	0.45	0.50	0.49
20	0.64	0.51	0.52	0.56	0.56
25	0.70	0.55	0.57	0 61	0 61
30	0.75	0.59	0.61	0.64	0.65
35	0.78	0.61	0.63	0.65	0 67
40	0.79	0.61	0 63	0.65	0 67
45	0.78	0.61	0.62	0.63	0.66
50	0.76	0.58	0 59	0.59	0.63
55	0.71	0.55	0.54	0 53	0.58
60	0.66	0.51	0.48	0.46	0.53
65	0.58	0.44	0 41	0.37	0.45
70	0.49	0.37	0.31	0.26	0.36
75	0.38	0.28	0.21	0.13	0.25
Average	0.63	0 49	0.48	0 49	0 52

Intended user Dipterocarps
Location Climatic type I

Table 7. Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 282	17 71	6 51	8 25	10 25	12 56	15 21	18 23	21 63	25 40	29 47	33 76	38 17	42 58	46 91	51 10	55 08	58 85	62 38	65 69	68 77	71 65	97 1	81 6	68 7
10	0 409	12 23	12 17	14 61	17 34	20 37	23 72	27 35	31 23	35 30	39 48	43 68	47 84	51 88	55 77	59 47	62 96	66 24	69 31	72 18	74 87	77 37	86 2	70 7	57 6
15	0 518	9 65	17 72	20 72	23 98	27 51	31 26	35 20	39 25	43 36	47 45	51 45	55 33	59 04	62 56	65 88	69 00	71 92	74 66	77 21	79 59	81 81	76 7	61 3	48 2
20	0 610	8 20	23 17	26 59	30 24	34 06	38 03	42 08	46 13	50 14	54 05	57 82	61 41	64.82	68 02	71 03	73 84	76 47	78 92	81 21	83 34	85 33	68.3	53 0	39 8
25	0 684	7 31	28 53	32 25	36 13	40 12	44 16	48 18	52 14	55 98	59 67	63.18	66 49	69 61	72 53	75 25	77 80	80 17	82 38	84 44	86 36	88 16	60 7	45 5	32.3
30	0 741	6 75	33 78	37 71	41 71	45 74	49 74	53 66	57 44	61 07	64 51	67 75	70 80	73 64	76 30	78 77	81 07	83.21	85 20	87 06	88 79	90 41	53 7	38 5	25 3
35	0 780	6 41	38 95	42 96	46 99	50 97	54 85	58 59	62 17	65 55	68 73	71 70	74 48	77.07	79 47	81.70	83 78	85 71	87 50	89 18	90 74	92 19	47 1	31 9	18 8
40	0 801	6 24	44 02	48 04	52 00	55 85	59 55	63 07	66 39	69 51	72 42	75 13	77 85	79 98	82 15	84 16	86 02	87 75	89 36	90 86	92 26	93 57	40 8	25 6	12.5
45	0 805	6 21	49 01	52 94	56 76	60 41	63 88	67 14	70 19	73 04	75 67	78.12	80 38	82 47	84.40	86.20	87 86	89.40	90 84	92 17	93 42	94 58	34 7	19 4	6 2
50	0 792	6 31	53 91	57 68	61 28	64 69	67 88	70 86	73 62	76 17	78 63	80 71	82 72	84.58	86 29	87 87	89 34	90.71	91 97	93.15	94 25	95 28	28 5	13 2	
55	0 761	6 57	58 72	62 26	65 59	68 70	71 59	74 25	76 71	78 97	81 05	82 91	84 73	86 35	87.85	89 23	90.51	91 70	92 81	93 84	94 80	95 69	22 2	6 8	
60	0 713	7 01	63 46	66 69	69 70	72 47	75 02	77 36	79.50	81 46	83 26	84 91	86 43	87 82	89 11	90.30	91.40	92 42	93 37	94 25	95 07	95 84	15 5		
65	0 647	7 73	68 11	70 98	73 61	76 02	78 21	80 20	82 02	83 68	85 20	86 58	87 86	89 03	90 11	91 10	92 02	92 88	93 67	94 41	95 10		8 2		
70	0 564	8 87	72 69	75 13	77 35	79 35	81 16	82 80	84 29	85 64	86 88	88 00	89 04	89.98	90 86	91 66	92 41	93 10	93.74						
75	0 463	10 80	77 19	79 15	80 91	82 49	83 90	85 18	86 33	87 38	88 33	89.18	89 98	90 71	91 38	92 00	92 57	93 10							
80	0 345	14 51	81 62	83 05	84 31	85 44	86 44	87 35	88 16	88 89	89 56	90 16	90 72	91.23	91 70	92.13									
85	0 209	23 96	85 97	86 82	87 56	88 22	88 80	89 32	89 79	90 21	90 59	90 94	91 25	91.54	91.81										
90	0 055	90 37	90 26	90 48	90 67	90 83	90 98	91 11	91 23	91 34	91.43	91 52	91 60	91.67											
95	0 000	999 99	94 47																						
100	0 000	999 99	98 62																						

Diameter growth function (G = 13813 + 03058 D — 00035 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Non-dipterocarps
Location Climatic type I

Table 8 Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 354	14 13	6 88	9 00	11 39	14 06	17 05	20 33	23 90	27 71	31 70	35 79	39 90	43 95	47 90	51 69	55 30	58 71	61 92	64 93	67 75	70 39	99 2	82 0	67 7
10	0 465	10 75	12 45	15 15	18 12	21 35	24 83	28 51	32 36	36 31	40 30	44 26	48 13	51 87	55 45	58 86	62 07	65 10	67 94	70 59	73 08	75 41	88 9	71 7	57 5
15	0 560	8 93	17 92	21 08	24 47	28 05	31 81	35 67	39 60	43 51	47 37	51 13	54 74	58 19	61 46	64 54	67 43	70 15	72 69	75 07	77 29	79 37	79 7	62 7	48,5
20	0 637	7 85	23 29	26 79	30 46	34 25	38 13	42 03	45 90	49 69	53 36	56 88	60 23	63 40	66 38	69 18	71 80	74,25	76 54	78 68	80 68	82 55	71 5	54 6	40 4
25	0 698	7 17	28 57	32 30	36 12	40 01	43 89	47 72	51 46	55 07	58 51	61 78	64 87	67 77	70 49	73 03	75 40	77 61	79 68	81 61	83 41	85 10	64 1	47 2	33 0
30	0 741	6 75	33 76	37 61	41 50	45 37	49 17	52 86	56 41	59 80	63 00	66 02	68 84	71 49	73 95	76 25	78 39	80,39	82 25	83 99	85 61	87 13	57 1	40 3	26 1
35	0 768	6 51	38 87	42 75	46 60	50 37	54 02	57 52	60 85	63 99	66 94	69 69	72 26	74 66	76 88	78 95	80 88	82,68	84 35	85 91	87 37	88 73	50 6	33 7	19 5
40	0 777	6 43	43 88	47 71	51 45	55 06	58 51	61 77	64 84	67 72	70 40	72 90	75 21	77 37	79 36	81 22	82 94	84 55	86 04	87 43	88 73	89 95	44 2	27 3	13 0
45	0 770	6 50	48 81	52 51	56 07	59 46	62 65	65 65	68 45	71 05	73 46	75 69	77 76	79 68	81 45	83 10	84 63	86 05	87 37	88 61	89 76	90 83	37 9	20 8	6 6
50	0 745	6 71	53 66	57 16	60 47	63 59	66 50	69 20	71 71	74 02	76 16	78 14	79 96	81 64	83 20	84 64	85 98	87 23	88 39	89 47	90 47	91 42	31 5	14 3	
55	0 704	7 10	58 43	61 65	64 67	67 48	70 07	72 46	74 66	76 68	78 54	80 26	81 84	83 29	84 64	85 89	87 04	88 11	89 11	90 04	90 91	91 73	24 9	7 4	
60	0 645	7 75	63 12	66 01	68 68	71 13	73 38	75 44	77 33	79 06	80 64	82 10	83 43	84 66	85 80	86 85	87 83	88 73	89 58	90 36	91 10	91 78	17 6		
65	0 570	8 78	67 73	70 23	72 51	74 58	76 46	78 18	79 74	81 17	82 48	83 67	84 77	85 78	86 71	87 57	88 37	89 11	89 80	90 44			9 5		
70	0 477	10 48	72 27	74 32	76 16	77 83	79 33	80 69	81 92	83 05	84 07	85 01	85 87	86 66	87 38	88 06	88 68	89 26							
75	0 368	13 60	76 73	78 28	79 66	80 89	81 99	82 99	83 89	84 70	85 45	86 12	86 74	87 32	87 84	88 33	88 78								
80	0 241	20 72	81 13	82 12	83 00	83 77	84 47	85 09	85 65	86 16	86 62	87 03	87 42	87 77	88 10	88 40									
85	0 098	51 14	85 45	85 85	86 19	86 50	86 76	87 01	87 22	87 42	87 59	87 75	87 90	88 04	88 16										
90	0 000	999 99	89 71																						
95	0 000	999 99	93 90																						
100	0 000	999 99	98 02																						

Diameter growth function (G = 22527 + 0274 D — 00034 D2)
Growth function computed by Monina T Urlarte, ERDB

Intended user Dipterocarps
Location Climatic type 2

Table 9 Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	86 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 304	16 43	6 61	8 43	10 47	12 75	15 31	18 14	21 24	24 59	28 14	31 85	35 63	39 44	43 19	46 85	50 38	53 74	56 94	59 96	62 80	65 47	109 3	90 1	74 5
10	0 412	12 13	12 17	14 55	17 17	20 02	23 10	26 38	29 83	33 41	37 07	40 74	44 37	47 93	51 37	54 66	57 81	60 79	63 60	66 25	68 74	71 08	97 7	78 7	63 0
15	0 504	9 93	17 62	20 46	23 50	26 72	30 11	33 61	37 19	40 80	44 39	47 92	51 34	54 64	57 79	60 78	63 61	66 28	68 80	71 16	73 38	75 46	87 5	68 7	53 0
20	0 579	8 64	22 99	26 15	29 48	32 93	36 47	40 04	43 62	47 14	50 59	53 91	57 11	60 15	63 03	65 75	68 31	70 72	72 98	75 10	77 09	78 95	78 5	59 8	44 1
25	0 637	7 85	28 26	31 66	35 15	38 70	42 27	45 82	49 29	52 67	55 92	59 03	61 98	64 76	67 39	69 86	72 18	74 35	76 39	78 29	80 08	81 76	70 3	51 6	36 0
30	0 679	7 36	33 45	36 97	40 53	44 09	47 61	51 04	54 35	57 54	60 57	63 44	66 14	68 69	71 07	73 31	75 40	77 35	79 18	80 90	82 51	84 01	62.7	44 0	28 5
35	0 704	7 10	38 55	42 11	45 65	49 14	52 52	55 78	58 90	61 85	64 64	67 27	69 73	72 04	74 19	76 20	78 08	79 84	81 48	83 01	84 45	85 80	55 6	36 8	21 3
40	0 713	7 01	43 56	47 08	50 53	53 86	57 06	60 11	62 99	65 70	68 24	70 62	72 84	74 91	76 84	78 63	80 31	81 88	83 34	84 70	85 98	87 18	48 7	29 8	14 2
45	0 706	7 08	48 49	51 90	55 18	58 31	61 27	64 07	66 69	69 14	71 43	73 55	75 53	77 37	79 08	80 67	82 15	83 53	84 82	86 03	87 16	88 21	41 8	22 8	7 2
50	0 682	7 33	53 35	56 56	59 61	62 49	65 18	67 70	70 05	72 23	74 25	76 12	77 86	79 47	80 96	82 35	83 65	84 85	85 98	87 03	88 01	88 93	34 9	15 7	
55	0 641	7 80	58 12	61 08	63 84	66 42	68 82	71 04	73 09	74 99	76 74	78 36	79 86	81 24	82 53	83 72	84 83	85 87	86 83	87 73	88 57	89 36	27 6	8 1	
60	0 584	8 56	62 82	65 45	67 89	70 13	72 20	74 11	75 86	77 46	78 95	80 31	81 57	82 73	83 81	84 81	85 74	86 61	87 41	88 17	88 87	89 54	19 7		
65	0 511	9 79	67 45	69 70	71 76	73 64	75 35	76 92	78 36	79 68	80 88	81 99	83 02	83 96	84 83	85 64	86 40	87 10	87 75	88 36	88 93		10 7		
70	0 421	11 89	72 00	73 81	75 46	76 94	78 29	79 51	80 63	81 65	82 58	83 43	84 22	84 95	85 62	86 24	86 82	87 35	87 85						
75	0 314	15 92	76 48	77 81	79 00	80 06	81 02	81 89	82 68	83 40	84 05	84 65	85 20	85 71	86 18	86 61	87 02	87 39							
80	0 191	26 18	80 90	81 69	82 39	83 01	83 57	84 07	84 53	84 94	85 31	85 66	85 97	86 27	86 53	86 78									
85	0 051	97 18	85 24	85 45	85 63	85 79	85 94	86 07	86 18	86 29	86 38	86 47	86 55	86 63	86 70										
90	0 000	999 99	89 52																						
95	0 000	999 99	93 73																						
100	0 000	999 99	97 88																						

Diameter growth function (G = 1798 + 02654 D — 00033 D2)
Growth function computed by Monina T Urlarte ERDB

Intended user Non-dipterocarps
Location Climatic type 2

Table 10. Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 283	17 66	6 49	8 12	9 91	11 88	14 03	16 37	18 89	21 61	24 48	27 50	30 63	33 83	37 07	40 30	43 49	46 61	49 65	52 57	55 38	58 07	125 8	103 7	85 6
10	0 371	13 48	11 93	14 02	16 27	18 69	21 26	23 99	26 86	29 84	32 90	36 02	39 16	42 29	45 39	48 42	51 36	54.21	56 94	59 56	62 07	64 45	112 7	90 9	72 7
15	0 445	11 24	17 30	19 75	22 34	25 08	27 93	30 88	33 91	36 99	40 08	43 17	46 22	49 21	52 13	54 94	57 66	60 25	62 74	65 11	67 36	69 50	101 2	79 5	61 3
20	0 506	9 89	22 60	25 32	28 15	31 09	34 09	37 15	40 22	43 29	46 33	49 32	52 22	55 04	57 76	60 36	62 85	65 23	67 49	69 63	71 67	73 60	90 9	69 3	51 2
25	0 553	9 05	27 82	30 73	33 72	36 76	39 82	42 89	45 93	48 92	51 84	54 67	57 41	60 03	62 54	64 94	67 22	69 38	71 44	73 38	75 22	76 97	81 5	59 9	41 8
30	0 586	8 53	32 97	35 99	39 05	42 12	45 16	48 17	51 11	53 97	56 73	59 39	61 93	64 36	66 67	68 86	70 93	72 90	74 76	76 52	78 18	79 75	72 7	51 2	33 1
35	0 607	8 24	38 05	41 11	44 17	47 19	50 16	53 04	55 84	58 53	61 11	63 57	65 91	68 13	70 23	72 22	74 10	75 88	77 55	79 14	80 63	82 04	64 4	42 8	24 7
40	0 613	8 15	43 06	46 10	49 09	52 00	54 83	57 56	60 17	62 67	65 04	67 30	69 43	71 44	73 34	75 13	76 82	78 41	79 91	81 32	82 66	83 92	56 4	34 7	16 6
45	0 606	8 25	48 01	50 95	53 81	56 57	59 22	61 75	64 16	66 44	68 59	70 62	72.54	74 34	76 04	77 63	79 13	80 55	81 88	83 13	84 31	85 43	48 4	26 5	8 4
50	0 586	8 53	52 89	55 68	58 36	60 91	63 35	65 65	67 82	69 87	71 79	73.60	75 29	76 89	78 38	79 78	81 10	82 34	83 51	84 60	85 64	86 62	40 3	18 2	
55	0 552	9 05	57 70	60 28	62 73	65 05	67 23	69 28	71 20	73 00	74 68	76 26	77 74	79 12	80 41	81 62	82 76	83 83	84 83	85 78	86 67	87 51	31 8	9 4	
60	0 505	9 90	62 46	64 77	66 94	68 98	70 88	72 66	74 31	75 86	77 30	78 64	79 89	81 06	82 15	83 18	84 14	85 04	85 88	86 68	87 43	88 14	22 6		
65	0 444	11 26	67 15	69 14	71 00	72 73	74,33	75 81	77 19	78 47	79 65	80 76	81.78	82 74	83 64	84 47	85 26	85 99	86 68	87 33	87 94	88 52	12 3		
70	0 370	13 53	71 77	73 41	74 91	76 30	77 58	78 75	79 84	80 84	81 77	82.64	83 44	84 19	84 88	85 54	86 14	86 71	87 25	87 75	88 23	88 68			
75	0 282	17 74	76 34	77 57	78 69	79 71	80 64	81 50	82 28	83 01	83 68	84 30	84 88	85 41	85 91	86 38	86 81	87 22	87 60	87 96	88 30				
80	0 180	27 71	80 86	81 63	82 32	82 95	83 53	84 05	84 53	84 98	85 38	85 76	86 11	86 43	86 73	87 01	87 28	87 52	87 75	87 97					
85	0 066	76 23	85 31	85 58	85 83	86 05	86 25	86 44	86 60	86 76	86 90	87 03	87 15	87 26	87 36	87 46	87 55	87 63							
90	0 000	999 99	89 71																						
95	0 000	999 99	94 05																						
100	0 000	999 99	98 33																						

Diameter growth function (G = 18204 + 02158 D — 00027 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Climatic type 3

Table 11. Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 294	17 01	6 55	8 25	10 14	12 21	14 49	16 97	19 66	22 54	25 59	28 77	32 06	35 39	38 73	42 05	45 29	48 44	51 47	54 38	57 15	59 79	122 4	100 4	82 6
10	0 386	12 95	12 01	14 20	16 56	19 11	21 82	24 69	27 71	30 83	34 03	37 27	40 52	43 73	46 88	49 94	52 90	55 74	58 45	61 04	63 49	65 82	109 7	88 0	70 1
15	0 464	10 78	17 40	19 96	22 68	25 54	28 53	31 61	34 77	37 96	41 16	44 33	47 45	50 48	53 42	56 24	58 94	61 52	63 97	66 29	68 49	70 57	98 6	77 0	59 2
20	0 527	9 49	22 71	25 55	28 51	31 57	34 69	37 87	41 05	44 20	47 31	50 35	53 29	56 13	58 84	61 43	53 90	66 24	68 46	70 55	72 54	74 41	88 7	67 2	49 4
25	0 575	8 69	27 93	30 96	34 07	37 23	40 40	43 56	46 68	49 73	52 70	55 56	58 30	60 93	63 43	65 80	68 04	70 17	72 17	74 06	75 85	77 54	79 6	58 2	40 4
30	0 609	8 21	33 08	36 22	39 39	42 55	45 69	48 77	51 76	54 66	57 45	60 12	62 65	65 06	67 35	69 50	71 54	73 46	75 26	76 97	78 58	80 09	71 2	49 8	32 0
35	0 629	7 95	38 16	41 33	44 48	47 58	50 61	53 55	56 38	59 08	61 68	64 13	66 45	68 65	70 71	72 66	74 50	76 22	77 85	79 37	80 82	82 17	63 2	41 7	24 0
40	0 634	7 89	43 16	46 29	49 35	52 33	55 20	57 96	60 59	63 09	65 45	07 68	69 79	71 76	73 62	75 36	77 00	78 54	79 99	81 35	82 63	83 84	55 5	33 9	16 1
45	0 624	8 01	48 09	51 11	54 02	56 82	59 50	62 04	64 44	66 71	68 84	70 84	72 71	74 47	76 12	77 67	79 12	80 48	81 76	82 96	84 09	85 15	47 9	26 0	8 1
50	0 600	8 33	52 95	55 79	58 50	61 08	63 52	65 81	67 96	69 98	71 87	73 64	75 29	76 83	78 27	79 62	80 89	82 08	83 19	84 23	85 22	86 14	40 0	17 9	
55	0 562	8 90	57 74	60 35	62 81	65 12	67 28	69 31	71 19	72 95	74 59	76 12	77 54	78 87	80 11	81 27	82 35	83 37	84 32	85 21	86 05	86 85	31 8	9 3	
60	0 509	9 82	62 47	64 78	66 94	68 95	70 82	72 55	74 16	75 65	77 03	78 32,	79 51	80 63	81 66	82 63	83 54	84 38	85 92	85 92	86 62	87 28	22 8		
65	0 442	11 32	67 13	69 09	70 91	72 59	74 13	75 56	76 87	78 09	79 22	80 26	81 22	82 12	82 96	83 74	84 47	85 15	85 79	86 39	86 95	87 48	12 4		
70	0 360	13 90	71 72	73 29	74 73	76 04	77 25	78 35	79 37	80 30	81 16	81 96	82 70	83 38	84 02	84 61	85 16	85,68	86 17	86 62	87 05				
75	0 263	19 00	76 25	77 38	78 40	79 33	80 17	80 94	81 65	82 30	82 89	83 44	83 95	84 42	84 86	85 26	85 64	86 00	86 33	86 64					
80	0 152	32 84	80 72	81 36	81 94	82 45	82 92	83 35	83 74	84 09	84 42	84 72	84 99	85 25	85 49	85 71	85 92	86 11							
85	0 027	186 43	85 13	85 24	85 34	85 42	85 50	85 57	85 64	85 70	85 70	85 80	85 85	85 89	85 93	85 97	86 00								
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 18747 + 02276 D — 00029 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Non-dipterocarps
Location Climatic type 3

Table 12 Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 266	18 81	6 40	7 97	9 72	11 67	13 83	16 23	18 85	21 69	24 73	27 93	31 25	34 62	38 01	41 36	44 63	47 80	50 83	53 73	56 48	59 09	124 8	101 8	83 6
10	0 366	13 65	11 92	14 02	16 31	18 79	21 46	24 31	27 31	30 44	33 65	36 91	40 16	43 39	46 54	49 59	52 53	55 33	58 01	60 55	62 95	65 22	111 6	88 9	70 7
15	0 451	11 09	17 34	19 86	22 54	25 38	28 35	31 44	34 60	37 80	41 00	44 17	47 28	50 29	53 20	55 98	58 64	61 16	63 55	65 80	67 93	65 95	100 1	77 7	69 5
20	0 519	9 63	22 67	25 49	28 44	31 50	34 63	37 80	40 98	44 14	47 23	50 25	53 16	55 95	58 62	61 16	63 56	65 83	67 98	70 00	71 90	73 70	90 0	67 7	49.6
25	0 572	8 74	27 92	30 95	34 05	37 21	40 38	43 54	46 65	49 68	52 61	55 44	58 14	60 70	63 14	65 44	67 61	69 66	71 58	73 40	75 10	76 71	80 9	58 6	40 5
30	0 609	8 22	33 08	36 22	39 39	42 55	45 68	48 74	51 71	54 57	57 31	59 92	62 40	64 74	66 95	69 02	70 98	72 82	74 54	76 17	77 69	79 13	72 5	50 2	32 1
35	0 629	7 95	38 16	41 33	44 47	47 56	50 57	53 48	56 26	58 92	61 45	63 83	56 08	68 19	70 18	72 04	73 79	75 43	76 97	78 42	79 78	81 06	64 5	42 1	24 0
40	0 634	7 89	43 16	46 27	49 32	52 27	55 10	57 81	60 38	62 81	65 10	67 25	69 27	71 16	72 93	74 59	76 14	77 59	78 96	80 24	81 44	82 57	56 9	34 2	16 1
45	0 622	8 04	48 08	51 06	53 94	56 70	59 31	61 78	64 11	66 30	68 34	70 25	72 04	73 71	75 26	76 72	78 08	79 36	80 55	81 67	82 72	83 71	49.3	26 4	8 2
50	0 595	8 41	52 92	55 71	58 36	60 87	63 23	65 44	67 50	69 42	71 22	72 89	74 44	75 89	77 24	78 50	79 67	80 77	81 80	82 77	83 67	84 52	41 6	18.2	
55	0 551	9 07	57 68	60 22	62 59	64 81	66 88	68 80	70 58	72 24	73 77	75 19	76 52	77 74	78 89	79 95	80 95	81 88	82 75	83 56	84 32	85 04	33 3	9 6	
60	0 492	10 17	62 38	64 59	66 64	68 53	70 28	71 90	73 39	74 76	76 03	77 21	78 30	79 31	80 25	81 12	81 94	82 70	83 41	84 08	84 71	85 30	24 2		
65	0 416	12 01	67 00	68 83	70 51	72 05	73 45	74 75	75 93	77 02	78 03	78 96	79 81	80 61	81 35	82 03	82 67	83 27	83 83	84 35	84 84	85 30	13 4		
70	0 325	15 39	71 55	72.95	74 22	75 37	76 42	77 37	78 25	79 05	79 78	80 46	81 09	81 66	82 20	82 70	83 16	83 60	84 00	84 38					
75	0 217	22 99	76 03	76 95	77 77	78 51	79 18	79 79	80 35	80 85	81 31	81 74	82 13	82 50	82 83	83 15	83 44	83 71							
80	0 094	53 17	80 44	80 83	81 18	81 49	81 76	82.01	82 24	82 45	82 64	82 81	82 97	83 12	83 26	83 38	83 50								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 14923 + 02491 D — 00032 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Dipterocarps
Location Climatic type 4

Table 13 Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 260	19 22	6 39	7 96	9 75	11 78	14 09	16 69	19 60	22 80	26 27	29 95	33 77	37 66	41 52	45 31	48 97	52 48	55 80	58 94	61 89	64 66	110 7	91 8	76 4
10	0 376	13 31	11 98	14 18	16 62	19 31	22 24	25 41	28 78	32 32	35 97	39 67	43 36	46 98	50 50	53 89	57 12	60 18	63 07	65 79	68 35	70 75	98 4	79 9	64 3
15	0 474	10 54	17 48	20 18	23 09	26 22	29 53	32 98	36 54	40 15	43 77	47 34	50 81	54 17	57 38	60 44	63 33	66 06	68 63	71 04	73 30	75 42	87 8	69 3	53.8
20	0 556	9 00	22 88	25 95	29 20	32 59	36 10	39 66	43 24	46 80	50 28	53 65	56 89	59 98	62 92	65 69	68.29	70 74	73 04	75 20	77 22	79 12	78 4	60.0	44 6
25	0 620	8 06	28 18	31 52	34 97	38 50	42 07	45 62	49 13	52 54	55 83	58 98	61 98	64 81	67 48	69 99	72 35	74 55	76 62	78 55	80 37	82 07	70 0	51 7	36 3
30	0 668	7 49	33 40	36 89	40 44	44 00	47 53	50 99	54 34	57 56	60 64	63 55	66 30	68 88	71 30	73 57	75 69	77 68	79 54	81 27	82 90	84 42	62 3	43 9	28 6
35	0 698	7 16	38 52	42 08	45 63	49 13	52.55	55 84	59 00	62 00	64 83	67 50	70 00	72 34	74 53	76 57	78 47	80 25	81 92	83 47	84 93	86 29	55 0	36 6	21 3
40	0 712	7 03	43 56	47 10	50 56	53 93	57 17	60 26	63 18	65 94	68 52	70 94	73 19	75 29	77 25	79 07	80 77	82 36	83 84	85 23	86 52	87 73	48 0	29 6	14 2
45	0 708	7 06	48 51	51 94	55 26	58 43	61 45	64 29	66 95	69 45	71 77	73 93	75 94	77 81	79 55	81 16	82 67	84 07	85 37	86 60	87 74	88 81	41 2	22 6	7 1
50	0 688	7 27	53 38	56 63	59 73	62 66	65 40	67 97	70 36	72 58	74 64	76 54	78 31	79 95	81 47	82 88	84 20	85 42	86 56	87 63	88 63	89 56	34.2	15 4	
55	0 650	7 69	58 17	61 17	63 99	66 63	69 07	71 34	73 44	75 38	77 16	78 82	80 34	81 76	83 07	84 28	85 41	86 46	87 44	88 36	89 21	90 02	27 0	8 0	
60	0 596	8 39	62 88	65 57	68 06	70 36	72 48	74 43	76 23	77 87	79 39	80 79	82 08	83 27	84 37	85 39	86 34	87 22	88 04	88 81	89 53	90 20	19 2		
65	0 524	9 54	67 52	69 83	71 95	73 88	75 65	77 27	78 75	80 10	81 34	82 48	83 53	84 50	85 40	86 23	87 00	87 72	88 39	89 01	89 59		10 4		
70	0 436	11 48	72 08	73 96	75 66	77 20	78 60	79 87	81 02	82 08	83 04	83 93	84 74	85 49	86 19	86 83	87 42	87 98	88 49						
75	0 330	15 14	76 56	77 96	79 20	80 33	81 34	82 25	83 08	83 83	84 52	85 14	85 72	86 25	86 74	87 20	87 62	88 01							
80	0 208	24 07	80 97	81 83	82 59	83 27	83 88	84 43	84 92	85 37	85 77	86 15	86 49	86 80	87 09	87 36									
85	0 068	73 32	85 32	85 59	85 84	86 05	86 24	86 41	86 57	86 71	86 83	86 95	87 05	87 15	87 24										
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 12769 + 0282 D — 00034 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Non-dipterocarps
Location Climatic type 4

Table 14 Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 320	15 63	6 69	8 57	10.65	12 96	15 49	18 26	21 23	24 40	27 71	31 11	34 56	37 99	41 36	44 64	47 80	50 81	53 67	56 38	58 94	61 35	121 0	97 2	78 6
10	0 418	11 95	12 19	14 57	17 16	19 94	22 89	26 01	29 25	32 56	35 91	39 25	42.54	45 74	48 83	51 79	54 61	57 29	59 81	62 20	64 44	66 55	108 9	85 4	66 9
15	0 500	10 00	17 59	20 36	23 29	26 37	29 56	32 83	36 14	39 44	42 70	45 89	48 97	51 93	54 75	57 43	59 97	62 36	64 62	66 74	68 73	70 61	98 3	75 1	56 7
20	0 565	8 86	22 90	25 94	29.09	32 33	35 62	38 91	42 17	45 36	48 46	51 45	54 30	57 02	59 59	62 02	64 30	66 45	68 47	70 37	72 15	73 83	89 0	65 8	47 5
25	0 612	8 17	28 12	31 32	34 59	37 88	41 15	44 36	47 50	50 53	53 43	56 20	58 82	61 29	63 62	65 81	67 87	69 80	71 61	73 30	74 89	76 39	80 5	57 4	39 1
30	0 643	7 78	33 24	36 52	39 80	43 05	46 22	49 30	52 26	55 08	57 76	60 29	62 67	64 91	67 01	68 98	70 82	72 54	74 15	75 67	77 09	78 42	72 7	49 4	31 2
35	9 656	7 62	38 28	41 55	44 76	47 88	50 90	53 78	56 52	59 11	61 55	63 84	65 99	67 99	69 87	71 62	73 26	74 79	76 22	77 56	78 82	79 99	65 4	41 8	23 5
40	0 653	7 66	43 24	46 41	49 47	52 42	55 22	57 87	60 36	62.70	64 89	66 94	68 84	70 62	72 28	73 82	75 26	76 61	77 87	79 04	80 15	81 18	58 2	34 3	15 9
45	0 633	7 90	48 11	51 11	53 96	56 67	59 22	61 60	63 83	65 91	67 84	69 63	71 30	72 85	74 30	75 64	76 89	78 06	79 15	80 17	81 13	82 03	51 1	26 6	8 1
50	0 595	8 40	52 90	55 66	58 25	60 67	62 92	65 02	66 97	68 77	70 44	71 98	73 41	74 74	75 97	77 12	78 19	79 18	80 11	80 98	81 80	82 56	43 7	18 6	
55	0 541	9 24	57 62	60 06	62.33	64 43	66 37	68 15	69 80	71 32	72 72	74 01	75 21	76 32	77 34	78 30	79 18	80 01	80 78	81 51	82 18	82 82	35 6	9 9	
60	0 469	10 65	62 65	64 33	66 23	67 97	69 57	71 03	72 37	73 59	74 72	75 77	76 73	77 61	78 44	79 20	79 91	80 57	81 19	81 77	82 31		26 4		
65	0 381	13 12	66 82	68 46	69 95	71 31	72 54	73 66	74 68	75 62	76 47	77 26	77 99	78 66	79 28	79 85	80 39	80 88	81 35	81 78			15 2		
70	0 276	18 14	71 30	72 47	73 51	74 45	75 30	76 07	76 77	77 40	77 99	78 52	79 01	79 46	79 88	80 27	80 63	80 97							
75	0 153	32 63	75 72	76 35	76 92	77 42	77 87	78 27	78 64	78 98	79 28	79 56	79 82	80 05	80 27	80 47	80 66								
80	0 014	361 27	80 06	80 12	80 17	80 21	80 25	80 29	80 32	8J 35	80 37	80,40	80 42	80 44	80 46	80 48									
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999,99																							
100	0 000	999 99																							

Diameter growth function (G = 20424 + 02482 D — 00034 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Climatic type I

Table 15 DIAMETER GROWTH PREDICTION TABLE

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 188	26 58	6 01	7 18	8 53	10 12	11 99	14 19	16 79	19 82	23 33	27 29	31 66	36 31	41 13	45 97	50 72	55 30	59 67	63 79	67 66	71 28	98 2	85 4	74 2
10	0 319	15 70	11 70	13 62	15 80	18 27	21 05	24 18	27 65	31 44	35 52	39 80	44 21	48 65	53 05	57 34	61 46	65 40	69 13	72 64	75 94	79 04	86 2	73 2	61 5
15	0 434	11 52	17 29	19 84	22 66	25 77	29 17	32 84	36 74	40 84	45 06	49 32	53 57	57 75	61 79	65 67	69 37	72 88	76 18	79 29	82 21	84 94	75 9	62 8	50 8
20	0 534	9 36	22 80	25 85	29 17	32 73	36 51	40 48	44 58	48 75	52 93	56 06	51 10	54 99	68 72	72 27	75 63	78 79	81 76	84 56	87 18	89 63	66 8	53 6	41 5
25	0 620	8 07	28 22	31 67	35 34	39 20	43 21	47 31	51 45	55 58	59 63	63 57	67 37	70 99	74 43	77 68	80 74	83 62	86 32	88 85	91 22	93 45	58 6	45 5	33 2
30	0 690	7 24	33 56	37 31	41 22	45 26	49 36	53 98	57 58	61 56	65 44	69 18	72 70	76 06	79 23	82 22	85 01	87 64	90 09	92 40	94 55	96 57	51 2	38 0	25 8
35	0 746	6 71	38 81	42 77	46 82	50 93	55 08	59 09	63 04	56 87	70 53	74 01	77 31	80 41	83 33	86 06	88 62	91 01	93 25	95 34	97 30	99 14	44 3	31 1	18 9
40	0 786	6 36	43 99	48 06	52 17	56 26	50 29	64 21	67 99	71 60	75 03	78 27	81 81	84 17	86 84	89 34	91 67	93 85	95 89	97 79	99 57	101 24	37 8	24 6	12 4
45	0 811	6 16	49 08	53 19	57 27	61 28	65 17	68 91	72 48	75 85	79 04	82 03	84 82	87 43	89 87	92 14	94 26	96 24	98 09	99 81	101 43	102 94	31 5	18 4	6 1
50	0 822	6 08	54 11	58 17	62 16	66 01	69 74	78 28	76 56	79 69	82 62	85 35	87 90	90 27	92 48	94 54	96 46	98 24	99 91	101 46	102 92	104 28	25 4	12 3	
55	0 817	6 12	59 05	63 01	66 83	70 49	73 91	77 28	80 29	83 15	85 82	88 30	90 50	32 74	94 73	96 58	98 30	99 90	101 35	102 79	104 09	105 31	19 3	6 2	
60	0 798	6 27	63 93	67 71	71 31	74 72	77 92	80 91	83 70	86 29	88 69	90 91	92 97	94 88	96 65	98 30	99 90	101 25	102 58	103 81	104 97	106 06	13 2		
65	0 763	6 55	68 73	72 27	75 61	78 73	81 63	84 33	86 82	89 13	91 26	93 22	95 84	96 72	98 28	99 73	101 07	102 32	103 49	104 57	105 59	106 54	6 8		
70	0 713	7 01	73 46	76 71	79 73	82 52	85 10	87 49	89 68	91 70	93 55	95 28	96 84	98 30	99 65	100 90	102 06	103 14	104 15	105 05	106 97	106 79			
75	0 649	7 71	78 13	81 02	83 68	86 12	88 36	90 42	92 29	94 02	95 60	97 09	98 89	99 63	100 77	101 83	102 81	103 79	104 58	105 37	106 12	106 81			
80	0 569	8 79	82 72	85 21	87 48	89 54	91 42	93 13	94 69	96 11	92 42	98 60	99 72	100 73	101 67	102 54	103 35	104 10	104 79	105 45					
85	0 475	10 54	87 26	89 29	91 12	92 78	94 28	95 64	96 87	98 00	99 09	99 97	100 83	101 63	102 36	103 04	103 67	104 26	104 81						
90	0 365	13 70	91 72	93 26	94 63	95 86	96 96	97 96	98 86	99 69	100 43	101 12	101 75	102 33	102 86	103 35	103 81								
95	0 240	20 80	96 13	97 12	98 00	98 78	99 48	100 11	100 68	101 19	101 66	102 09	102 48	102 84	103 17	103 48									
100	0 101	49 63	100 47	100 88	101 24	101 55	101 84	102 09	102 32	102 52	102 71	102 88	103 06	103 18	103 31										

Diameter growth function (0 = 04274 + 03058 D = 003 D2) = 003 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Non-dipterocarps
Location Region 1

Table 16. Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
			5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 393	12 74	7 08	9 42	12 04	14 94	18 14	21 60	25 30	29 17	33 13	37 11	41 04	44 86	48 53	52 02	55 31	58 40	61 30	64 00	66 53	68 89	102 5	82 7	67 1
10	0 501	9 99	12 63	15 51	18 65	22 04	25 63	29 38	33 23	37 12	40 98	44 76	48 41	51 90	55 21	58 32	61 25	63 99	66 55	68 94	71 17	73 25	92 3	72 8	57 2
15	0 590	8 47	18 07	21 36	24 86	28 53	32 31	36 15	39 99	43 77	47 45	50 99	54 35	57 53	60 53	63 34	65 96	68 41	70 69	72 83	74 81	76 67	83 4	64 1	48 6
20	0 661	7 56	23 41	26 99	30 70	34 50	38 33	42 14	45 86	49 46	52 91	56 18	59 27	62 17	64 88	67 41	69 77	71 97	74 02	75 93	77 71	79 38	75 5	56 2	40 8
25	0 714	7 00	28 64	32 39	36 21	40 03	43 80	47 47	51 01	54 39	57 59	60 60	63 42	66 05	68 50	70 78	72 90	74 87	76 71	78 42	80 02	81 51	68 3	49 0	33 5
30	0.748	6 68	33 78	37 60	41 41	45 15	48 78	52 27	55 58	58 71	61 64	64 38	66 94	69 31	71 51	73 56	75 46	77 23	78 87	80 40	81 83	83 16	61 5	42 2	26 7
35	0 764	6 55	38 82	42.61	46 33	49 91	53 35	56 60	59 65	62 51	65 17	67 56	69 94	72 07	74 03	75 86	77 55	79 12	68 50	81 95	83 22	84 40	66 1	35 6	20.1
40	0 761	6 57	43 77	47 45	50 99	54 36	57 54	60 52	63 25	65 87	68 26	70 46	72.50	74 39	76 13	77 74	79 24	80 63	81 92	83 12	84 24	85.28	48 9	29 1	13 6
45	0 739	6 76	48 63	52 11	55 41	58 51	61 40	64 08	66 56	68 85	70 95	72 90	74 68	76 33	77 86	79 27	80 57	81 78	82 91	83 95	84 98	85 84	42 7	22 5	6 9
50	0 699	7 15	53 41	56 62	59 61	62 39	64 96	67 32	69 49	71 48	73 31	74 98	76 53	77 95	78 26	80 47	81 59	82 63	83 59	84 49	85 33	86 11	36 2	15 7	
55	0 641	7 80	58 09	60 96	63 61	66 03	68 25	70 27	72 12	73 81	75 35	76 77	78 07	79 26	80 36	81 38	82 32	83 19	84 00	84 75	85 46	86 12	29 3	8 3	
60	0 564	8 86	62 70	65 16	67 40	69 44	71 28	72 90	74 48	75 86	77 12	78 28	79 33	80 30	81 20	82 02	82 79	83 49	84 15	84 77			21 5		
65	0 469	10 67	67 22	69 22	71 02	72 63	74 09	75 40	76 58	77 66	78 64	79 53	80 35	91 10	81 79	82 43	83 02	83 56							
70	0 355	14 09	71 67	73 15	74 46	75 63	76 68	77 62	78 46	75 23	79 92	80 56	81 13	81 67	82.15	82 60	83 02								
75	0 222	22 47	76 04	76 94	77 74	78 44	79 07	79 63	80 13	80 58	80 99	81 37	81 71	82 02	82 31										
80	0 072	69 86	80 33	80 62	80 86	81 08	81 27	81 45	81 60	81 74	81 86	81 97	82 08	82 17											
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 26597 + 02717 D — 00037 D2)
Growth function computed by Monina T Urlarte, ERDB

Intended user Non-dipterocarps
Location Region 2

Table 17. Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
			5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 309	16 17	6 63	8 42	10 40	12 58	14 96	17 55	20 34	23 30	26 42	29 64	32 93	36 24	39 53	42 75	45 89	48 91	51 81	54 57	57 20	59 68	124 4	100 7	81 9
10	0 401	12 45	12 09	14 36	16 81	19 44	22 23	25 17	28 24	31 39	34 60	37 82	41 02	44 16	47 22	50 18	53 01	55 72	58 30	60 75	63 07	65 26	111 9	88 4	69 7
15	0 478	10 46	17 47	20 11	22 89	25 81	28 85	31 96	35 13	38 31	41 47	44 59	47 62	50 56	53 39	56 09	58 67	61 11	63 43	65 62	67 69	69 64	101 0	77 7	59 0
20	0 539	9 27	22 77	25 66	28 67	31 76	34 90	38 07	41 22	44 33	47 37	50 32	53 16	55 89	58 48	60 95	63 28	65 49	67 58	69 55	71 40	73 15	91 2	68.0	49 4
25	0 585	8 55	27 98	31 04	34 17	37 32	40 48	43 60	46 66	49 63	52 51	55 26	57 89	60 40	62 77	65 01	67 12	69 11	70 99	72 76	74 42	75 99	82 3	59 2	40.6
30	0 615	8 13	33 11	36 25	39 41	42 54	45 63	48 64	51 55	54 35	57 02	59 57	61 98	64 25	66 40	68 43	70 33	72 12	73 80	75 39	76 88	78 28	74 1	50 9	32 3
35	0 630	7 94	38 16	41 30	44 41	47 45	50 40	53 25	55 97	58 56	61 01	63 33	65 52	67 58	69 51	71 32	73 02	74 62	76 12	77 53	78 86	80 11	66 3	42 9	24 3
40	0 629	7 95	43 13	46 20	49 19	52 08	54 84	57 48	59 98	62 34	64 56	66 65	68 61	70 44	72 16	73 77	75 28	76 69	78 02	79 26	80 44	81 54	58 8	35 0	16 4
45	0 613	8 16	48 02	50.95	53 76	56 44	58 98	61 37	63 63	65 74	67 72	69 57	71 30	72 91	74 42	75 83	77 15	78 39	79 55	80 63	81 66	82 62	51 2	27 1	8 4
50	0 581	8 60	52 84	55 56	58 13	60 56	62 83	64 96	66 95	68 81	70 53	72 14	73 64	75 04	76 34	77 55	78 69	79 75	80 75	81 68	82 56	83 39	43 4	18 8	
55	0 534	9 37	57 59	60 03	62 32	64 45	66 43	68 27	69 98	71 57	73 04	74 40	75 67	76 85	77 95	78 97	79 93	80 82	81 66	82 44	83 18	83 87	35 1	9 9	
60	0 471	10 62	62 27	64 38	66 33	68 13	69 80	71 33	72 75	74 06	75 26	76 38	77 42	78 38	79 28	80 11	80 89	81 62	82 30	82 93	83 53	84 10	25 6		
65	0 393	12 73	66 88	68 60	70 18	71 62	72 94	74.16	75 27	76 29	77 24	78 11	78 91	79 66	80 35	81 00	81 60	82 16	82 69	83 18	83 65		14 4		
70	0 299	16 73	71 42	72 71	73 87	74 93	75 89	76 76	77 56	78 30	78 97	79 60	80 17	80 70	81 19	81 65	82 08	82 48	82 86	83 21					
75	0 190	26 38	75 89	76 69	77 41	78 06	78 64	79 17	79 65	80 09	80 50	80 87	81 21	81 53	81 82	82 09	82 35	82 59							
80	0 065	77 21	80 30	80 57	80 81	81 02	81 21	81 39	81 54	91 69	81 82	81 94	82 05	82 15	82 24	82 33	82 41								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 20166 + 02309 D — 00031 D2)
Growth function computed by Monina T Urlarte ERDB

Intended user Dipterocarps
Location Region 2

Table 18. Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (mc)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 304	16 45	6 61	8 41	10 42	12 67	15 17	17 94	20 96	24 22	27 70	31 33	35 06	38 83	42 57	46 24	49 80	53 22	56 47	59 56	62 48	65 24	109 4	90 7	75 3
10	0 408	12 26	12 14	14 49	17 06	19 86	22 87	26 08	29 47	32 99	36 59	40 23	43 85	47 41	50 88	54 22	57 42	60 46	63 34	66 07	68 64	71 07	97 8	79 2	63 7
15	0 496	10 07	17 58	20 37	23 35	26 52	29 84	33 29	36 83	40 40	43 97	47 50	50 94	54 27	57 46	60 51	63 41	66 15	68 74	71 18	73 48	75 64	87 5	69 1	53 6
20	0 570	8 78	22 94	26 05	29 32	32 72	36 21	39 75	43 29	46 81	50 26	53 61	56 84	59 93	62 87	65 66	68 29	70 77	73 11	75 31	77 38	79 32	78 4	60 1	44 6
25	0 627	7 97	28 21	31 55	35 00	38 51	42 05	45 57	49 05	52 44	55 71	58 86	61.86	64 71	67 41	69 95	72 34	74 59	76 71	78 69	80 56	82 31	70 1	51 9	36 4
30	0 669	7 47	33 40	36 88	40 40	43 94	47.44	50 87	54 21	57 42	60 49	63 42	66 19	66 80	71 26	73 57	75 74	77.77	79 68	81 47	83 15	84 73	62 4	44 2	28 7
35	0 696	7 19	38 50	42 04	45 56	49 03	52 43	55 71	58 86	61 86	64 71	67 40	69 94	72 32	74 55	76 64	78 59	80 43	82 14	83 75	85 26	86 68	55 1	36 9	21 4
40	0 707	7 07	43 53	47 04	50 48	53 83	57 06	60 14	63 08	65 85	68 46	70 91	73.21	75 35	77 36	79 24	80 99	82 64	84 17	85 61	86 96	88 23	48 1	29 8	14 3
45	0 702	7 12	48 48	51 89	55 19	58 35	61 37	64 22	66 91	69 43	71 79	74 00	76 06	77 98	79 77	81 44	83 00	84 46	85 82	87 10	88 30	89 42	41 2	22 7	7 2
50	0 682	7 33	53 36	56 60	59 69	62 62	65 38	67 97	70 40	72 66	74 77	76 72	78 55	80 24	81 82	83 29	84 66	85 94	87 14	88 26	89 31	90 29	34 2	15 5	
55	0 647	7 73	58 16	61 16	63 99	66 65	69 13	71 44	73 58	75 57	77 42	79 13	80 71	82.18	83 55	84 83	86 01	87 12	88 15	89 12	90 03	90 88	26 8	8 0	
60	0 596	8 39	62 89	65 60	68 12	70 46	72 63	74 64	76 49	78 20	79 77	81 23	82 59	83 84	85 00	86 08	87 08	88 02	88 90	89 72	90 49	91 21	19 0		
65	0 529	9 44	67 55	69 91	72 08	74 07	75 91	77 59	79 14	80 56	81 87	83 08	84.19	85 23	86 18	87 07	87 90	88 67	89 39	90 07	90 70	91 29			
70	0 448	.11 17	72 14	74 09	75 87	77 49	78 97	80 32	81 55	82 68	83 72	84 68	85 56	86 38	87 13	87 83	88 48	89 09	89 66	90 19					
75	0 350	14 28	76 66	78 16	79 51	80 73	81 83	82 84	83 75	84 59	85 35	86 06	86 70	87 30	87 85	88 37	88 85	89 29	89 71						
80	0 237	21 09	81 12	82 11	83 00	83 80	84 51	85 16	85 75	86 29	86 78	87 23	87.64	88 02	88 37	88 70	89 00								
85	0 109	46 01	85 51	85 96	86 35	86 70	87 02	87 30	87 56	87 79	88 01	88 20	88 38	88 55	88 70	88 84									
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 18432 + 02646 D — 00031 D2)
Growth function computed by Monina T Urlarte, ERDB

Intended user Dipterocarps
Location Region 3

Table 19 Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 168	29 82	5 89	6 91	8 08	9 42	10 96	12 74	14 79	17 14	19 80	22 78	26 03	29 52	33 15	36 85	40 54	44 15	47 65	50 99	54 17	57 17	125 7	105 0	88 5
10	0 285	17 57	11 50	13 18	15 05	17 13	19 44	21 97	24 74	27 71	30 87	34 16	37 54	40 95	44 35	47 68	50 91	54 02	56 99	59 81	62 48	65 00	110 9	90 4	73 6
15	0 385	12 98	17 02	19 22	21 62	24 22	27 00	29 96	33 05	36 36	39 54	42 84	46 11	49 33	52 46	55 48	58 37	61 13	63 74	66 22	68 55	70 75	98 3	77 9	61 1
20	0 469	10 66	22 43	25 05	27 83	30 76	33 82	36 98	40 21	43 45	46 68	49 86	52 96	55 96	58 83	61 58	64 18	66 65	68 98	71 18	73 26	75 21	87 3	67 1	50 2
25	0 537	9 32	27 76	30 67	33 70	36 83	40 02	43 24	46 46	49 63	52 74	55 74	58 63	61 40	64 02	66 51	68 87	71 09	73 18	75 14	77 00	78 74	77 5	57 4	40 6
30	0 588	8 51	33 00	36 10	39 27	42 48	45 69	48 87	52 00	55 03	57 95	60 75	63 42	65 96	68 34	70 59	72 72	74 71	76 59	78 35	80 00	81 56	68 7	48 6	31 8
35	0 622	8 04	38 15	41 34	44 56	47 75	50 90	53 97	56 94	59 79	62 50	65 08	67 52	69 81	71 97	74 00	75 91	77 70	79 37	80 95	82 43	83 82	60 4	40 4	23 6
40	0 640	7 81	43 21	46 42	49 59	52 70	55 71	58 61	61 38	64 01	66 49	68 84	71 04	73 11	75 05	76 86	78 56	80 15	81 65	83 05	84 36	85 59	52 6	32 5	15 7
45	0 642	7 79	48 19	51 33	54 38	57 33	60 15	62 84	65 38	67 77	70 02	72 12	74 09	75 93	77 65	79 26	80 76	82 17	83 48	84 72	85 88	86 96	45 0	24 7	7 9
50	0 627	7 98	53 09	56 08	58 96	61 69	64 28	66 71	69 00	71 14	73 13	74 99	76 73	78 34	79 85	81 26	82 57	83 80	84 94	86 02	87 03	87.97	37 3	16 9	
55	0 595	8 40	57 91	60 69	63 32	65 79	68 10	70 27	72 28	74 15	75 89	77 50	79 00	80 40	81 69	82 90	84 03	85 08	86.07	86 99	87 85	88 67	29 4	8 7	
60	0 547	9 14	62 66	65 15	67 48	69 65	71 66	73 53	75 25	76 85	78 32	79 69	80 95	82 13	83 22	84 24	85 18	86 06	86 89	87 66	88 39	89 07	20 8		
65	0 483	10 36	67 33	69 48	71 47	73 29	74 98	76 53	77 95	79 26	80 47	81 59	82 62	83 57	84 46	85 29	86 05	86 77	87 44	88 07	88 66	89 21	11 3		
70	0 402	12 45	71 92	73 67	75 27	76 73	78 06	79 28	80 39	81 42	82 36	83 22	84 02	84 76	85 44	86 08	86 67	87 22	87 74	88 22	88 68				
75	0 304	16 44	76 44	77 74	78 92	79 98	80 94	81 81	82 61	83 33	84 00	84 62	85 18	85 70	86 19	86.64	87 05	87 44	87 81						
80	0 190	26 30	80 90	81 69	82 40	83 04	83 61	84 13	84 60	85 03	85 43	85 79	86 12	86 42	86 71	86 97	87.22	87 44							
85	0 060	83 82	85 28	85 52	85 74	85 93	86 10	86 26	86 40	86 53	86 64	86 75	86 85	86 94	87 02	87 10									
90	0 000	999 99																							
95	0 000	999.99																							
100	0 000	999 99																							

Diameter growth function (G = 03416 + 02836 D — 00033 D2)
Growth function computed by Monina T Urlarte, ERDB

Intended user Non-dipterocarps
Location Region 3

Table 20 Diameter Growth Prediction Table

DBH		YEARS	D I A M E T E R (cm) R E A C H E D I N																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 128	39 15	5 67	6 42	7 24	8 17	9 20	10 36	11 66	13 13	14 77	16 61	18 67	20 94	23 43	26 13	29 00	32 00	35 10	38 25	41 40	44 52	149 4	127 4	109 1
10	0 221	22 62	11 16	12 42	13 80	15 30	16 95	18 74	20 68	22 78	25 04	27 45	30 00	32,67	35 44	38 27	41 15	44 04	46 91	49 75	52 52	55 22	131 3	109 3	90 5
15	0 302	16 54	16 57	18 26	20 08	22 03	24 11	26 32	28 66	31 12	33 68	36 33	39 04	41 80	44 58	47 36	50 11	52 81	55 46	58 04	60 54	62 95	115 9	93 9	74 8
20	0 372	13 45	21 92	23 95	26 11	28 38	30 76	33 24	35 81	38 45	41 14	43 86	46 59	49 31	52 00	54 64	57 23	59 75	62 19	64 54	66 80	68 98	102 4	80 5	61 3
25	0 429	11 66	27 20	29 50	31 91	34 40	36 97	39 60	42 28	44 98	47 69	50 38	53 04	55 66	58 22	60 71	63 12	65 44	67 68	69 83	71 89	73 86	90 4	68 6	49 3
30	0 474	10 54	32 42	34 92	37 49	40 12	42 78	45 48	48 17	50 86	53 51	56 12	58 66	61 14	63 54	65 86	68 09	70 23	72 28	74 24	76 11	77 89	79 5	57 7	38 4
35	0 508	9 85	37 57	40 20	42 86	45 55	48 24	50 92	53 57	56 18	58 73	61 21	63 61	65 93	68 16	70 30	72 34	74 30	76 17	77 95	79 65	81 26	69 3	47 5	28 3
40	0 529	9 45	42 66	45 35	48 04	50 72	53 37	55 99	58 54	61 03	63 43	65 76	67 99	70 14	72 19	74 15	76 01	77 79	79 48	81 09	82 63	84 08	59 7	37 9	18 7
45	0 538	9 29	47 69	50 38	53 03	55 65	58 21	60 71	63 12	65 46	67 70	69 85	71 90	73 86	75 73	77 50	79 19	80 80	82 32	83 76	85 14	86 44	50 4	28 6	9 3
50	0 535	9 34	52 66	55 29	57 85	60 36	62 78	65 12	67 37	69 52	71 57	73 53	75 40	77 17	78 85	80 44	81 95	83 38	84 74	86 02	87 24	88 40	41 1	19 3	
55	0 521	9 60	57 57	60 08	62 51	64 85	67 10	69 25	71 30	73 25	75 10	76 86	78 53	80 10	81 59	83 00	84 34	85 60	86 79	87 93	89 00	90 02	31 8	9 8	
60	0 494	10 12	62 43	64 77	67 01	69 15	71 19	73 12	74 95	76 69	78 33	79 87	81 33	82 71	84 01	85 24	86 40	87 49	88 53	89 51	90 44	91 32	22 1		
65	0 455	10 98	67 22	69 34	71 36	73 26	75 06	76 75	78 35	79 85	81 27	82 60	83 85	85 02	86 13	87 18	88 16	89 09	89 97	90 80	91 59	92 34	11 6		
70	0 405	12 36	71 97	73 82	75 56	77 19	78 73	80 16	81 51	82 77	83 95	85 06	86 10	87 07	87 99	88 85	89 66	90 43	91 15	91 84	92 49	93 10			
75	0 342	14 62	76 65	78 19	79 63	80 96	82 21	83 37	84 45	85 45	86 40	87 28	88 10	88 87	89 60	90 28	90 92	91 52	92 09	92 63	93 14	93 62			
80	0 267	18 71	81 28	82 47	83 56	84 57	85 51	86 38	87 18	87 93	88 63	89 27	89 88	90 45	90 98	91 48	91 95	92 39	92 81	93 20	93 58	93 93			
85	0 181	27 70	85 86	86 65	87 37	88 03	88 64	89 20	89 72	90 20	90 65	91,07	91 45	91 82	92 16	92 47	92 77	93 05	93 32	93 57	93 81	94 03			
90	0 082	61 10	90 39	90 74	91 06	91 35	91 62	91 86	92 09	92 30	92 49	92 67	92 83	92 99	93 13	93 27	93 40	93 52	93 63	93 74	93 84				
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G= 02243 + 02226 D - 00024 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Region 4

Table 21. Diameter Growth Prediction Table

DBH		YEARS	D I A M E T E R (cm) R E A C H E D I N																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 251	19 89	6 34	7 87	9 61	11 60	13 87	16 44	19 34	22 55	26 04	29 78	33 67	37 63	41 59	45 47	49 22	52 81	56 22	59 43	62 44	65 28	109 2	90 9	76 1
10	0 370	13 53	11 95	14 13	16 55	19 22	22 15	25 33	28 73	32 30	36 01	39 77	43 53	47 23	50 82	54 28	57 58	60 71	63 66	66 44	69 05	71 49	96 9	78 8	63 8
15	0 471	10 62	17 46	20 15	23 07	26 20	29 53	33 02	36 63	40 29	43 97	47 60	51 15	54 58	57 86	60 98	63 93	66 71	69 33	71 79	74 10	76 26	86 3	68 4	53 4
20	0 555	9 01	22 88	25 96	29 22	32 64	36 18	39 80	43 44	47 05	50 60	54 04	57 34	60 50	63 49	66 32	68 98	71 48	73 83	76 03	78 09	80 02	77 0	59 2	44 1
25	0 622	8 04	28 20	31 55	35 04	38 61	42 23	45 84	49 41	52 88	56 24	59 46	62 52	65 41	68 14	70 70	73 11	75 36	77 47	79 44	81 29	83 03	68 6	50 9	35 8
30	0 672	7 44	33 42	36 95	40 55	44 16	47 75	51 27	54 69	57 98	61 12	64 10	66 91	69 55	72 03	74 35	76 52	78 54	80 44	82 21	83 87	85 43	60 9	43 2	28 2
35	0 705	7 09	38 56	42 17	45 78	49 34	52 82	56 19	59 41	62 48	65 38	68 11	70 67	73 07	75 30	77 39	79 34	81 16	82 86	84 45	85 94	87 33	53 7	35 9	20 9
40	0 721	6 93	43 61	47 21	50 74	54 18	57 49	60 65	63 65	66 47	69 12	71 60	73 91	76 07	78 07	79 95	81 69	83 31	84 83	86 25	87 57	88 82	46 7	28 9	13 9
45	0 720	6 94	48 58	52 08	55 47	58 72	61 81	64 73	67 47	70 03	72 42	74 64	76 71	78 63	80 41	82 07	83 62	85 06	86 40	87 65	88 83	89 93	39 9	22 0	7 0
50	0 702	7 12	53 46	56 79	59 97	62 98	65 81	68 45	70 91	73 20	75 32	77 29	79 12	80 81	82 37	83 83	85 18	86 45	87 62	88 72	89 74	90 71	33 1	15 0	
55	0 667	7 49	58 26	61 35	64 26	66 98	69 51	71 86	74 03	76 04	77 89	79 60	81 18	82 65	84 00	85 26	86 43	87 52	88 53	89 48	90 36	91 19	26 0	7 8	
60	0 616	8 12	62 98	65 77	68 36	70 75	72 96	74 99	76 85	78 57	80 15	81 61	82 95	84 19	85 33	86 40	87 38	88 30	89 16	89 96	90 71	91 41	18 4		
65	0 547	9 15	67 63	70 05	72 27	74 30	76 15	77 85	79 41	80 83	82 13	83 33	84 44	85 45	86 39	87 27	88 08	88 83	89 53	90 18	90 80		9 9		
70	0 461	10 85	72 20	74 19	76 00	77 64	79 13	80 48	81 71	82 84	83 86	84 81	85 67	86 47	87 21	87 89	88 52	89 11	89 66						
75	0 358	13 97	76 69	78 21	79 57	80 79	81 89	82 89	83 79	84 61	85 36	86 05	86 68	87 26	87 79	88 29	88 75	89 17							
80	0 238	21 02	81 12	82 10	82 98	83 76	84 46	85 09	85 66	86 17	86 64	87 07	87.47	87 83	88 16	88 47	88 76								
85	0 101	49 50	85 47	85 88	86 24	86 56	86 85	87 10	87 33	87 54	87 73	87 90	88 05	88 20	88 33										
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 11632 + 02872 D — 00034 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Non-dipterocarps
Location Region 4

Table 22 Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0.267	18 73	6 43	8 08	9 98	12 18	14 71	17 60	20 85	24 45	28 34	32.42	36 61	40 78	44 87	48 80	52 54	56 06	59.36	62 44	65.31	67 98	104 0	86 0	71 6
10	0 395	12 66	12 10	14 45	17 09	20 01	23 23	26 72	30 44	34 31	38 27	42.25	46 15	49 94	53 56	57 00	60 25	63.29	66 13	68 78	71 26	73 56	92 4	74 6	60.1
15	0 504	9 93	17 65	20 55	23 71	27 11	30 72	34 48	38 33	42 22	46 06	49 81	53 43	56 87	60 13	63 20	66 07	68 76	71 27	73 61	75 79	77 82	82.4	64 8	50 3
20	0 594	8 42	23 09	26 40	29 91	33 59	37 38	41 22	45 04	48 80	52.45	55 95	59 27	62 41	65 35	68 11	70.68	73 08	75 32	77 40	79 34	81 16	73 6	56 1	41 6
25	0 665	7 52	28 42	32 01	35 74	39 54	43 36	47 15	50 85	54 42	57 83	61 06	64 10	66 95	69 61	72 09	74 40	76 55	78 55	80 42	82 16	83 78	65 8	48 3	33 8
30	0 716	6 98	33 65	37 41	41 22	45 03	48 78	52 43	55 94	59 28	62 43	65 39	68 16	70.74	73 14	75 37	77.44	79 36	81 16	82 82	84 38	85 83	58 5	41 1	26 6
35	0 749	6 67	38 78	42 60	46 39	50 12	53 72	57 17	60 44	63 52	66 40	69 09	71 59	73 91	76 07	78 06	79 92	81 64	83 24	84 72	86 11	87 41	51 8	34 3	19 8
40	0 763	6 55	43 82	47 59	51 28	54 84	58 23	61 43	64 44	67 25	69 86	72 27	74 51	76 59	78 50	80 28	81 93	83 45	84 87	86 19	87 42	88 57	45 3	27 7	13 2
45	0 758	6 60	48 75	52 40	55 91	59 23	62 36	65 29	68 01	70 53	72 86	75 01	77 00	78 83	80 52	82 08	83 53	84 88	86 13	87 29	88 37	89 38	38 9	21 2	6 7
50	0 734	6 81	53 60	57 04	60 29	63 33	66 17	68 79	71 20	73 43	75 48	77 36	79 10	80 69	82 17	83 53	84 79	85 96	87 04	88 05	88 99	89 87	32.5	14 5	
55	0 691	7 24	58 36	61 51	64 45	67 16	69 66	71 96	74 06	75 99	77 75	79 37	80 86	82 23	83 49	84.65	85 73	86 72	87 65	88 51	89 32	90 07	25 7	7 6	
60	0 629	7 95	63 03	65 83	68 40	70 75	72 89	74 84	76 62	78 24	79 72	81 08	82.32	83 46	84 52	85 49	86 38	87 21	87 99	88 70	89 37		18 4		
65	0 548	9 13	67 62	69,99	72 15	74 10	75 86	77 46	78 90	80 22	81 42	82 51	83 51	84 43	85 28	86 06	86 78	87 44	88 70				10 0		
70	0 448	11 17	72 12	74 02	75 71	77 23	78 60	79 83	80 94	81 95	82 86	83 69	84 45	85 15	85 79	86 38	86 93								
75	0 329	15 22	76 54	77 90	79 10	80.17	81 13	81 98	82 75	83 44	84 07	84 64	85 16	85 64	86 08	86.49									
80	0 190	26 26	80 89	81 66	82 33	82 92	83 45	83 92	84 34	84 72	85 06	85 37	85 66	85 92	86.16										
85	0 033	150 06	85 15	85 29	85 40	85 50	85 59	85 67	85 74	85 80	85 85	85 91	85 95	86 00											
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 12002 + 03128 D — 00038 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Region 6

Table 23 Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 315	15 86	6 66	8 50	10 54	12 80	15 27	17 98	20 89	24 01	27 29	30 68	34 15	37 64	41 09	44 48	47 76	50 92	53 94	56 81	59 53	62 10	117 5	95 9	78 5
10	0 411	12 16	12 15	14 49	17 02	19 75	22 66	25 74	28 95	32 27	35 64	39 03	42 39	45 69	48 90	51 98	54 96	57 78	60 47	63 01	65 41	67 68	105 4	84 1	66 8
15	0 492	10 17	17 55	20 27	23 17	26 21	29 38	32 64	35 97	39 31	42 63	45 91	49 10	52 18	55 14	57 97	60 66	63 21	65 62	67 90	70 05	72 07	94 9	73 7	56 4
20	0 557	8 98	22 86	25 87	29 00	32 23	35 52	38 85	42 16	45 43	48 63	51 73	54 72	57 58	60 30	62 88	65 32	67 63	69 81	71 85	73 78	75 60	85 5	64 4	47 2
25	0 606	8 24	28 09	31 29	34 55	37 86	41 18	44 46	47 68	50 82	53 85	56 75	59 52	62 15	64 64	66 99	69 20	71 28	73 24	75 09	76 83	78 46	76 9	55 9	38 7
30	0 640	7 81	33 24	36 53	39 85	43 14	46 40	49 57	52 65	55 60	58 43	61 11	63 66	66 06	68 32	70 45	72 45	74 32	76 09	77 75	79 30	80 77	68 9	47 9	30 7
35	0 659	7 59	38 31	41 62	44 89	48 11	51 23	54 25	57 13	59 88	62 48	64 94	67 25	69 43	71 47	73 38	75 17	76 86	78 44	79 92	81 31	82 62	61 4	40 2	23 0
40	0 662	7 55	43 30	46 55	49 72	52 78	55 73	58 54	61 20	63 71	66 08	68 30	70 38	72 33	74 16	75 86	77 46	78 96	80 36	81 67	82 91	84 07	54 1	32 7	15 5
45	0 650	7 70	48 21	51 33	54 33	57 19	59 91	62 48	64 90	67 16	69 28	71 27	73 11	74 84	76 45	77 96	79 36	80 68	81 91	83 07	84 15	85 17	46 8	25 2	7 8
50	0 622	8 04	53 05	55 97	58 74	61 36	63 82	66 12	68 27	70 27	72 14	73 88	75 49	77 00	78 40	79 71	80 93	82 07	83 14	84 14	85 08	85 96	39 3	17 4	
55	0 578	8 65	57 82	60 47	62 96	65 29	67 46	69 47	71 34	73 08	74 68	76 17	77 56	78 84	80 04	81 15	82 19	83 17	84 07	84 92	85 72	86 47	31 4	9 1	
60	0 519	9 63	62 51	64 85	67 01	69 02	70 87	72 57	74 15	75 60	76 95	78 19	79 34	80 41	81 40	82 32	83 18	83 99	84 74	85 44	86 10	86 72	22 6		
65	0 445	11 24	67 13	69 09	70 89	72 54	74 05	75 43	76 71	77 88	78 95	79 95	80 86	81 71	82 50	83 24	83 92	84 56	85 16	85 72	86 24	86 74	12 5		
70	0 355	14 09	71 69	73 22	74 61	75 88	77 03	78 08	79 04	79 91	80 72	81 46	82 15	82 79	83 37	83 92	84 43	84 90	85 35	85 77					
75	0 249	20 04	76 18	77 24	78 19	79 04	79 81	80 52	81 15	81 74	82 27	82 77	83 22	83 64	84 03	84 39	84 72	85 04							
80	0 128	38 91	80 60	81 14	81 61	82 04	82 42	82 76	93 08	83 36	83 62	83 86	84 08	84 29	84 47	84 65	84 81								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 20369 + 02386 D — 00031 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Non-dipterocarps
Location Region 6

Table 24 Diameter Growth Prediction Table

DBH		YEARS	D I A M E T E R (cm) R E A C H E D I N																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 279	17 92	6 47	8 12	9 95	11 98	14 24	16 73	19 44	22 37	25 49	28 76	32 13	35 55	38 96	42.32	45 60	48 76	51 78	54 66	57 40	59 98	122 7	100 0	82 0
10	0 379	13 19	11 98	14 15	16 51	19 07	21 82	24 74	27 81	30 99	34 26	37 56	40 85	44 10	47 26	50 33	53 27	56 07	58 74	61 27	63 67	65 93	109 8	87 4	69 5
15	0 463	10 80	17 40	19 98	22 73	25 63	28 67	31 81	35 02	38 27	41 51	44 71	47 84	50 87	53 79	56 58	59 24	61 76	64 15	66 40	68 53	70 54	98 6	76 5	58 5
20	0 531	9 42	22 73	25 61	28 62	31 73	34 91	38 13	41 35	44 54	47 67	50 70	53 63	56 44	59 12	61 66	64 07	66 34	68 49	70 51	72 41	74 20	88 7	66 7	48 8
25	0 583	8 58	27 97	31 05	34 21	37 41	40 63	43 82	46 97	50 03	52 99	55 83	58 84	61 12	63 56	65 87	68 05	70 10	72 02	73 84	75 54	77 15	79 8	57 8	40 0
30	0 619	8 08	33 13	36 32	39 53	42 74	45 90	48 99	51 99	54 88	57 64	60 26	62 75	65 10	67 32	69 40	71 36	73 20	74 93	76 55	78 08	79 52	71 5	49 5	31 7
35	0 638	7 83	38 21	41 42	44 60	47 73	50 77	53 70	56 51	59 19	61 73	64 13	66 39	68 51	70 50	72 37	74 13	75 77	77 31	78 76	80 12	81 40	63 7	41 6	23 7
40	0 642	7 78	43 20	46 35	49 43	52 42	55 28	58 01	60 60	63 05	65 35	67 52	69 54	71 44	73 22	74 88	76 44	77 89	79 26	80 54	81 74	82 87	56 2	33 8	15 9
45	0 630	7 93	48 11	51 14	54 05	56 83	59 47	61 96	64 31	66 51	68 56	70 49	72 28	73 96	75 52	76 98	78 35	79 62	80 82	81 94	82 99	83 98	48 7	26 0	8 1
50	0 602	8 30	52 95	55 78	58 46	60 99	63 37	65 60	67 68	69 61	71 42	73 09	74 66	76 11	77 46	78 73	79 91	81 01	82 04	83 01	83 92	84 77	41 0	18 0	
55	0 558	8 96	57 72	60 28	62 68	64 92	67 00	68 94	70 74	72 40	73 95	75 38	76 71	77 94	79 09	80 16	81 16	82 96	82 96	83 78	84 55	85 27	32 9	9 4	
60	0 498	10 04	62 40	64 64	66 71	68 63	70 39	72 02	73 52	74 91	76 19	77 37	78 47	79 48	80 43	81 31	82 13	82 89	83 61	84 28	84 91	85 50	23 9		
65	0 422	11 85	67 02	68 88	70 57	72 13	73 55	74 86	76 05	77 15	78 17	79 10	79 97	80 76	81 51	82 20	82 84	83 44	84 00	84 53	85 02		13 3		
70	0 330	15 16	71 57	72 99	74 27	75 44	76 50	77 47	78 35	79 16	79 91	80 59	81 22	81 80	82 34	82 85	83 32	83 75	84 16	84 54					
75	0 222	22 56	76 05	76 98	77 82	78 58	79 26	79 88	80 44	80 95	81 42	81 85	82 25	82 62	82 96	83 28	83 57	83 85							
80	0 098	51 26	80 46	80 86	81 22	81 54	81 83	82 09	82 32	82 53	82 73	82 91	83 08	83 23	83 37	83 50	83 62								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 02243 + 02226 D- 00024 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Region 7

Table 25 Diameter Growth Prediction Table

DBH		YEARS	D I A M E T E R (cm) R E A C H E D I N																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 283	17 69	6 49	8 14	9 97	12 00	14 24	16 69	19 35	22 21	25 25	28 43	31 71	35 03	38 36	41 65	44 85	47 96	50 94	53 79	56 50	59 07	125 1	101 9	83 4
10	0 378	13 21	11 98	14 13	16 47	18 99	21 68	24 54	27 54	30 65	33 84	37 06	40 28	43 45	46 56	49 57	52 47	55 24	57 89	60 40	62 78	65 03	112 1	89 2	70 7
15	0 459	10 90	17 38	19 92	22 62	25 47	28 44	31 52	34 66	37 83	41 00	44 13	47 20	50 18	53 05	55 81	58 44	60 94	63 31	65 56	67 68	69 68	100 8	78 1	59 7
20	0 524	9 55	22 69	25 52	28 47	31 51	34 63	37 78	40 93	44 05	47 11	50 10	52 98	55 74	58 39	60 90	63 29	65 55	67 68	69 70	71 60	73 39	90 8	68 2	49 8
25	0 573	8 73	27 92	30 94	34 03	37 17	40 31	43 44	46 51	49 52	52 42	55 22	57 89	60 44	62 86	65 14	67 31	69 34	71 27	73 08	74 78	76 39	81 7	59 1	40 8
30	0 6071	8 24	33 07	36 19	39 33	42 47	45 56	48 59	51 53	54 36	57 08	59 67	62 12	64 45	66 64	68 71	70 66	72 49	74 22	75 84	77 37	78 81	73 3	50 7	32 4
35	0 625	8 00	38 14	41 28	44 39	47 45	50 42	53 30	56 06	58 69	61 19	63 56	65 79	67 90	69 87	71 73	73 48	75 12	76 66	78 10	79 46	80 75	65 3	42 6	24 3
40	0 628	7 96	43 13	46 21	49 22	52 14	54 94	57 62	60 17	62 57	64 84	66 98	68 99	70 87	72 63	74 29	75 84	77 29	78 65	79 93	81 14	82 27	57 7	34 7	16 3
45	0 615	8 12	48 04	50 99	53 84	56 56	59 15	61 59	63 90	66 06	68 09	69 99	71 77	73 43	74 99	76 44	77.80	79 07	80 27	81 39	82 44	83 44	50 0	26 7	8 3
50	0 587	8 51	52 88	55 64	58 26	60 74	63 07	65 25	67 30	69 21	70 99	72 65	74 20	75 64	76 98	78 24	79 42	80 52	81 55	82 52	83 42	84 28	42 2	18 5	
55	0 544	9 20	57 65	60 14	62 49	64 68	66 73	68 63	70 40	72 04	73 57	74 98	76 30	77 52	78 67	79 73	80 73	81 66	82 53	83 34	84 11	84 83	33 8	9 7	
60	0 484	10 32	62 34	64 52	66 54	68 42	70 15	71 75	73 23	74 59	75 86	77 03	78 12	79 12	80 06	80 94	81 75	82 52	83 23	83 90	84 53	85 12	24 6		
65	0 410	12 20	66 97	68 77	70 43	71 95	73 35	74 63	75 81	76 89	77 89	78 81	79 67	80 46	81.20	81 89	82 53	83 12	83 68	84 21	84 70	85 16	13 7		
70	0 320	15 64	71 52	72 90	74 16	75 30	76 34	77 29	78 15	78 95	79 68	80 36	80 98	81 56	82 10	82 60	83 06	83 50	83 90	84 29					
75	0 214	23 36	76 01	76 92	77 73	78 47	79 13	79 74	80 29	30 79	81 26	81 68	82 07	82 44	82 77	83 09	83 38	83 65	83 91						
80	0 093	53 84	80 44	80 82	81 17	81 47	81 75	82 00	82 23	82 43	82 62	82 80	82 96	83 11	83 25	83 37	83 49								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 17127 + 02382 D — 00031 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Non dipterocarps
Location Region 7

Table 26 Diameter Growth Prediction Table

DBH		YEARS	D I A M E T E R (cm) R E A C H E D I N																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 281	17 81	6 47	8 09	9 87	11 82	13 95	16 26	18 74	21 40	24 20	27 12	30 12	33 17	36 23	39 26	42 23	45 13	47 92	50 61	53 17	55 62	136 3	109 6	88 8
10	0 368	13 57	11 92	13 99	16 22	18 60	21 13	23 80	26 59	29 46	32 40	35 37	38 34	41 28	44 16	46 97	49 68	52 28	54 78	57 16	59 43	61 58	122 6	96 3	75 6
15	0 441	11 34	17 28	19 69	22 25	24 92	27 69	30 55	33 45	36 39	39 32	42 22	45 06	47 83	50 51	53 09	55 56	57 92	60 17	62 30	64 32	66 24	110 7	84 6	64 0
20	0 499	10 03	22 55	25 22	27 99	30 83	33 72	36 64	39 55	42 44	45 27	48 04	50 71	53 29	55 76	58 12	60 37	62 50	64 52	66 44	68 25	69 97	100 1	74 2	53 6
25	0 541	9 24	27 75	30 58	33 46	36 37	39 28	42 17	45 01	47 78	50 47	53 06	55 55	57 92	60 18	62 33	64 36	66 29	68 10	69 82	71 45	72 98	90 5	64 6	44 1
30	0 569	8 79	32 87	35 77	38 69	41 58	44 43	47 22	49 93	52 55	55 05	57 45	59 73	61 90	63 94	65 88	67 71	69 44	71 07	72 60	74 05	75 42	81 7	55 6	35 1
35	0 582	8 60	37 91	40 81	43 68	46 49	49 22	51 86	54 39	56 81	59 12	61 30	63 37	65 32	67 16	68 90	70 53	72 07	73 52	74 88	76 17	77 39	73 3	47 0	26 5
40	0 579	8 63	42 88	45 70	48 46	51 12	53 68	56 12	58 45	60 65	62 74	64 70	66 55	68 29	69 92	71 46	72 90	74 26	75 54	76 74	77 87	78 94	65 2	38 5	17 9
45	0 562	8 90	47 77	50 45	53 03	55 50	57 84	60 06	62 15	64 12	65 97	67 70	69 33	70 85	72 28	73 62	74 88	76 06	77 17	78 22	79 20	80 13	57 2	29 9	9 1
50	0 530	9 44	52 59	55 07	57 42	59 64	61 73	63 69	65 53	67 25	68 85	70 36	71 76	73 07	74 30	75 45	76 52	77 53	78 48	79 37	80 21	81 00	48 8	20 8	
55	0 482	10 37	57 34	59 55	61 62	63 56	65 37	67 05	68 62	70 08	71 43	72 70	73 87	74,97	76 00	76 96	77 85	78 70	79 48	80 23	80 92	81 58	39 7	11 1	
60	0 420	11 91	62 03	63 91	65 66	67 28	68 77	70 16	71 44	72 63	73 73	74 76	75 71	76 59	77 42	78 19	78 91	79 58	80 22	80 81	81 37	81 90	29 4		
65	0 343	14 59	66 64	68 15	69 53	70 80	71 97	73 04	74 03	74 94	75 78	75 56	77 28	77 95	78 58	79 16	79 71	80 22	80 70	81 15	81 58	81 98	16 8		
70	0 250	19 98	71 19	72 27	73 25	74 14	74 96	75 70	76 38	77 01	77 59	78 13	78 62	79 08	79 51	79 91	80 28	80 63	80 95	81 26					
75	0 143	34 99	75 68	76 28	76 82	77 32	77 76	78 17	78 54	78 88	79 19	79 48	79 74	79 99	80 22	80 43	80 63	80 82	80 99						
80	0 021	243 31	80 10	80 18	80 26	80 33	80 39	80 44	80 49	80 54	80 58	80 62	80 66	80 69	80 72	80 75	80 78	80 82							
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 17815 + 02203 D − 0003 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Region 8

Table 27. Diameter Growth Prediction Table

DBH		YEARS	D I A M E T E R (cm) R E A C H E D I N																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 310	16 12	6 63	8 43	10 42	12 60	14 99	17 59	20 39	23 37	26 51	29 76	33 09	36 45	39 80	43 09	46 29	49 38	52 35	55 19	57 89	60 44	121 6	99 1	81 0
10	0 402	12 43	12 10	14 37	16 83	19 46	22 27	25 23	28 32	31 51	34 75	38 02	41 28	44 48	47 60	50 63	53 54	56 32	58 97	61 49	63 88	66 14	109 3	87 0	68 9
15	0 479	10 43	17 48	20 12	22 92	25 86	28 91	32 06	35 26	38 49	41 71	44 88	47 98	50 99	53 88	56 66	59 31	61 83	64 22	66 48	68 61	70 63	98 4	76 3	58 3
20	0 541	9 24	22 78	25 69	28 72	31 83	35 01	38 22	41 42	44 59	47 69	50 71	53 63	56 42	59 09	61 63	64 04	66 32	68 48	70 52	72 44	74 25	88 7	66 8	48 8
25	0 588	8 50	28 00	31 09	34 24	37 44	40 64	43 81	46 93	49 98	52 92	55 75	58 46	61 04	63 49	65 80	67 99	70 05	72 00	73 83	75 56	77 19	79 9	58 0	40 0
30	0 620	8 06	33 13	36 32	39 52	42 70	45 85	48 92	51 91	54 78	57 53	60 16	62 65	65 00	67 23	69 33	71 31	73 17	74 92	76 57	78 12	79 58	71 7	49 7	31 8
35	0 637	7 85	38 20	41 39	44 56	47 66	50 69	53 61	56 41	59 08	61 62	64 03	66 29	68 43	70 44	72 33	74 11	75 77	77 34	78 81	80 20	81 51	63 9	41 8	23 9
40	0 639	7 82	43 18	46 32	49 38	52 34	55 19	57 92	60 50	62 95	65 27	67 44	69 48	71 40	73 20	74 88	76 46	77 95	79 34	80 65	81 88	83 03	56 3	34 0	16 0
45	0 626	7 98	48 09	51 10	53 99	56 76	59 40	61 89	64 24	66 45	68 52	70 46	72 27	73 97	75 56	77 05	78 44	79 74	80 96	82 11	83 19	84 21	48 8	26 2	8 2
50	0 598	8 36	52 93	55 74	58 42	60 95	63 33	65 56	67 65	69 61	71 43	73 13	74 71	76 19	77 58	78 87	80 07	81 20	82 26	83 26	84 19	85 07	41 1	18 1	
55	0 555	9 01	57 70	60 26	62 66	64 91	67 00	68 96	70 77	72 46	74 03	75 49	76 84	78 11	79 28	80 38	81 41	82 37	83 27	84 11	84 90	85 65	32 8	9 5	
60	0 497	10 06	62 40	64 65	66 73	68 66	70 45	72 10	73 63	75 04	76 35	77 56	78 69	79 74	80 71	81 62	82 47	83 26	84 00	84 70	85 35	85 97	23 7		
65	0 424	11 79	67 04	68 91	70 63	72 22	73 67	75 01	76 24	77 37	78 42	79 38	80 28	81 11	81 88	82 60	83 28	83 90	84 49	85 04	85 56	86 05	13 1		
70	0 336	14 87	71 60	73 06	74 39	75 59	76 69	77 70	78 62	79 47	80 25	80 97	81 63	82 25	82 82	83 36	83 85	84 32	84 75	86 16					
75	0 233	21 44	76 10	77 10	77 99	78 80	79 53	80 19	80 80	81 36	81 87	82 34	82 77	83 17	83 54	83 89	84 21	84 52	84 80						
80	0 115	43 41	80 54	81 02	81 45	81 84	82 18	82 50	82 78	83 04	83 28	83 50	83 70	83 89	84 06	84 23	84 38								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 20318 + 0229 D − 0003 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user: Non-dipterocarps
Location Region 8

Table 28. Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 231	21 63	6 22	7 57	9 08	10 75	12 61	14 66	16 92	19 38	22 05	24 89	27 88	30 98	34 14	37 32	40 48	43 58	46 59	49 50	52 28	54 94	134 7	110 3	90 9
10	0 327	15 27	11 71	13 58	15 61	17 81	20 18	22 72	25 41	28 23	31 16	34 16	37 20	40 24	43 25	46 21	49 08	51 86	54 52	57 07	59 51	61 82	120 2	96 0	76 6
15	0 408	12 24	17 12	19 39	21 81	24 37	27 07	29 88	32 77	35 73	38 71	41 69	44 64	47 54	50 35	53 08	55 70	58 20	60 59	62 87	65 03	67 08	107 6	83 7	64 4
20	0 475	10 53	22 44	25 02	27 71	30 50	33 38	36 31	39 27	42 22	45 15	48 02	50 82	53 53	56 14	58 64	61 02	63 29	65 45	67 49	69 42	71 25	96 5	72 8	53 5
25	0 526	9 51	27 68	30 47	33 33	36 24	39 19	42 14	45 06	47 93	50 74	53 45	56 07	58 58	60 97	63 25	65 41	67 47	69 41	71 24	72 98	74 62	86 6	62 9	43 7
30	0 562	8 90	32 85	35 75	38 69	41 63	44 56	47 44	50 26	53 00	55 64	58 17	60 58	62 88	65 06	67 13	69 09	70 93	72 68	74 32	75 88	77 34	77 4	53 8	34 5
35	0 583	8 58	37 93	40 88	43 81	46 71	49 54	52 30	54 97	57 52	59 97	62 29	64 50	66 59	68 56	70 42	72 17	73 83	75 39	76 85	78 24	79 55	68 8	45 1	25 8
40	0 589	8 49	42 94	45 85	48 71	51 49	54 18	56 77	59 24	61 59	63 82	65 93	67 92	69 79	71 55	73 21	74 77	76 24	77 62	78 92	80 15	81 31	60 6	36 6	17 3
45	0 580	8 61	47 87	50 68	53 39	56 01	58 50	60 88	63 13	65 25	67 25	69 13	70 90	72 56	74 12	75 58	76 95	78 24	79 45	80 59	81 67	82 68	52 4	28 1	8 8
50	0 557	8 98	52 74	55 37	57 88	60 28	62 54	64 67	66 68	68 56	70 32	71 97	73 51	74 96	76 31	77 58	78 77	79 88	80 93	81 92	82 84	83 72	44 1	19 4	
55	0 518	9 66	57 53	59 92	62 19	64 32	66 31	68 18	69 92	71 55	73 06	74 47	75 79	77 03	78 18	79 25	80 26	81 20	82 09	82 92	83 71	84 45	35 2	10 2	
60	0 464	10 78	62 25	64 35	66 32	68 14	69 84	71 42	72,89	74 25	75 51	76 68	77 78	78 79	79 74	80 63	81 46	82 24	82 97	83 65	84 30	84 90	25 5		
65	0 395	12 66	66 90	68 66	70 28	71 77	73 15	74 42	75 60	76 68	77 69	78 62	79 49	80 29	81 04	81 74	82 39	83 01	83 58	84 12	84 63	85 11	14 1		
70	0 311	16 07	71 49	72 84	74 08	75 22	76 25	77 20	78 08	78 88	79 63	80 31	80 95	81 54	82 09	82 61	83 09	83 53	83 96	84 35	84 72				
75	0 212	23 55	76 01	76 92	77 74	78 48	79 16	79 78	80 34	80 86	81 34	81 78	82 19	82 57	82 92	83 25	83 55	83 84	84 11	84 36					
80	0 098	50 79	80 46	80 88	81 25	81 58	81 88	82 15	82 40	82 63	82 84	83 03	83 21	83 38	83 53	83 67	83 81	83 93							
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 12004 + 02373 D — 0003 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Dipterocarps
Location Region 10

Table 29 Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 348	14 36	6 83	8 85	11 08	13 52	16 18	19 05	22 12	25 36	28 74	32 19	35 69	39 16	42 59	45 92	49 14	52 22	55 16	57 94	60 58	63 07	115 7	93 9	76 4
10	0 441	11 35	12 30	14 79	17 47	20 34	23 38	26 57	29 87	33 25	36 66	40 07	43 42	46 70	49 87	52 91	55 82	58 59	61 21	63 69	66 03	68 24	104 2	82 7	65 2
15	0 517	9 67	17 68	20 52	23 53	26 68	29 93	33 27	36 64	40 02	43 35	46 62	49 79	52 84	55 76	58 54	61 19	63 68	66 05	68 27	70 37	72 35	94 1	72 7	55 3
20	0 579	8 64	22 97	26 07	29 29	32 59	35 94	39 30	42 64	45 92	49 11	52 20	55 15	57 98	60 66	63 20	65 60	67 86	69 99	71 99	73 88	75 66	85 0	63 7	46 4
25	0 624	8 01	28 18	31 45	34 78	38 13	41 48	44 78	48 00	51 13	54 14	57 02	59 75	62 34	64 79	67 10	69 27	71 32	73 24	75 04	76 74	78 34	76 7	55 5	38 2
30	0 655	7 64	33 31	36 65	40 00	43 33	46 59	49 77	52 83	55 77	58 57	61 22	63 73	66 09	68 31	70 40	72 36	74 20	75 93	77 55	79 07	80 50	69 0	47 7	30 4
35	0 670	7 47	38 35	41 70	44 99	48 22	51 34	54 34	57 20	59 92	62 49	64 91	67 18	69 32	71 32	73 20	74 95	76 60	78 14	79 59	80 95	82 23	61 7	40 2	22 8
40	0 669	7 48	43 32	46 59	49 76	52 82	55 75	58 53	61 16	63 64	65 97	68 16	70 20	72 11	73 89	75 56	77 13	78 59	79 96	81 24	82 44	83 58	54 5	32 8	15 4
45	0 653	7 66	48 22	51 33	54 32	57 16	59 86	62 39	64 77	67 00	69 08	71 02	72 83	74 51	76 09	77 56	78 93	80 21	81 41	82 54	83 59	84 59	47 3	25 3	7 8
50	0 621	8 05	53 04	55 94	58 68	61 27	63 69	65 95	68 06	70 02	71 84	73 54	75 12	76 58	77 95	79 22	80 41	81 52	82 55	83 53	84 44	85 29	39 9	17 5	
55	0 574	8 72	57 79	60 41	62 86	65 15	67 27	69 24	71 06	72 75	74 31	75 76	77 10	78 35	79 51	80 58	81 59	82 53	83 41	84 23	85 00	85 73	32 0	9 2	
60	0 511	9 78	62 47	64 75	68 87	68 82	70 61	72 27	73 80	75 20	76 50	77 70	78 81	79 84	80 79	81 68	82 51	83 28	84 00	84 68	85 31	85 91	23 2		
65	0 433	11 55	67 07	68 97	70 71	72 29	73 74	75 07	76 29	77 41	78 44	79 39	80 26	81 08	81 83	82 53	83 18	83 79	84 36	84 89	85 39		12 9		
70	0 339	14 74	71 61	73 07	74 39	75 58	76 67	77 66	78 56	79 39	80 15	80 85	81 49	82 08	82 64	83 15	83 63	84 07	84 49						
75	0 230	21 75	76 09	77 05	77 92	78 70	79 41	80 05	80 63	81 16	81 64	82 09	82 50	82 88	83 23	83 56	83 86	84 15							
80	0 105	47 52	80 49	80 93	81 31	81 66	81 97	82 25	82 50	82 73	82 94	83 13	83 31	83 48	83 63	83 77	83 90								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 24041 + 02311 D — 00031 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Non-dipterocarps
Location Region 10

Table 30. Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 307	16 31	6 62	8 41	10 39	12 58	14 98	17 61	20 45	23 48	26 67	29 99	33 39	36 81	40 21	43 55	46 79	49 92	52 91	55 76	58 46	61 02	120 3	98 0	80 1
10	0 402	12 44	12 10	14 38	16 86	19 52	22.37	25 37	28 51	31 75	35 05	38 38	41 68	44 93	48 09	51 14	54 07	56 87	59 53	62 05	64 43	66 68	107 9	85 9	68 1
15	0 482	10 37	17 50	20 16	23 00	25 97	29 08	32 27	35 53	38 81	42 07	45 28	48 42	51 46	54 38	57 17	59 83	62 35	64 74	66 99	69 12	71 13	97 1	75 3	57 6
20	0 546	9 15	22 81	25 76	28 82	31 99	35 22	38 47	41 72	44 93	48 08	51 13	54 07	56 88	59 57	62 11	64 53	66 81	68 96	70 99	72 90	74 70	87 5	65 8	48.1
25	0 595	8 40	28 03	31 17	34 37	37 61	40 86	44 08	47 25	50 33	53 30	56 16	58 88	61 47	63 92	66 24	68 43	70 49	72 43	74 25	75 97	77 59	57 1	57 1	39 5
30	0 629	7 95	33 18	36 41	39 66	42.89	46 08	49 19	52 21	55 11	57 89	60 53	63 03	65 40	67 63	69 72	71 70	73 55	75 29	76 93	78 47	79 92	70 7	49 0	31 3
35	0 647	7 73	38 24	41 49	44 70	47 85	50 91	53 87	56.70	59 39	61 95	64 36	66 64	68 78	70 78	72 67	74 44	76 10	77 65	79 12	80 49	81 78	63 0	41 2	23 5
40	0 649	7 70	43 23	46 41	49 52	52.52	55 40	58 15	60 76	63 23	65 55	67 73	69 78	71 69	73 48	75 16	76 74	78 21	79 59	80 89	82 11	83 25	55 6	33 5	15 8
45	0 636	7 86	48 14	51 19	54 12	56 93	59 59	62.10	64 46	66 68	68 76	70 70	72 51	74 21	75 79	77 27	78 65	79 94	81 16	82 29	83 36	84 36	48 2	25 8	8 0
50	0 607	8 23	52 98	55 83	58 53	61 08	63 49	65 73	67 83	69 79	71 62	73 32	74 90	76 37	77 74	79 03	80 22	81 34	82 39	83 37	84 30	85 16	40 6	17 8	
55	0 563	8 88	57 74	60 33	62 75	65 02	67 13	69 09	70 91	72 60	74 16	75 62	76 97	78 22	79 39	80 48	81 49	82 44	83 33	84 16	84 94	85 58	32 5	9 4	
60	0 504	9 93	62 43	64 70	66 79	68 74	70 53	72 18	73 71	75 12	76 43	77 63	78 75	79 79	80 75	81 65	82 49	83 27	84 00	84 69	85 33	85 94	23 5		
65	0 428	11 67	67 05	68 94	70 67	72 26	73 71	75 04	76 27	77 39	78 43	79 39	80 28	81 10	81 86	82 57	83 23	83 85	84 42	84 96	85 47	85 95	13 0		
70	0 338	14 80	71 61	73 07	74 39	75 59	76 69	77 68	78 60	79.43	80 20	80 91	81 56	82 17	82 73	83 25	83 74	84 19	84 62	85 02					
75	0 232	21 58	76 10	77 08	77 96	78 75	79 47	80 12	80 72	81 26	81 75	82.21	82 63	83 02	83 39	83 72	84 03	84 33							
80	0 110	45 40	80 52	80 97	81 38	81 74	82 07	82 37	82 64	82 88	83 10	83 31	83 50	83 67	83 84	83 99	84 13								
85	0 000	999 99																							
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 19573 + 02373 D — 00031 D2)
Growth function computed by Monina T Uriarte ERDB

Intended user Dipterocarps
Location Region 11

Table 31. Diameter Growth Prediction Table

DBH		YEARS	DIAMETER (cm) REACHED IN																				YEARS TO REACH CLASS		
CLASS (cm)	PAI (cm)	IN CLASS	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	70 cm	60 cm	50 cm
5	0 352	14 21	6 85	8 91	11 18	13 68	16 43	19 41	22 63	26 04	29 62	33 32	37 07	40 83	44 55	48 18	51 69	55 06	58 28	61 33	64 23	66 96	105 9	87 8	72 6
10	0 448	11 17	12 34	14 89	17 65	20 62	23 79	27 14	30 63	34 23	37 88	41 55	45 19	48 76	52 22	55 55	58 75	61 79	64 67	67 40	69 98	72 42	95 0	77 0	61 8
15	0 529	9 45	17 74	20 68	23 80	27 09	30 52	34 06	37 66	41 28	44 89	48 44	51 90	55 25	58 46	61 52	64 44	67 20	69 81	72 28	74 60	76 79	85 4	67 5	52 2
20	0 596	8 39	23 07	26 30	29 67	33 15	36 71	40 31	43 91	47 47	50 95	54 33	57 59	60 70	63 67	66 49	69 15	71 67	74 04	76 27	78 37	80 35	76 7	58 9	43 6
25	0 648	7 71	28 31	31 74	35 27	38 84	42 44	46 01	49 53	52 95	56 27	59 45	62 48	65 37	68 10	70 68	73 11	75 40	77 56	79 58	81 49	83 28	68 6	50 9	35 7
30	0 686	7 29	33 48	37 03	40 62	44 20	47 75	51 23	54 60	57 86	60 97	63 93	66 74	69 40	71 90	74 26	76 47	78 55	80 50	82 34	84 06	85 68	61 2	43 4	28.2
35	0 710	7 05	38 57	42 16	45 73	49 26	52 69	56 02	59 21	62 26	65 16	67 89	70 47	72 90	75 18	77 32	79 32	81 20	82 97	84 62	86 18	87 64	54 1	36 3	21 1
40	0 718	6 96	43 59	47 15	50 64	54 03	57 30	60 44	63 42	66 24	68 90	71 40	73 75	75 95	78 01	79 94	81 74	83 44	85 02	86,51	87 90	89 21	47 2	29 3	14 1
45	0 713	7 02	48 53	51 99	55 34	58 55	61 61	64 52	67 26	69 84	72 26	74 52	76 63	78 61	80 45	82 18	83 79	85 30	86 71	88 04	89 28	90 44	40 3	22.3	7 1
50	0 693	7 22	53 41	56 70	59 84	62 83	65 65	68 30	70 78	73 11	75 27	77 29	79 17	80 92	82 56	84 08	85 51	86 84	88 08	89 25	90 34	91 37	33 4	15 3	
55	0 658	7 60	58 22	61 28	64 17	66 89	69 43	71 81	74 02	76 07	77 98	79 75	81 40	82 93	84 35	85 68	86 92	88 08	89 16	90 18	91 13	92 03	26.2	7 9	
60	0 609	8 21	62 96	65 73	68 33	70 74	72 98	75 06	76 98	78 76	80 40	81 93	83 34	84 66	85 88	87 01	88 07	89 06	89 98	90 85	91 66	92 42	18 4		
65	0 545	9 17	67 63	70 07	72 32	74 40	76 31	78 08	79 70	81 20	82 58	83 85	85 03	86 13	87 15	88 09	88 97	89 79	90 56	91 28	91 96	92 59	9 9		
70	0 467	10 71	72 24	74 29	76 16	77 87	79 44	80 88	82 20	83 40	84 52	85 54	86 49	87 37	88 18	88 94	89 64	90 30	90 92	91 49	92 03				
75	0 374	13 36	76 78	78 39	79 85	81 18	82 38	83 48	84 48	85 40	86 24	87 02	87 73	88 39	89 00	89 57	90 10	90 60	91 06	91 49					
80	0 267	18 72	81 26	82 39	83 41	84 32	85 14	85 89	86 57	87 19	87 76	88 29	88 77	89 21	89 63	90 01	90 36	90 70							
85	0 146	34 36	85 68	86 29	86 82	87 31	87 74	88 13	88 48	88 80	89 10	89 37	89 62	89 85	90 06	90 26	90 44								
90	0 009	534 18	90 04	90 08	90 12	90 15	90 17	90 20	90 22	90 24	90 26	90 27	90 29	90.30	80 31	90 33									
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G = 24156 + 02352 D — 00029 D2)
Growth function computed by Monina T Uriarte, ERDB

Intended user Non-dipterocarps
Location Region 11

Table 32 Diameter Growth Prediction Table

DBH CLASS (cm)	PAI (cm)	YEARS IN CLASS	DIAMETER (cm) REACHED IN 5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years	45 Years	50 Years	55 Years	60 Years	65 Years	70 Years	75 Years	80 Years	85 Years	90 Years	95 Years	100 Years	YEARS TO REACH CLASS 70 cm	60 cm	50 cm
5	0 354	14 13	6 88	9 00	11 39	14 06	17 05	20 33	23 90	27 71	31 70	35 79	39 90	43 95	47 90	51 69	55 30	58 71	61 92	64 93	67 75	70 39	99 2	82 0	67
10	0 465	10 75	12 45	15 15	18 12	21 35	24 83	28 51	32 36	36 31	40 30	44 26	48 13	51 87	55 45	58 86	62 07	65 10	67 94	70 59	73 08	75 41	88 9	71 7	57
15	0 560	8 93	17 92	21 08	24 47	28 05	31 81	35 67	39 60	43 51	47 37	51 13	54 74	58 19	61 46	64 54	67 43	70 15	72 69	75 07	77 29	79 37	79 7	62 7	48
20	0 637	7 85	23 29	26 79	30 46	34 25	38 13	42 03	45 90	49 69	53 36	56 88	60 23	63 40	66 38	69 18	71.80	74 25	76 54	78 68	80 68	82 55	71 5	54 6	40
25	0 698	7 17	28 57	32 30	36 12	40 01	43 89	47 72	51 46	55 07	58 51	61 78	64 87	67 77	70 49	73 03	75 40	77 61	79 68	81 61	83 41	85 10	64 1	47 2	33
30	0 741	6 75	33 76	37 61	41 50	45 37	49 17	52 86	56 41	59 80	63 00	66 02	68 84	71 49	73 95	76 25	78 39	80 39	82 25	83 99	85 61	87 13	57 1	40 3	26
35	0 768	6 51	38 87	42 75	46 60	50 37	54 02	57 52	60 85	63 99	66 94	69 69	72 26	74 66	76 88	78 95	80 88	82 68	84 35	85 91	87 37	88 73	50 6	33 7	19
40	0 777	6 43	43 88	47 71	51.45	55 06	58 51	61 77	64 84	67 72	70 40	72 90	75 21	77 37	79 36	81 22	82 94	84 55	86 04	87 43	88 73	89 95	44 2	27 3	13
45	0 770	6 50	48 81	52 51	56 07	59 46	62,65	65 65	68 45	71 05	73 46	75 69	77 76	79 68	81 45	83 10	84 63	86 05	87 37	88 61	89 76	90 83	37 9	20 8	6
50	0 745	6 71	53 66	57 16	60 47	63 59	66 50	69 20	71 71	74 02	76 16	78 14	79 96	81 64	83 20	84 64	85 98	87 23	88 39	89 47	90 47	91 42	31 5	14 3	
55	0 704	7 10	58 43	61 65	64 67	67 48	70 07	72 46	74 66	76 68	78 54	80 26	81 84	83 29	84 64	86 89	87 04	88 11	89 11	90 04	90 91	91 73	24 9	7 4	
60	0 645	7 75	63 12	66 01	68 68	71 13	73 38	75 44	77 33	79 06	80 64	82 10	83 43	84 66	85 80	86 85	87 83	88 73	89 58	90 36	91 10	91 78	17 6		
65	0 570	8 78	67 73	70 23	72 51	74 58	76 46	78 18	79 74	81 17	82 48	83 67	84 77	85 78	86 71	87 57	88 37	89 11	89 90	90 44			9 5		
70	0 477	10 48	72 27	74 32	76 16	77 83	79 33	80 69	81 92	83 05	84 07	85 01	85 87	86 66	87 38	88 06	88 68	89 26							
75	0 368	13 60	76 73	78 28	79 66	80 89	81 99	82 99	83 89	84 70	85 45	86 12	86 74	87 32	87 84	88 33	88 78								
80	0 241	20 72	81 13	82.12	83 00	83 77	84 47	85 09	85 65	86 16	86 62	87 03	87 42	87 77	88 10	88 40									
85	0 098	51 14	85 45	85 85	86 19	86 50	86 76	87 01	87 22	87 42	87 59	87 75	87 90	88 04	88 16										
90	0 000	999 99																							
95	0 000	999 99																							
100	0 000	999 99																							

Diameter growth function (G= 22527 + 0274 D - 00034 D2)
Growth function computed by, Monina T Uriarte, ERDB

Table 33. Diameter reached after 30 years by region

Species group	DBH class	REGIONS 1	2	3	4	6	7	8	10	11
Dipterocarp	5	14.19	17.94	12 74	16.44	17.98	16.69	17.59	19.05	19.41
	10	24.18	26.08	21.97	25.33	25.74	24.54	25.23	26.57	27.14
	15	32.84	33 29	29.96	33 02	32.64	31.52	32.06	33.27	34.06
	20	40.48	39.75	36.98	39.80	38.85	37.78	32.22	39.30	40.31
	25	47.31	45.57	43.24	45.84	44.46	43.44	43.81	44.78	46.01
	30	53.48	50.87	48.87	51.27	49.57	48.59	48.92	49.77	51.23
	35	59.09	55.71	53.97	56.19	54.25	53.30	53.61	54.34	56.02
	40	64.21	60.14	58.61	60.65	58 54	57.62	57.92	58.53	60.44
	45	68.91	64.22	62.84	64.73	62.48	61.59	61.89	62.39	64.52
	50	73.23	67.97	66.71	68.45	66.12	65.25	65.56	65.95	68.30
	55	77.23	71.44	70.27	71.86	69.47	68.63	68.96	69.24	71.81
	60	80.91	74.64	73.53	74.99	72.57	71.75	72.10	72.27	75.06
	65	84.33	77.59	76.53	77.85	75.43	74.63	75.01	75.07	78.08
	70	87.49	80.32	79.28	80.48	78.08	77.29	77.70	77.66	80.88
	75	90.42	82.84	81.81	82.89	80.52	79.74	80.19	80.05	83.48
Non-Dipterocarp	5	21.60	17.55	10.36	17.60	16.73	16.26	14.66	17.61	20.33
	10	29.38	25.17	18.74	26.72	24.74	23.80	22.72	25.37	28 51
	15	36.15	31 96	26.32	34.84	31.81	30.55	29.88	32.27	35.67
	20	42.14	38.07	33.24	41.22	38.13	36.64	36.31	38.47	42.03
	25	47.47	43.60	39.60	47.15	43.82	42.17	42.14	44.08	47.72
	30	52.27	48.64	45 48	52.43	48.99	47.22	47.44	49.19	52.86
	35	56.60	53.25	50.92	57.17	53.70	51.86	52.30	53.87	57.52
	40	60.52	57.48	55.99	61.43	58.01	56.12	56.77	58.15	61.77
	45	64.08	61.37	60.71	65.29	61.96	60.06	60.88	62.10	65.65
	50	67.36	64.96	65 12	68.79	65.60	63.69	64.67	65.73	69.20
	55	70.27	68.27	69.25	71.96	68.94	67.05	68.18	69.09	72.46
	60	72.96	71.33	73.12	74.84	72.02	70.16	71.42	72.18	75.44
	65	75.40	74.16	76.75	77.46	74.86	73.04	74.42	75.04	78.18
	70	77.62	76.76	80.16	79.83	77.47	75.70	77.20	77.68	80.69
	75	79.63	79.17	83.37	81.98	79.88	78.17	79.78	80.12	82.99

Table 34. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in climatic type I

DBH class (cm)	30 years			35 years		
	Dipt.	Non-dipt	Total	Dipt	Non-dipt	Total
5	13.8987	21.8445	35.7432	13.8987	23.5354	37.4341
10	10.6381	30.0803	40.7184	16.0737	30.0803	46.1540
15	19.6010	28.1257	47.7267	27.2350	29.6623	56.8973
20	19.2213	17.7599	36.9812	23.8357	24.7473	48.5830
25	12.1845	22.6486	34.8331	12.1845	22.6486	34.8331
30	14.4114	17.1132	31.5246	14 4114	17.1132	31.5246
35	10.6775	19.4076	30.0851	10.6775	19.4076	30.0851
40	12.0766	15.0446	27.1212	12.0766	14.2958	26.3724
45	16.2125	6.6912	22.9037	16.7895	7.1812	23.9707
50	10.5494	6.6740	17.2234	15.0204	6.6740	21.6944
55	6.8528	2.7230	9.5758	6.8528	4.4116	11.2644
60	4.0442	0.1695	4.2137	5.1396	0.1695	5.3091
65	3.7831	0.1271	3.9102	5.8547	0.1271	5.9818
70	2.0873	0.0953	2.1826	5.8910	0.0953	5.9863
75	2.8155	0.0715	2.8870	3.1683	0.0715	3.2398
Total	159.0539	188.5760	347.6299	189.1094	200.2207	389.3301

DBH class (cm)	40 years			45 years		
	Dipt.	Non-dipt.	Total	Dipt.	Non-dipt.	Total
5	20.0941	31.8226	73.9167	27.3746	31.8226	59.1972
10	18.3903	35.1608	73.5511	25.5527	38.1744	63.7271
15	33.7731	33.4383	125.2114	33.7731	33.4383	67.2114
20	25.0792	33.2251	60.3043	26.1477	35.2130	61.3607
25	16.5245	24.0037	42.5282	23.0010	28.6525	51.6535
30	21.2328	21.8345	73.0673	25.1833	30.2500	55.4333
35	13.2935	25.4416	34.7351	16.8734	25.4416	42.3150
40	19.7556	13.3480	33.1036	19.7556	13.3480	33.1036
45	23.9053	7.1812	31.0865	23.9053	10.0854	33.9907
50	15.0204	9.0088	16.0292	17.9290	11.0088	28.9378
55	11.2653	4.4116	11.6769	13.4467	6.7566	20.2033
60	8.4490	0.3087	8.7577	10.0850	0.5675	10.6525
65	6 3367	0.2315	6 5682	7.5638	0.4256	7.9894
70	6.7525	0.1736	4.9261	7.6728	0.3192	7.9920
75	3.5644	0.1302	3.6946	4.2546	0.2394	4.4940
Total	243.4427	239.7202	483.1629	282.5186	265.7429	548.2615

Table 35. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in climatic type II

DBH class (cm)	30 years Dipt.	Non-dipt.	Total	35 years Dipt.	Non-dipt.	Total
5	4.2178	5.4366	9.6544	4.2178	11.1426	15.3604
10	10.9131	24.0399	34.9530	16.8307	24.0399	40.8706
15	12.7459	21.8461	34.5920	12.7459	29.5449	42.2908
20	13.6622	16.1736	29.8358	17.0553	22.4029	39.4582
25	10.6775	19.6834	30.3609	12.6079	19 6834	32.2913
30	8.4427	14.4857	22.9284	10.2021	14.4857	24.6878
35	11.0462	16.8853	27.9315	15.6932	16.8853	32.5785
40	13.6764	2.8872	16.5636	18.0419	2.8872	20.9291
45	14.2173	2.2124	16.4297	14.2173	5.5585	19.7758
50	17.9261	3.5309	21.4570	17.9261	9.0080	26.9341
55	11.5837	5.7081	17.2918	15.7412	5.7081	21.4493
60	17.2974	17.0493	34.3467	17.2974	17.0493	34.3467
65	10.2946	8.3712	18.6658	12.9731	8.3712	21.3443
70	7.7210	6.2784	13.9994	9.7298	6.2784	16.0082
75	5.7907	4.7088	10.4995	7.2973	4.7088	12.0061
Total	170.2126	169.2969	339.5095	202.5770	197.7542	400.3312

DBH class (cm)	40 years Dipt.	Non-dipt.	Total	45 years Dipt.	Non-dipt.	Total
5	8.6727	11.1426	19.8153	13.3755	20.0896	33.4651
10	21.8781	30.8205	52.6986	21.8781	32.5013	54 3794
15	17.7947	29.5449	47.3396	22.2141	40.9240	63.1381
20	17.0553	31.2905	48.3458	19.2709	31.2905	50.5614
25	14.9217	24.6179	39.5396	18.9217	24.6179	43.5391
30	19.5377	18.2439	37.7816	19.5377	18.2439	37.7816
35	15.6932	20.8473	36.5405	20.7024	20.8473	41.5497
40	18.0419	7.2540	25.2959	19.1153	7.2540	26.3693
45	15.0632	5.5585	20.6217	15.0632	10.1809	25.2441
50	17.9261	9.0080	26.9341	24.3600	9.0080	33.3680
55	15.7412	6.6100	22.3512	15.7412	6.6100	22.3512
60	17.2974	17.0493	34.3467	21.8059	17.0493	38.8552
65	12.9731	12.7870	25.7601	18.8544	12.7870	31.6414
70	9.7298	9.5902	19.3200	10.6408	9.5902	20.2310
75	7.2973	7.1927	14.4900	8.9806	7.1927	16.1733
Total	229.6234	241.5573	471.1807	270.4613	268.1866	538.6479

Table 36. PROJECTED VOLUME (m^3) PER HECTARE AFTER Projected volume in climatic type III

DBH class (cm)	30 years Dipt.	30 years Non-dipt.	30 years Total	35 years Dipt.	35 years Non-dipt.	35 years Total
5	0.7471	2.1165	2.8636	1.7035	4.0927	5.7962
10	13.3078	19.6639	32.9717	14.0123	19.6639	33.6762
15	3.0039	18.6017	21.6056	7.0843	25.1634	32.2477
20	16.6945	24.3774	41.0719	16.6945	24.3774	41.0719
25	18.6084	17.2569	35.8653	18.6084	17.2569	35.8653
30	17.8657	15.8786	33.7443	17.8657	15.8786	33.7443
35	18.0392	13.5119	31.5511	18.0392	13.5119	31.5511
40	17.8849	6.6461	24.5310	17.8849	6.6461	24.5310
45	11.7830	5.8486	17.6316	17.0263	10.7641	27.7904
50	14.2899	8.4925	22.7824	17.2364	8.4925	25.7289
55	13.1499	5.6079	18.7578	13.1499	5.6079	18.7578
60	12.4054	3.7247	16.1301	12.4054	5.7199	18.1253
65	5.9026	3.0849	8.9875	5.9026	3.0849	8.9875
70	4.4269	1.5425	5.9694	4.4269	2.3137	6.7406
75	3.3202	1.1569	4.4771	3.3202	1.7353	5.0555
Total	171.4294	147.5110	318.9404	185.3605	164.3092	349.6697

DBH class (cm)	40 years Dipt.	40 years Non-dipt.	40 years Total	45 years Dipt.	45 years Non-dipt.	45 years Total
5	3.1292	4.0927	7.2219	3.1292	6.1611	9.2903
10	14.0123	32.1514	46.1637	22.8189	43.4927	66.3116
15	10.2104	32.0731	42.2835	10.2104	32.0731	42.2835
20	23.7002	28.6761	52.3763	23.7002	28.6761	52.3763
25	23.6577	23.2016	46.8593	26.8551	27.4528	54.3079
30	24.8114	18.7880	43.5994	24.8114	18.7880	43.5994
35	18.3358	15.9631	34.2989	18.3358	15.9631	34.2989
40	25.8435	12.2320	38.0755	25.8435	12.2320	38.0755
45	17.0263	10.7641	27.7904	20.5369	12.8898	33.4267
50	17.2364	10.1696	27.4060	17.2364	10.1716	27.4080
55	15.5554	5.6079	21.1633	15.5554	8.6120	24.1674
60	12.4054	5.7199	18.1253	12.4054	5.7399	18.1453
65	9.3041	3.0849	12.3890	9.3041	4.3049	13.6090
70	6.9780	2.3137	9.2917	6.9780	3.2287	10.2067
75	5.2335	1.7353	6.9688	5.2335	2.4215	7.6550
Total	227.4396	206.5734	434.0130	242.9542	232.2073	475.1615

Table 37. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in climatic type IV

DBH class (cm)	30 years Dipt.	Non-dipt.	Total	35 years Dipt.	Non-dipt.	Total
5	0.5544	1.6770	2.2314	1.2607	1.6770	2.9377
10	7.7295	13.1780	20.9075	10.1592	15.2326	25.3918
15	13.0429	28.9773	42.0202	13.0429	28.9773	42.0202
20	10.8340	21.7853	32.6193	15.9838	21.7853	37.7691
25	21.3234	16.1034	37.4268	21.2699	16.1034	37.3733
30	13.0993	11.0995	24.1988	16.6039	11.0995	27.7034
35	9.0516	7.2553	16.3069	10.3689	7.2553	17.6242
40	12.4121	9.8162	22.2283	15.4324	9.8162	25.2486
45	9.8397	5.2439	15.0836	9.8397	8.9564	18.7961
50	13.2144	6.9710	20.1854	13.2144	6.9710	20.1854
55	7.0059	2.9139	9.9198	9.9476	2.9139	12.8615
60	5.6611	2.9655	8.6266	5.6611	2.9655	8.6266
65	8.3662	6.7503	15.1165	11.7458	6.7503	18.4961
70	2.2746	11.2289	13.5035	3.8094	11.2289	15.0383
75	4.7060	8.4217	13.1277	6.6071	8.4217	15.0288
Total	139.1151	154.3872	293.5023	164.9468	160.1543	325.1011

DBH class (cm)	40 years Dipt.	Non-dipt.	Total	45 years Dipt.	Non-dipt.	Total
5	2.3290	2.3947	4.7237	2.3290	4.2218	6.5508
10	10.1592	16.8197	26.9789	17.4747	16.8197	34.2944
15	14.1557	37.4586	51.6143	16.1108	42.1645	58.2753
20	15.9838	30.3380	46 3218	19.9337	30.7940	50.7277
25	26.9606	16.3454	43.3060	26.9606	20.3982	47.3588
30	19.0202	16.5678	35.5880	19.0202	19.3482	38.3684
35	10.3689	8.4729	18.8418	13.7499	8.4729	22.2228
40	15.4324	16.7657	32.1981	19.1233	16.7657	35.8890
45	12.5689	8.9564	21.5253	12.5689	10.2348	22.8037
50	15.5591	9.0743	24.6334	15.5591	9.0743	24.6334
55	9.9476	2.9139	12.8615	9.9476	7.3345	17.2821
60	7.4607	7.4643	14.9250	7.4607	7.4643	14.9250
65	13.5955	6.7503	20.3458	13.5955	6.7503	20.3458
70	4.1966	11.2289	15.4255	4.1966	15.0627	19.2593
75	7.1475	8.4217	15.5692	7.1475	9.7970	16.9445
Total	184.8857	199.9726	384.8583	205.1781	224.7029	429.8810

REGION I

Table 38. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in Region 1

DBH class (cm)	30 years Dipt.	30 years Non-dipt.	30 years Total	35 years Dipt.	35 years Non-dipt	35 years Total
5	11.2040	13.5121	24.7161	16.1440	14.1629	30.3033
10	11.2775	10.8269	22 1044	14.2220	12.2356	26.4576
15	20.5840	15.2036	35.7876	25.5840	16.7181	42.3021
20	17.3408	7.9970	25.3378	20.8889	10.4743	31.3632
25	21.7649	9.8473	31.6122	23.9948	12.9078	36.9026
30	19.6744	7.7913	27.4657	25.6862	9.0338	34.7200
35	14.8040	10.2068	25.0108	16.6650	12.1308	28.7958
40	25.8313	12.6551	38.4864	28.4438	12.6551	41.0989
45	16.4438	6.7413	23.1857	18.4425	6.7413	25.1838
50.	20.5550	4.3060	24.8610	22.5775	5.9945	28.5720
55	11.2775	5.2295	16.5070	11.2775	5.7459	17.0234
60	8.4581	4.4221	12.8802	8.4581	4.4221	12.8802
65	6.3436	3.8166	10.1602	6.3436	3.8166	10.1602
70	4.7577	1.3624	6.1201	4.7577	1.3624	6.1201
75	3.5683	1.0218	4.5901	3.5683	1.0218	4.5901
Total	213.8849	114.9398	328.8247	247.0503	129.4230	376.4733

DBH class (cm)	40 years Dipt.	40 years Non-dipt.	40 years Total	45 years Dipt.	45 years Non-dipt.	45 years Total
5	16.1404	16.8509	32.9913	19.0340	20.3076	39.3416
10	14.2220	15.2356	29.4576	16.9360	17.2506	34.1866
15	28.2115	20.3496	48.5611	33.6820	22.3496	56.0316
20	23.2227	14.1408	37.3635	25.6431	19.4383	45.0814
25	25.5392	15.4473	40.9865	30.5392	16.9153	47.4545
30	29.2640	10.6538	39.9178	32.9608	12.1139	45.0747
35	16.6650	14.2228	30.8878	20.1550	17.9615	38.1165
40	30.4438	16.6594	47.1032	33.3875	18.8568	52.2443
45	20.3875	9.7624	30.1499	25.0406	13.4711	38.5117
50	22.5775	7.0718	29.6493	23.7805	10.1033	33.8838
55	12.6998	6.0538	18.7536	15.8354	7.5775	23.4129
60	9.5249	6.5404	16.0653	11.8766	6.5404	18.4170
65	7.1436	4.4053	11.5489	8.9074	5.2620	14.1694
70	5 3577	2.5540	7.9117	6.6806	3.1967	9.8773
75	4.0183	2.9155	6.9338	5.1005	2.9155	8.0160
Total	265.4179	162 8634	428.2813	309.5592	194.2601	503.8193

REGION II

Table 39. PROJECTED VOLUME (m^3) PER HECTARE AFTER Projected volume in Region II

DBH class (cm)	30 years Dipt.	Non-dipt.	Total	35 years Dipt.	Non-dipt.	Total
5	1.0254	1.3549	2.3803	1.0254	1.3549	2.3803
10	15.8892	9.3700	25.2592	17.4026	15.1069	32.5095
15	22.5239	12.0200	35.5439	22.5239	14.9662	37.4901
20	17.9980	20.0045	38.0025	22.7830	21.3315	44.1145
25	16.0124	10.9910	27.0034	21.8113	12.8889	22.7002
30	18.4842	13.9425	32.4267	20.9779	13.9425	34.9204
35	12.9842	9.2198	22.2040	22.2040	9.2198	25.5221
40	18.2985	7.3186	25.6171	21.2421	8.6227	26.8648
45	12.5200	4.1307	16.6507	12.5200	6.7225	13.2425
50	13.7350	0.4533	14.1883	13.7350	0.4533	14.1883
55	10.1305	4.8099	14.9344	15.6924	4.8039	20.4963
60	13.9292	4.9131	18.8423	13.9292	5.3730	19.3022
65	10.4469	3.4626	13.9095	10.4469	3.4626	13.9095
70	7.8352	4.8556	12.6908	7.8352	5.5970	10.4322
75	5.8764	1.6417	7.5181	5.8764	3.9477	7.8241
Total	197.689	108.4822	306.1712	230.0053	127.7934	357.7987

DBH class (cm)	40 years Dipt.	Non-dipt.	Total	45 years Dipt.	Non-dipt.	Total
5	2.8163	1.6520	4.4683	4.8438	1.6520	6.4958
10	20.3005	15.1069	35.4074	20.3005	17.2144	37.5149
15	23.6625	20.0354	43.6979	29.9535	20.0354	49.9889
20	22.7830	23.2624	46.0454	31.0339	23.2624	54.2963
25	21.8113	20.7640	42.5753	24.7539	24.8587	49.6126
30	20.9779	15.9251	36.9030	26.3388	15.9251	42.2639
35	16.3023	12.0834	28.3857	18.9248	12.0834	31.0082
40	21.2421	8.6227	29.8648	25.0417	10.9834	36.0251
45	14.7594	6.7225	21.4819	14.7594	9.5714	24.3308
50	21.2758	6.0048	27.2806	21.2758	6.0048	27.2806
55	15.6924	4.8039	20.4963	15.6924	5.2536	20.9460
60	14.7693	5.3730	20.1423	15.5714	5.3730	20.9444
65	11.8270	3.4626	15.2896	13.1786	3.4626	16.6412
70	8.6202	5.5970	14.2172	10.3839	5.5970	15.9809
75	6.9652	3.9477	10.9129	7.0379	3.9477	10.9856
Total	243.8052	153.3634	397.1686	279.0903	165.2249	444.3152

REGION III

Table 40. PROJECTED VOLUME (m^3) PER HECTARE AFTER Projected volume in Region III

DBH class (cm)	30 years Dipt.	30 years Non-dipt.	30 years Total	35 years Dipt.	35 years Non-dipt.	35 years Total
5	0.2395	0.2089	0.4484	0.2395	0.2089	0.4484
10	3.0607	7.7681	10.8288	8.3552	7.7681	16.1233
15	6.1630	11.0474	17.2104	12.0266	19.7198	31.7464
20	10.7460	17.3352	28.0812	13.2804	17.3352	30.6156
25	12.5054	21.8471	34.3525	12.5054	21.8471	34.3525
30	15.9060	14.7933	30.6993	15.9060	19.5756	35.4816
35	6.4140	17.3032	23.7172	6.4140	18.1226	24.5366
40	15.9691	14.9330	30.9021	15.9691	17.3848	33.3539
45	8.1457	11.8989	20.0446	8.1457	12.4293	20.5750
50	7.3416	15.7384	23.0800	8.0318	15.7384	23.7702
55	4.8956	7.3303	12.2259	4.8956	7.3303	12.2259
60	4.0621	3.2070	7.2691	4.0621	3.2070	7.2691
65	2.0581	0.5345	2.5926	3.0465	2.4052	5.4517
70	1.5435	0.4008	1.9443	2.2848	1.8039	4.0887
75	1.1576	0.3006	1.4582	1.7136	1.3529	3.0665
Total	100.2097	144.6467	244.8546	116.8763	166.2291	283.1054

DBH class (cm)	40 years Dipt.	40 years Non-dipt.	40 years Total	45 years Dipt.	45 years Non-dipt.	45 years Total
5	0.2395	0.5191	0.7586	0.5494	0.5191	1.0685
10	10.1241	12.2178	22.3419	10.1227	12.2178	22.3405
15	12.0266	19.7198	31.7464	14.8616	24.9073	39.7689
20	17.2476	26.6444	43.8920	17.2476	26.6444	43.8920
25	19.8256	26.2413	46.0669	22.4999	34.7244	57.2243
30	18.0524	19.5756	37.6280	19.5551	20.5025	40.0576
35	6.9479	18.1226	25.0705	6.9479	26.7147	33.6626
40	19.9271	17.3848	37.3119	19.9271	18.1597	38.0868
45	8.9115	12.4293	21.3408	8.9115	13.1218	22.0333
50	8.0318	16.0829	24.1147	11.3740	16.0829	27.4569
55	6.9327	8.2337	15.1664	6.9327	8.2337	15.1664
60	4.0621	3.2070	7.2691	5.1990	5.4252	10.6247
65	3.0465	2.4052	5.4517	3.4517	4.0689	7.9685
70	2.2848	1.8039	4.0887	2.9247	3.0516	5.9763
75	1.7136	1.3529	3.0665	2.1935	2.2887	4.4822
Total	139.3738	185.9403	325.3141	153.1468	216.6627	369.8095

REGION IV

Table 41. PROJECTED VOLUME (m^3) PER HECTARE AFTER Projected volume in Region IV

DBH class (cm)	30 years Dipt.	Non-dipt.	Total	35 years Dipt.	Non-dipt.	Total
5	3.2909	2.1208	5.4117	5.6368	2.1208	7.7576
10	4.5519	8.9302	13.4821	6.8071	13.6603	20.4674
15	3.0495	16.4846	19.5341	3.0495	27.2417	30.2912
20	5.8028	18.8116	24.6144	8.0092	23.5113	31.5205
25	4.9904	19.1237	24.1141	7.2148	19.6669	26.8817
30	8.0405	16.2382	24.4787	8.4151	21.3898	29.8049
35	9.2587	13.0020	22.2607	11.5254	13.4509	24.9763
40	9.9886	16.8100	26.7986	12.6552	20.4757	33.1309
45	7.7675	16.4228	24.1903	7.7675	19.6709	27.4380
50	14.0628	10.6378	24.7006	14.0628	10.6378	24.7006
55	8.8041	8.7180	17.5221	10.3207	11.9939	22.3146
60	2.8399	5.4108	8.2507	2.8399	5.4108	8.2507
65	2.1299	2.1513	4.2812	2.1299	4.0581	6.1880
70	1.5974	1.6134	3.2108	1.5974	3.0435	4.6409
75	1.1980	1.2100	2.4080	1.1980	2.2826	3.4806
Total	87.3729	157.6852	245.0581	103.2293	198.6150	301.8443

5	7.1522	3.2401	10.3923	7.1522	4.9563	12.1085
10	6.8071	20.4538	27.2609	8.9474	33.8009	42.7483
15	3.9605	27.2417	31.2022	5.4663	34.0474	39.5137
20	8.0092	24.1792	32.1884	11.5791	24.1792	35.7583
25	7.5510	25.9064	33.4574	7.5510	26.8007	34.3517
30	10.4753	22.1283	32.6036	10.4753	22.1283	32.6036
35	11.5254	18.0749	29.6003	13.9868	18.0749	32.0617
40	12.6552	20.1757	33.1309	15.5368	22.0575	37.5943
45	13.9433	19.6709	33.6142	13.9433	25.3592	39.3025
50	15.3041	17.4059	32.7100	15.3041	16.4059	32.7100
55	10.3207	13.0544	23.3751	12.9780	13.0544	26.0324
60	2.4905	9.7908	12.2813	2.9835	9.7908	12.7743
65	4.8678	7.3431	12.2109	5.2376	7.3431	12.5807
70	1.4008	5.5073	6.9081	1.6782	5.5073	7.1855
75	2.0506	4.1304	6.1810	3.2586	4.3890	7.3890
Total	118.5137	238.6029	357.1166	136.0782	268.6363	404.7145

REGION VI

Table 42. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in Region VI

DBH class (cm)	30 years			35 years		
	Dipt.	Non-dipt.	Total	Dipt.	Non-dipt.	Total
5	3.0175	4.0722	7.0897	3.0175	5.1534	8.1709
10	6.9136	7.2689	14.1825	8.6818	8.4081	17.0899
15	4.6966	2.4344	7.1310	4.6966	3.1293	7.8259
20	11.1426	3.1139	14.2615	11.1426	3.1189	14.2615
25	17.4894	5.4500	22.9394	21.5228	5.4500	26.9728
30	22.0614	3.2934	25.3548	28.0691	3.2934	31.3625
35	16.4197	6.2636	22.6833	16.4197	6.2636	22.6833
40	15.3639	8.1456	23.5095	15.3639	8.1456	23.5095
45	16.9691	4.8055	21.7746	22.0098	6.3857	28.3955
50	20.9663	2.5559	23.5222	29.8738	4.0392	33.9130
55	15.9712	5.9169	21.8881	15.9712	6.7794	22.7506
60	22.2374	1.4376	23.6750	22.2374	2.9243	23.1617
65	18.3276	1.5854	19.9130	18.3276	1.5854	19.9130
70	13.7457	1.5854	15.3311	13.7457	2.1890	15.9347
75	10.3092	1.1890	11.4982	10.3092	1.8917	12.2009
Total	215.6312	59.1227	274.7539	241.3887	68.7570	310.1457

DBH class (cm)	30 years			45 years		
	Dipt.	Non-dipt.	Total	Dipt.	Non-dipt.	Total
5	5.9136	5.1534	11.0670	5.9136	7.2689	13.1825
10	8.6818	8.4087	17.0905	10.6966	10.5247	21.2213
15	6.4509	5.2692	11.7201	8.5174	5.2692	13.7866
20	14.7120	4.0463	18.7583	18.1049	6.8910	24.9959
25	21.5228	7.3944	28.9172	27.3838	9.0732	36.4570
30	28.0691	4.8967	32.9658	34.8883	7.4392	42.3275
35	20.4088	8.1456	28.5544	20.4088	8.1456	28.5544
40	19.9278	10.9706	30.8966	19.9278	10.9708	30.8986
45	22.0098	6.3857	28.3955	23.7052	9.4781	33.1833
50	30.8138	4.0392	34.8530	30.8138	6.1085	36.9223
55	21.3211	6.7794	28.1005	21.3211	8.5854	29.9065
60	22.2374	2.9243	25.1617	24.2086	2.9243	27.1329
65	20.6778	1.5854	22.2632	20.6778	2.1934	22.8712
70	15.5083	2.1890	17.6973	15.5083	4.6450	20.1533
75	12.3812	1.8917	14.2729	12.3812	2.2337	14.6149
Total	270.6362	80.0798	350.7160	294.4572	101.7510	396.2082

REGION VII

Table 43. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in Region VII

DBH class (cm)	30 years Dipt.	30 years Non-dipt.	30 years Total	35 years Dipt.	35 years Non-dipt.	35 years Total
5	2.0316	6.5026	8.5342	4.0471	11.6763	15.7234
10	14.2467	30.3759	44.6226	19.0083	30.3759	49.3842
15	15.9097	32.5975	48.5072	21.9669	34.2950	56.2619
20	15.1657	21.5945	36.7602	15.1657	27.7320	42.8977
25	16.7117	16.8849	33.5966	22.8978	25.2405	48 1383
30	17.7662	16.0963	33.8625	18.8682	10.3146	29.1828
35	15.9002	5.1826	21.0828	15.9002	13.8706	29.7708
40	14.8532	11.9738	26.8270	14.8532	9.3755	24.2287
45	14.7950	6.3388	21.1338	16.7279	6.3388	22.0667
50	19.3952	3.0152	22.4104	19.3952	3.0152	22.4104
55	7.8294	1.6072	9.4366	7.8294	4.2143	12.0437
60	6.3157	5.3985	11.7142	13.1551	5.3985	18.5536
65	13.9705	4.6586	18.6291	13.9705	4.6586	18.6291
70	10.5458	9.4778	20.0236	10.9801	9.4778	20.4579
75	5.7623	7.8312	13.5935	8.2351	7.8312	16.0663
Total	191.1989	179.5354	370.7343	223.0007	203.8118	426.8155

DBH class (cm)	40 years Dipt.	40 years Non-dipt.	40 years Total	45 years Dipt.	45 years Non-dipt.	45 years Total
5	4.0471	11.6763	15.7230	8.6309	21.8071	30.4380
10	19.0083	49.6988	68.7071	26.2452	49.6988	75.9440
15	27.6756	44.2083	71.8839	27.6756	56.8843	84.5599
20	22.8978	27.7320	50.6298	22.8978	31.4553	54.3531
25	18.8682	26.1745	45.0427	18.8682	26.1744	45.0426
30	25.8786	17.6057	43.4843	25.8786	17.6057	43.4843
35	21.3479	13.8706	35.2185	21.3479	16.8608	38.2087
40	16.7938	9.3755	26.1693	16.7938	10.3911	27.1849
45	16.7279	6.3493	23.9772	18.2478	6.3493	24.6071
50	15.3717	3.0152	18.3869	15.3717	7.9062	23.2779
55	7.8294	4.2143	12.0437	16.3080	4.2143	20.5223
60	13.1551	6.2248	19.3799	13.1551	6.2248	19.3799
65	13.9705	4.6586	18.6291	14.8663	4.6586	19.5249
70	10.9801	9.4778	20.4579	11.1497	10.1497	21.2994
75	8.8584	8.1084	16.9668	9.3623	8.1084	17.4707
Total	248.4104	242.3901	485.8005	266.8089	278.4888	545.2977

REGION VIII

Table 44. PROJECTED VOLUME (m^3) PER HECTARE AFTER Projected volume in Region VIII

DBH class (cm)	30 years Dipt.	Non-dipt	Total	35 years Dipt.	Non-dipt.	Total
5	5.3829	9.7464	15.1293	5 3829	9 7464	15.1293
10	20.5161	37.2187	57.7348	33 2457	37.3287	70.4644
15	21.0627	28 2018	49.2648	22 8781	33.2733	56.1514
20	14.6298	17.1456	31 7754	14.6298	20.0616	34.6914
25	12.6838	14.5637	27.2475	12 6838	18.9658	31.6496
30	16.3948	12.1104	28 5052	16.3948	19.5145	35.9093
35	13.6772	11.7149	25.3921	13.6772	12.3686	26.0458
40	10.1837	8.2840	18.4677	10 1837	9.2087	19.3924
45	7.5335	7.2211	14.7546	10.0153	8.2986	18.3139
50	12.3967	3.8769	16.2736	12.9933	3.8769	16.8702
55	9.5740	5.8898	15.4638	9.5740	5.8898	15.4638
60	8.0695	5.4186	13 4881	9.3450	5.4186	14 7636
65	4.3285	1 8577	6.1862	4.3285	3.0640	7 3935
70	3.2464	1.6933	4.9397	3.2464	2.2860	5.5324
75	2 4348	1.2700	3.7048	2 4348	1.7145	4.1493
Total	**162.1144**	**166.2129**	**328.3273**	**181.0133**	**190.9060**	**371.9193**

DBH class (cm)	40 years Dipt.	Non-dipt	Total	45 years Dipt.	Non-dipt.	Total
5	16.9565	16.8534	33.8099	16 9565	16.8534	33.8099
10	33.2457	43.4388	76.6845	36.6406	47.4388	84.0794
15	23.3562	33 2733	56 6295	23.3562	40.5095	63.8657
20	16.9898	27.2960	44.2858	20.3784	35.2415	55.6199
25	18.8085	20.5613	39.3698	21.5085	20.5613	42.0698
30	18.4788	20.6034	39 0822	18 4788	20.6034	39.0822
35	15.2142	13.7492	28 9634	15 2142	13.7492	28.9634
40	13.5885	9 2087	22 7472	13.5385	10.5828	24.1213
45	10.0153	8.2986	18.3139	10.4973	8.2986	18.7959
50	12.9933	6.2264	19.2179	13.9086	6.2264	20.1350
55	9.5740	5.8898	15.4638	10.5281	6.8770	17.4051
60	9.3450	5.4186	14.7636	9.3450	7.6468	16.9918
65	4.3285	3.3130	7.6415	5.2465	3.3130	8.5595
70	3.2464	2.2860	5 5324	5 4380	2.2860	7.7240
75	2.4348	1.7145	4 1493	3.8260	2.0485	5.8745
Total	208.5255	218.1310	426.6565	224.8612	242.2362	467.0974

REGION X

Table 45. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in Region X

DBH class (cm)	30 years Dipt.	Non-dipt.	Total	35 years Dipt.	Non-dipt.	Total
5	3.5069	12.3303	15.8372	3.5069	12.3303	15.8372
10	10.1350	32.1112	42.2562	14.4384	40.4843	54.9227
15	12.3361	27.8448	40.1809	12.3361	30.2976	42.6337
20	12.9148	25.3780	38.2928	18.2277	25.3780	43.6057
25	13.3883	23.7542	37.1425	17.6531	23.7542	41.4073
30	14.7015	24.1924	38.8939	19.6159	24.1924	43.3583
35	14.9149	8.4915	23.4064	14.9149	8.4915	23.4064
40	17.4453	15.5197	32.9650	17.4453	15.5197	32.9650
45	13.7294	9.2188	22.9482	19.1225	9.2480	28.3705
50	14.1103	9.5874	23.6977	16.4372	10.1068	26.5440
55	17.6430	7.9275	25.5705	17.5847	7.9275	25.5122
60	12.6928	2.2240	14.9168	13.1885	3.1073	16.2958
65	7.9605	3.2075	11.1680	8.8914	3.2075	12.0989
70	5.9704	2.4056	8.3760	5.9704	2.4056	8.3760
75	4.4778	1.8042	6 2820	4.4778	1.8042	6.2820
Total	175.9370	205.9971	381.9341	203.3608	218.2549	421.6157

DBH class (cm)	40 years Dipt.	Non-dipt.	Total	45 years Dipt.	Non-dipt.	Total
5	6 4300	20.3557	26.7857	9.1512	20.3557	29.5069
10	20.7251	42.3632	63.0883	23.7251	46.7454	70.4705
15	15.9358	37.3807	53 3165	22.4915	37.3807	59.8722
20	18.2277	30.4992	48.7269	24 0341	25.6304	59.6645
25	17.6531	32.3652	50.0183	23.0137	34.2470	57.2607
30	19.1659	26 1443	45 3102	20.4571	29.6786	50.1357
35	15.9098	10.3454	26 2552	15.9098	16.3454	32.2552
40	24 2981	15.5689	39.8670	24.2981	15.5689	39.8670
45	19.1225	9.2480	28.3705	22.2759	12.8199	35.0958
50	16.4372	10.1068	26.5440	16 4372	14.0168	30.5440
55	17.5847	11 0759	28.6606	18.6885	11.0759	29.7644
60	13.1885	3.1073	16.2958	14.2120	5.3305	19.5425
65	8 8914	3 2075	12.0989	9 4095	6.2301	15.6396
70	6.6686	2.4056	9.0742	6.6686	3.6726	10 3412
75	5 0015	1.8042	6.8057	5.7300	2.7545	8.4845
Total	225 2399	255.9779	481 2178	256 5023	291.9424	548.4447

REGION XI

Table 46. PROJECTED VOLUME (m^3) PER HECTARE AFTER
Projected volume in Region XI

DBH class (cm)	30 years Dipt.	Non-dipt.	Total	35 years Dipt.	Non-dipt.	Total
5	6.7284	2.8763	9.6047	11.3958	5.4732	16.8690
10	16.7043	10.2981	27.0024	19.9741	10.2981	30.2722
15	24.4570	11.9799	36.4369	26 9044	11.9901	38.8945
20	19.7627	10.9086	30.6713	24 5619	16.1175	40.6794
25	16.9708	12.6476	29.6184	20.5305	12.6476	33.1781
30	11.4226	13.3121	24.7347	13 8063	13.3121	27.1184
35	13.4603	12.4143	25.8746	15.4129	12.4143	27.8272
40	10.7317	12.2640	22.9957	16.9831	14.0601	31.0432
45	14.9673	10.5812	25.5485	14.9673	12.1482	27.1155
50	12.7413	11.3809	24.1302	12.7413	11.3889	24.1302
55	5.3281	8.6625	13.9906	8.6674	10.7876	19.4550
60	8.1101	12.3146	20.4247	8.1101	12.3146	20.4247
65	10.0825	8.7359	18.8184	10.0825	8.7359	18.8184
70	5.0618	7.0519	12.1137	5.0618	7.0519	12.1137
75	3.7963	4.7889	8.5852	3.7963	5.7889	9.5852
Total	180.3252	150.2248	330 5500	212.9957	164.5290	377.5247

DBH class (cm)	40 years Dipt.	Non-dipt.	Total	45 years Dipt.	Non-dipt.	Total
5	11.3958	7.7430	19.1388	13.4485	7.7430	21.1915
10	22.9946	18.6510	41.6456	24.6208	18.6669	43.2877
15	26.9044	17.7153	44.6197	28.7082	17.7153	46.4235
20	24.5619	17.4918	42.0537	26.0556	20.3917	46.4473
25	22.0409	16.8059	38.8468	22.0409	20.1695	42.2104
30	16.2915	13.5566	29.8481	22.2915	19.9635	42.2550
35	15.4129	18.2814	33.6943	18.3911	18 2814	36.6725
40	16.9831	16.0808	33.0639	19.5173	16.0808	35.5981
45	17.2007	12.1482	19.3489	17.2007	16.3475	33.5482
50	16.8135	14.7008	31.5143	16.8135	14.7008	31.5143
55	8.6674	10.7876	19.4550	10.1101	11.5256	21.6357
60	10.5005	14.0907	24.5912	12.0825	15.8942	27.9767
65	12.1253	10.5680	22.6933	15.0618	12.4206	27.4824
70	8.8439	7.9260	16.7699	10.7963	8.8154	19.6117
75	4.1329	6.9445	11.0774	5.3472	6.9445	12.2917
Total	234.8693	203.4916	438.3609	262.4860	225.6607	488.1467

出典

Uriarte, M T , Virtucio, F D (1988) Growth and Yield of Residual Forests in the Philippines, Occasional Paper No 1 (1988), College Laguna 1-75

天然林　オセアニア　オーストラリア　(1)(ノースクィーンズランド)
rain forestの成長予測のための森林成長モデル。

成長・収穫に関する表，図，式など

3 1 Diameter Increment

An essential component of a growth model is the prediction of diameter increment. In monospecific stands, a robust approach is to predict the stand basal area increment and apportion this among the component trees (Vanclay 1985). However, in mixed stands, it is expedient to predict the increment of each individual stem. Increment can be predicted as diameter or basal area increment; theoretical (Vanclay 1983) and empirical (West 1980) analyses have confirmed that both approaches are equally efficient. The choice between these should be made on the basis of the distribution of residuals.

A suitable time interval should be selected to minimize the effects of climatic variation and of any measurement error. The interval should be sufficiently long to ensure a large increment relative to the measurement error. A period of 5 years appears to fulfill these requirements.

It is desirable to use equations which are inherently constrained to provide sensible predictions near the limits of the data, especially if data are sparse. Diameter increment equations should pass through the origin (or have a small positive intercept), should rise to a broad plateau, decrease and asymptotically approach zero or reach a sensible maximum diameter. Robust equations with such a shape include:

$$Log(DI) = a + b \times D + c \times Log(D)$$

$$DI = a \times D^{c} \times (D_{max} - D)$$

$$DI = a \times D \times \left\{ \left(\frac{D_{max}}{D} \right)^{c} - 1 \right\}$$

where DI is diameter increment, D is diameter, D_{max} is the maximum attainable diameter, and a, b, and c are parameters to be estimated. Although D_{max} can be estimated by regression, it is often expedient to provide a subjective estimate, especially if data for large trees are scarce. These equations provide the basic elements of increment functions; terms such as site quality and stand basal area should also be incorporated.

The first equation can be fitted by linear regression, the second with a few iterations of linear regression, but the last equation requires non-linear regression. Although it is theoretically preferable to use generalized least squares (Ferguson and Leech 1978, 1981) for remeasured plot data, ordinary least squares can generally be used if the number of plots is large relative to the number of remeasurements.

A great variety of competition indices have been employed in plantation growth models, but appear to offer little advantage in mixed forests. Stand basal area is generally more useful than competition indices (Vanclay 1983). If an additional term is desired to reflect the relative position in the stand, the basal area of trees bigger than the subject tree is often effective.

3 2 Mortality

Mortality functions should predict natural regular mortality. Mortality arising directly from logging can be better accommodated through a logging damage function. Catastrophic mortality should not be included in a deterministic function, as it generally leads to an undesirable distribution of residuals and can be handled better in other ways (Hamilton 1980).

Many approaches have been devised for modelling mortality in even-aged monospecific stands, but the alternatives are greatly reduced for mixed stands. Threshold increment and limiting competition approaches have been widely used, but do not appear to provide robust results, and empirical methods offer more promise (Vanclay 1983).

Hamilton (1980) argues that it is inappropriate to estimate relative mortality using linear functions, and that a logistic function is more appropriate:

$$P = \left(1+e^{-f(x)}\right)^{-1}$$

where P is the probability of survival, and $f(x)$ is some suitable linear function. This has the advantage that survival over a n year period can be predicted as the nth power of the annual probability. Mortality is derived as $1-P$.

To enable parameter estimation using linear regression, this equation can be expressed as

$$Log\left(\frac{P}{1-P}\right) = f(x)$$

In mixed forests, a linear function in tree diameter and stand basal area generally provides reliable estimates of mortality. Mortality arising indirectly from logging can be accommodated by including time since logging (or cyclone):

$$Log\left(\frac{P}{1-P}\right) = a + \frac{b}{DBH} + c \times SBA + \frac{d}{TSL}$$

where D is diameter, SBA is stand basal area and TSL is time since logging (or cyclone).

3.3 Recruitment

The need for a recruitment or regeneration model depends on the intended length of projection. If long projections are envisaged, prediction of recruitment is essential, as recruitment will influence stand basal area. A common and simple approach is to assume that there is a constant pool of regeneration which is replenished as stems are recruited into the larger stand fraction, and whose composition never changes. Other authors try to model recruitment more explicitly. For example, Hann (1980) predicted recruitment from site index, total stand basal area and basal area in the smallest size class.

Recruitment is critical to successful predictions from succession models (Shugart 1984) and it is intuitive to examine how these stochastic models deal with recruitment, even if their methods cannot be directly applied to deterministic yield models. Recurring themes are seed sources, leaf area indices, soil moisture, gap size and the nature of the substrate (mineral soil of leaf litter). For yield models, equivalent concepts are stand composition, stand basal area, site quality, basal area removed and time since logging.

The modelling of recruitment is influenced by inventory technique more than any other growth model component. If a large fixed area plot is used to measure all stems to a relatively small size limit, then the "constant pool" method may perform well, especially if stems smaller than the recruitment size were measured. In contrast, point sampling (probability proportional to size) is unlikely to provide a realistic indication of the species composition of the advance growth, and the constant pool method is likely to fail.

Some growth models employ regeneration sub-models to predict the growth of regeneration from seed until it is recruited into the main model (eg. Ek and Monserud 1974, Vanclay 1985). This provides good predictions in some forest types, but may be an unnecessary complication in rainforests where seedling mortality is high and most of the stems colonizing gaps after disturbance exist prior to the disturbance.

4 The Queensland Rainforest Growth Model

The rainforest growth model (Vanclay 1987) is the most sophisticated of the native forest growth models employed by the Queensland Department of Forestry. Yet despite the complex nature of the forest that it simulates, it is comparatively simple and is readily adapted to other forest types.

The rainforest growth model is a cohort model which admits a maximum of 200 cohorts for each stand. Initially, stems from the same species group and whose diameters differ by less than five millimetres are grouped into a single cohort. If necessary, greater differences are accommodated by forming groups of stems most similar in size.

During simulation, cohorts comprising more than a critical number of stems or exhibiting diameter increments exceeding five millimetres per annum may split into two new cohorts, one with 25% of the stems and 1.3 times the predicted current annual increment, and one with 75% of the stems and 0.9 times the predicted current annual increment. This reflects the skewed nature of increment commonly observed in rainforest stands. The critical number of stems varies with stem size, and is twenty stems per hectare for stems below 40 cm dbh (diameter at breast height, over bark), five stems per hectare for stems exceeding 40 cm dbh, and two stems per hectare for stems exceeding the normal merchantable size (50 to 100 cm diameter breast height or above buttressing depending upon species). The total number of cohorts is maintained below 200 by merging, within species groups, cohorts with the most similar diameters.

4.1 Grouping Species

Because of the large numbers of tree species represented in tropical rainforests, it is clearly impractical to develop separate functional relationships for each tree species. To sensibly aggregate these species, it is expedient to employ three criteria, namely the volume relationship, logging practice and growth pattern. In the model, species groups are identified by a four digit code, SVLG, where S represents the datum source (0 = inventory, 1 = predicted ingrowth), V indicates the volume equation to be used (1 to 4), L indicates the logging rule applicable (1 to 9 inclusive) and G indicates the growth group. Five growth groups were identified on the basis of merchantability, size commonly attained and growth rate. Generally, group 1 (large, fast growing) contains gap opportunists, group 3 (small, fast growing) contains other pioneer and short-lived species, and groups 2 and 4 (slow growing) contain shade tolerant species. Practical necessity required the use of a single (fifth) group for all non-commercial species, as inventory identified only commercial and potentially commercial species, with most non-commercial species recorded as miscellaneous.

4.2 Diameter Increment

Because of the vast amount of data, the disproportionate representation of smaller size classes, and to facilitate graphical analyses of the residuals, the data were grouped according to site quality, soil parent material, stand basal area and 5 cm dbh classes. Some cells were further grouped to enable the estimation of the variance within each cell. The mean dbh and stand basal area of each cell were used in the analysis, and site quality and soil parent material were included as dummy (0, 1) variables. Linear regression, weighted by the inverse of the variance, produced the following results (Figure 1):

$$DI_1 = (140-20\,TG - D)\times D^{0.667}\times(2.497 + 1.196\,SQ - 1.061\,BV - 0.02859\,SBA)\times 10^{-4}$$

$$DI_2 = (160-30\,TG - D)\times D^{0.667}\times(2.543 + 0.2737\,CG - 0.02902\,SBA)\times 10^{-4}$$

$$DI_3 = (120 - D)\times D^{0.765-0.051\,TG}\times(2.478 + 1.055\,SQ - 0.8328\,CG - 0.03364\,SBA)\times 10^{-4}$$

$$DI_4 = (110 - D)\times D^{0.833+0.013\,TG}\times(1.542 + 0.3924\,CG - 0.01741\,SBA)\times 10^{-4}$$

$$DI_5 = (170-40\,SA-60\,TG - D)\times D^{0.667}\times(2.076 - 0.3831\,CG - 0.01894\,SBA)\times 10^{-4}$$

where DI_i is the dbh increment (cm/ann) of growth group i, D is dbh (cm), SBA is stand basal area (m^2/ha of stems exceeding 20 cm dbh), SQ is 1 for good sites and 0 for poor sites, BV is 1 on Basic Volcanic parent material, CG is 1 on Coarse Granite parent material, SA is 1 on Sedimentary, Metamorphic and Acid Volcanic parent material, and TG is 1 on Tully Granite parent material.

4.3 Mortality

Mortality is predicted from tree size and stand density:

$$P_1 = \left(1 + e^{5.899 - 6.039\,D^{-1} - 0.008392\,SBA}\right)^{-1}$$

$$P_2 = \left(1 + e^{4.379 + 0.1010\,D - 0.0007908\,D^2 - 0.01477\,SBA}\right)^{-1}$$

$$P_3 = \left(1 + e^{5.261 - 5.838\,D^{-1}}\right)^{-1}$$

$$P_4 = \left(1 + e^{5.331 - 2.802\,D^{-1} - 0.004500\,SBA}\right)^{-1}$$

$$P_5 = \left(1 + e^{4.894 - 1.764\,D^{-1}}\right)^{-1}$$

where P_i is the annual probability of mortality within growth group i, D is dbh (cm) and SBA is stand basal area (m^2/ha of stems exceeding 20 cm dbh). The trend in growth group 2 contrasts strongly to that of the other growth groups (Figure 2), but is not inconsistent with findings of other workers (e.g. Buchman *et al*, 1983).

4.4 Recruitment

As the minimum stem size measured in inventory has varied between 3 and 20 cm dbh, recruitment must be predicted at 20 cm dbh. However, data concerning stems less than 20 cm dbh can be employed by marking the lower limit of measurement with a "ghost" stem in each growth group, and activating the prediction of recruitment for any growth group only when the marker (or ghost stem) attains 20 cm dbh.

Total recruitment was predicted as

$$N = 5.466 - 0.06469\,SBA + 1.013\,SQ$$

where N is the number of recruits (*stems/ha/ann* at 20 cm dbh), SBA is stand basal area (m^2/ha of stems exceeding 20 cm dbh) and SQ is 1 on good sites and 0 on poor sites. On average, recruitment does not exceed 6.5 stems per hectare per annum, and does not occur where stand density exceeds 100 and 85 square metres per hectare basal area on good and poor sites respectively.

The proportion of recruitment in each growth group is predicted using a logistic function incorporating stand basal area, composition and site quality:

$$P_1 = 1 - \left(1 + e^{-2.407 - 0.005608\,SBA + 0.01105\,B_1 + 0.00464\,B_1 SQ}\right)^{-1}$$

$$P_2 = 1 - \left(1 + e^{-2.572 - 0.006756\,SBA + 0.11800\,B_2 - 0.06434\,B_2 SQ}\right)^{-1}$$

$$P_3 = 1 - \left(1 + e^{-1.761 - 0.008240\,SBA - 0.08076\,B_3 + 0.16610\,B_3 SQ}\right)^{-1}$$

$$P_4 = 1 - \left(1 + e^{-2.440 - 0.010690\,SBA + 0.16470\,B_4 - 0.06230\,B_4 SQ}\right)^{-1}$$

$$P_5 = 1 - \left(1 + e^{-0.655 - 0.024960\,SBA + 0.10630\,B_5 - 0.02621\,B_5 SQ}\right)^{-1}$$

where P_i is the proportion of the total recruitment as growth group i, SBA is stand basal area (m^2/ha of stems exceeding 20 cm dbh), B_i is the basal area of growth groups i, and SQ is 1 on good sites and 0 on poor sites. The use of the basal area of each growth group rather than the number of stems ensures robust predictions when inventory data derived from point sampling are projected. To ensure that these estimated proportions summed to exactly 1.0, the proportions were standardized:

$$P'_i = \frac{P_i}{\sum P}$$

The proportion of recruitment within each growth group assigned to any logging group is determined according to the composition of the corresponding stand fraction. The use of numbers of stems rather than basal area ensures reliable predictions despite the presence of useless veteran trees. Thus, for example, if it is determined that five percent of the growth group 1 stems in the existing stand are useless, then five percent of the predicted growth group 1 recruits will be assigned to that category. A similar procedure is followed to determine the volume group.

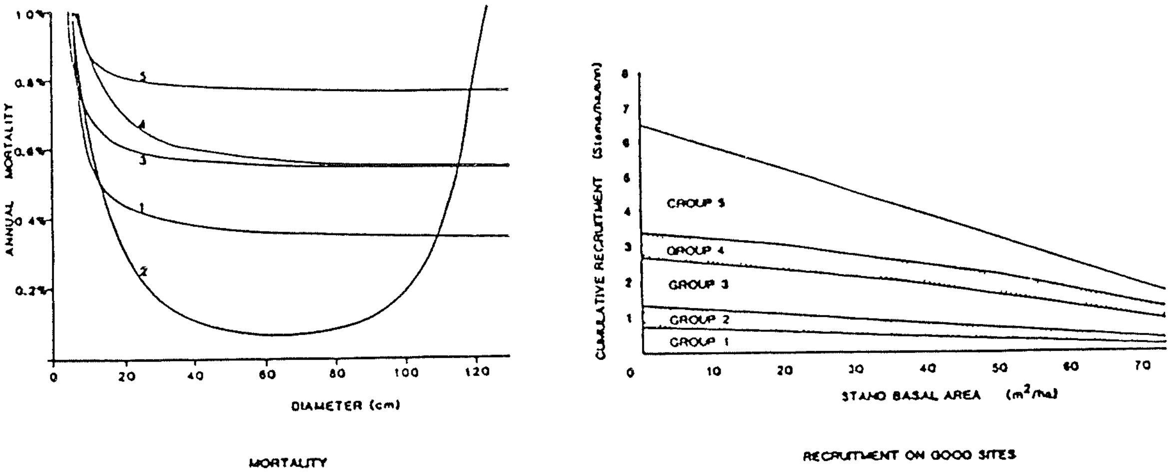


Figure 2. Mortality and Recruitment Functions
(Assuming 20 m^2/ha Basal Area)

- 7 -

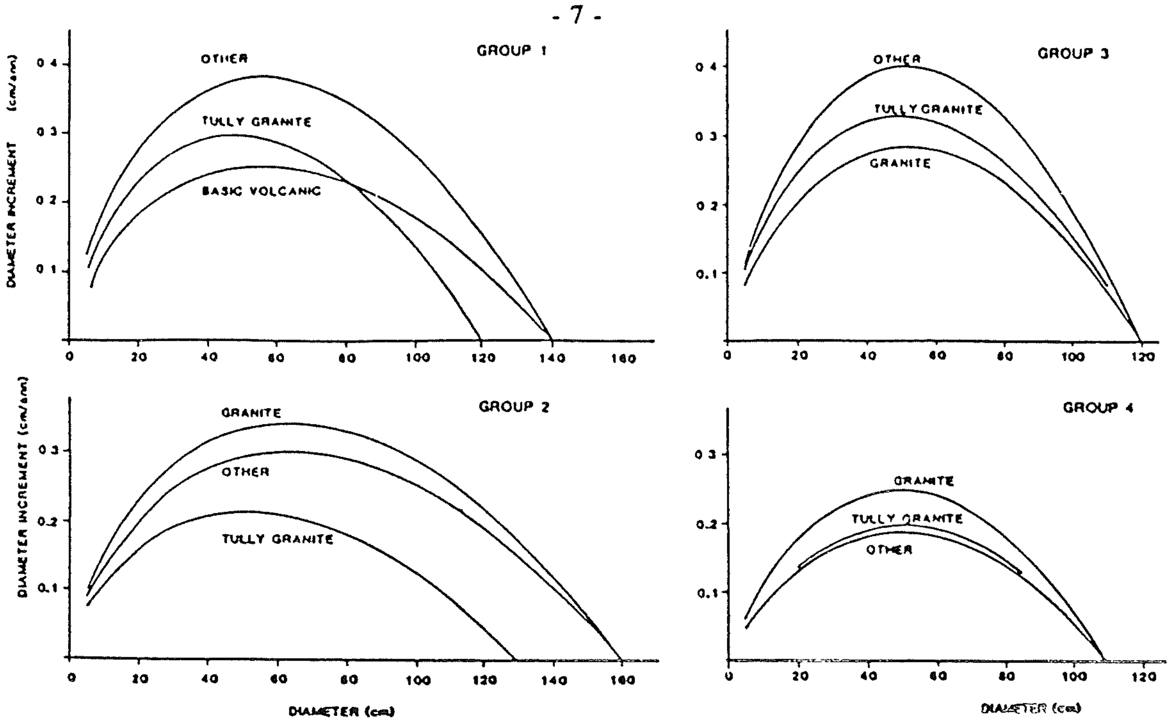


Figure 1. Diameter Increment Functions
(Assuming 20 m^2/ha Basal Area and Good Site)

出典

Vanclay, Jerome K (1988). A stand growth model for yield prediction in rainforests Design, implementation and enhancements. IUFRO Growth and yield in tropical mixed/moist forests conference (1988), Kuala Lumpur, Malaysia.

天然林　オセアニア　オーストラリア　(2)(ノースクィーンズランド)
Queensland rain forest Growth modelを用いたrain forestの解析。

データ採取地の立地環境

成長・収穫に関する表，図，式など

TABLE 1

Example of the cohort approach

Specific name	Trade name	Inventory data	Cohort list group SVLC	Cohort Year 0 DBH	Year 0 N/ha	Year 1 DBH	Year 1 N/ha	Year 2 DBH	Year 2 N/ha	Year 3 DBH	Year 3 N/ha	Year 10 DBH	Year 10 N/ha	Year 25 DBH	Year 25 N/ha
						41 97	1 85	42.30	1 85	42 64	1 84	44 99	1 83	49 96	1 81
Cardwellia sublimis	Northern silky oak	NSO 41 L	322	41 50	7.39	41 83	5 54	42 26	1.38	42 59	1 38	44 94	1 38	49 92	1 36
								42.13	4.15	42 46	4 15	44.81	4 13	49.78	4 08
Sloanea australia	Blush alder	BLA 49 L	374	49 50	5 20	49 92	1 29	50 22	1 29	50 51	1 28	52 57	1 23	56 81	1 14
						49.79	3 88	50.09	3 86	50 38	3 84	52 44	3 70	56 68	3 41
Cardwellia sublimis	Northern silky oak	NSO 26	492	26 50	18 13	26 80	18 10	27 08	18 07	27 36	18 05	29 35	17 86	33 67	17 51
Canarium baileyanum	Brown cudgerie	BRC 68	495	68 50	2 71	68 85	2 69	69 18	2 67	69 51	2 65	71 82	2 51	76 60	2 24
Xanthophyllum octandrum	Macintyre's boxwood	MCB 42	495	42 50	7 05	42 82	6 99	43 13	6 94	43 43	6 89	45 56	6 52	50 11	5 81
		MCB 36	495	36 50	9.56	36 81	9 48	37 09	9 41	37 38	9.34	39 41	8 84	43 76	7 86
	Miscellaneous	MIS 24	495	24 50	21 21	24 76	21 04	24 99	20 87	25 24	20 71	26 95	19 58	30 69	17 39
	Miscellaneous	MIS 16 MIS 16 MIS 16	495	16 50	140 30	16 71	139 14	16 90	138 00	17 10	136 86	18 50	129 19	21 62	114 34
	Flag 1		2491	15 00	1 00	15 20	1 00	15 39	0 99	15 57	0 99	16 91	0 96	19.88	0 90
	Flag 2		2492	15 00	1 00	15 22	1 00	15 43	0 99	15 64	0 99	17 15	0 97		
	Flag 3		2493	15 00	1.00	15.29	0 99	15 57	0 99	15 85	0 98	17 90	0 93		
	Flag 4		2494	15 00	1.00	15 19	0 99	15 36	0 99	15 54	0.98	16 79	0 94	19 59	0 86
	Flag 5		2495	15.00	1 00	15 20	0 99	15 38	0 98	15.57	0 98	16 90	0 92	19 87	0 81
	Recruits group 2		1322											20 11	0 66
			1492											20.39	0 38
	Recruits group 3		1493											22 21	2 29
			1493											21.24	3 42
			1493											20 31	3 56

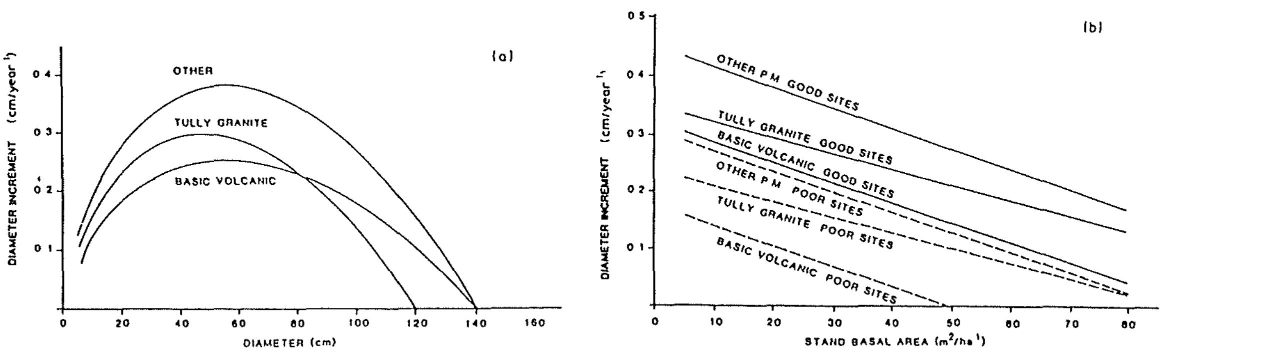


Fig 3 Diameter increment of growth group 1 (a) Stand basal area 20 m² ha⁻¹, good sites (b) Diameter = 50 cm DBHOB

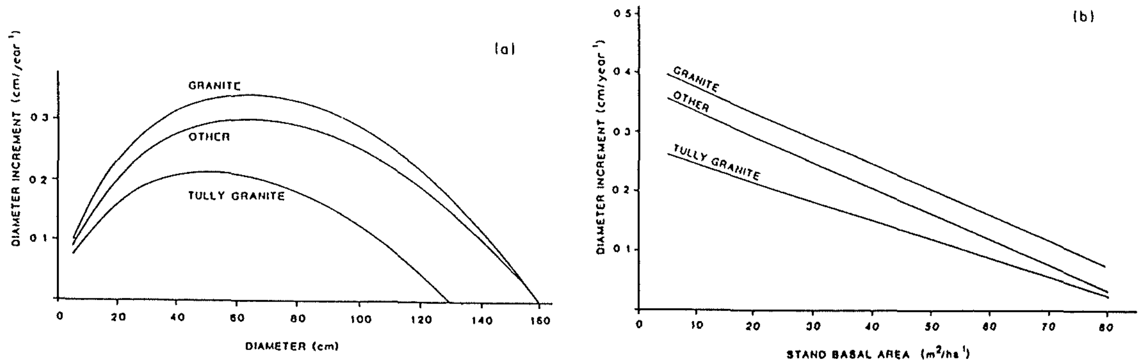


Fig 4 Diameter increment of growth-group 2 (a) Stand basal area 20 m^2 ha^{-1}, all sites (b) Diameter = 50 cm DBHOB

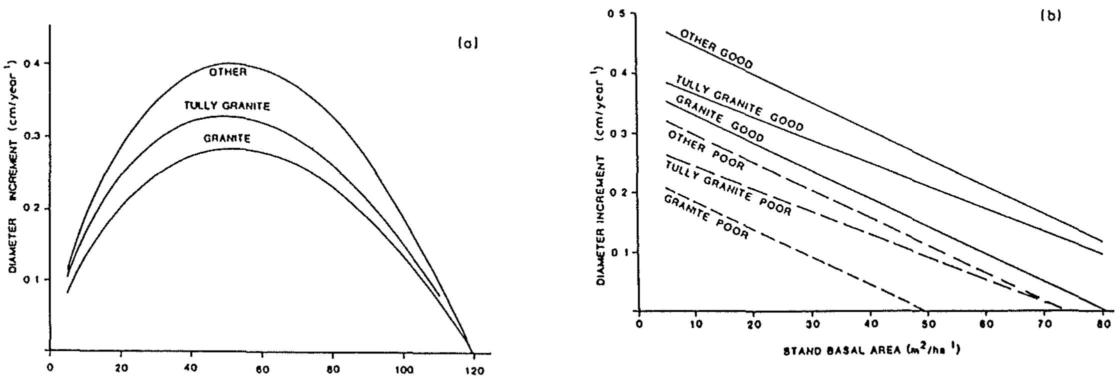


Fig 5 Diameter increment of growth group 3 (a) Stand basal area 20 m^2 ha^{-1}, good sites (b) Diameter = 50 cm DBHOB

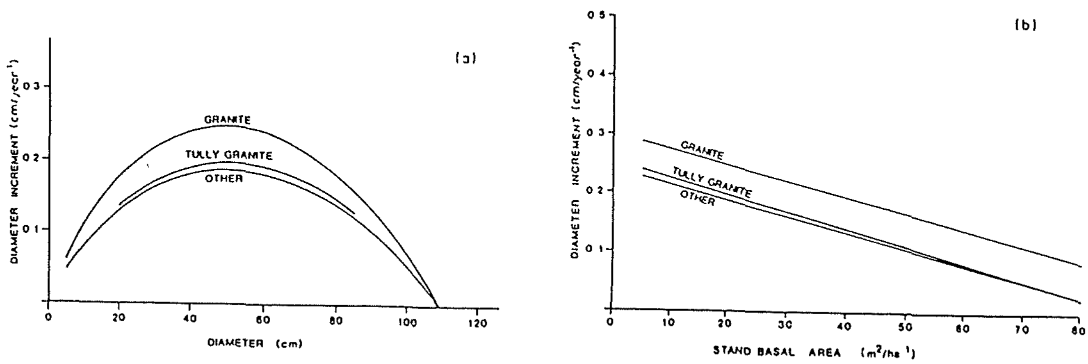


Fig 6 Diameter increment of growth group 4 (a) Stand basal area 20 m^2 ha^{-1}, all sites (b) Diameter = 50 cm DBHOB

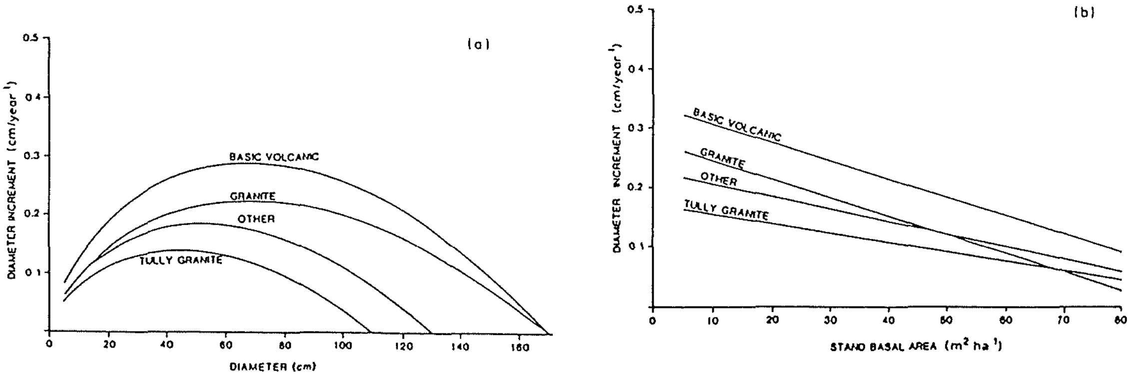


Fig 7 Diameter increment of growth group 5 (a) Stand basal area 20 m^2 ha^{-1}, all sites (b) Diameter = 50 cm DBHOB

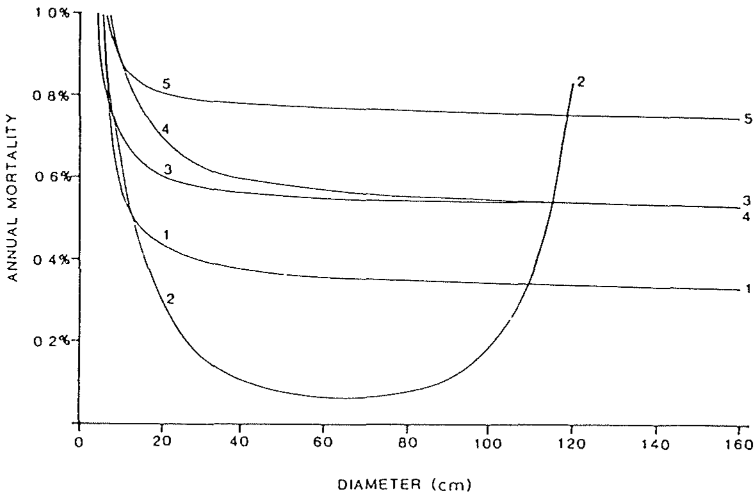


Fig 8 Predicted mortality assuming 20 m^2 ha^{-1} basal area

出典

Vanclay, J K. (1989) A growth model for North Queensland rainforests. For , Ecology and Management, 27 · 245-271

天然林　アフリカ　　アフリカ各国 (1)

植生タイプ (Nigeria:Northern Guinea savanna, Zaire:Mimbo woodland, Zambia:Mimbo woodland, Mua Livulezi:Bamboo savanna, Malawi:Shrub savanna,Wood-lannd savanna, Tree savanna, Cut-over savanna) の断面積成長量。

データ採取地の立地環境

成長・収穫に関する表, 図, 式など

Table no.9

Figures for basal area increment cited by Abayomi (1982)					
Locality	Vegetation type	G Basal Area (m^2/ha/yr)	Δ G Basal Area (m^2/ha/yr)	$\frac{G}{\Delta G}$ (years)	Source
Afaka, Nigeria	Northern Guinea savanna	7.1	0.24	30	Kemp, 1963
IBP Research site, Zaire	Miombo woodland	13.3	0.30	34	Malaisse, 1978
Ndola, Zambia	Miombo woodland	16.1	0.15	107	Endean, 1968
Mua Livulezi	Bamboo savanna	15.9	0.20	79	Edwards,
Malawi	Shrub savanna with bamboo	11.2	0.25	45	unpubl.
	Woodland savanna	15.0	0.21	71	
	Tree savanna	4.3	0.47	9	
Bunda, Malawi	Cut-over savanna	11.9	0.57	21	Edwards, as above

出典

FAO (1989). Studies on the volume and yield of tropical forest stands. 1. Dry forest formations. FAO Forestry Paper 51/1 · 51-56

天然林　アフリカ　　アフリカ各国（2）（マリ、ナイジェリア、カメルーン）
　　年平均降雨量と材積成長との関係付け。

成長・収穫に関する表，図，式など

444 - Yield expressed as a function of precipitation

Following the examination of a number of experimental

results Clement proposes the following expresion for yield p in m^3/ha/year

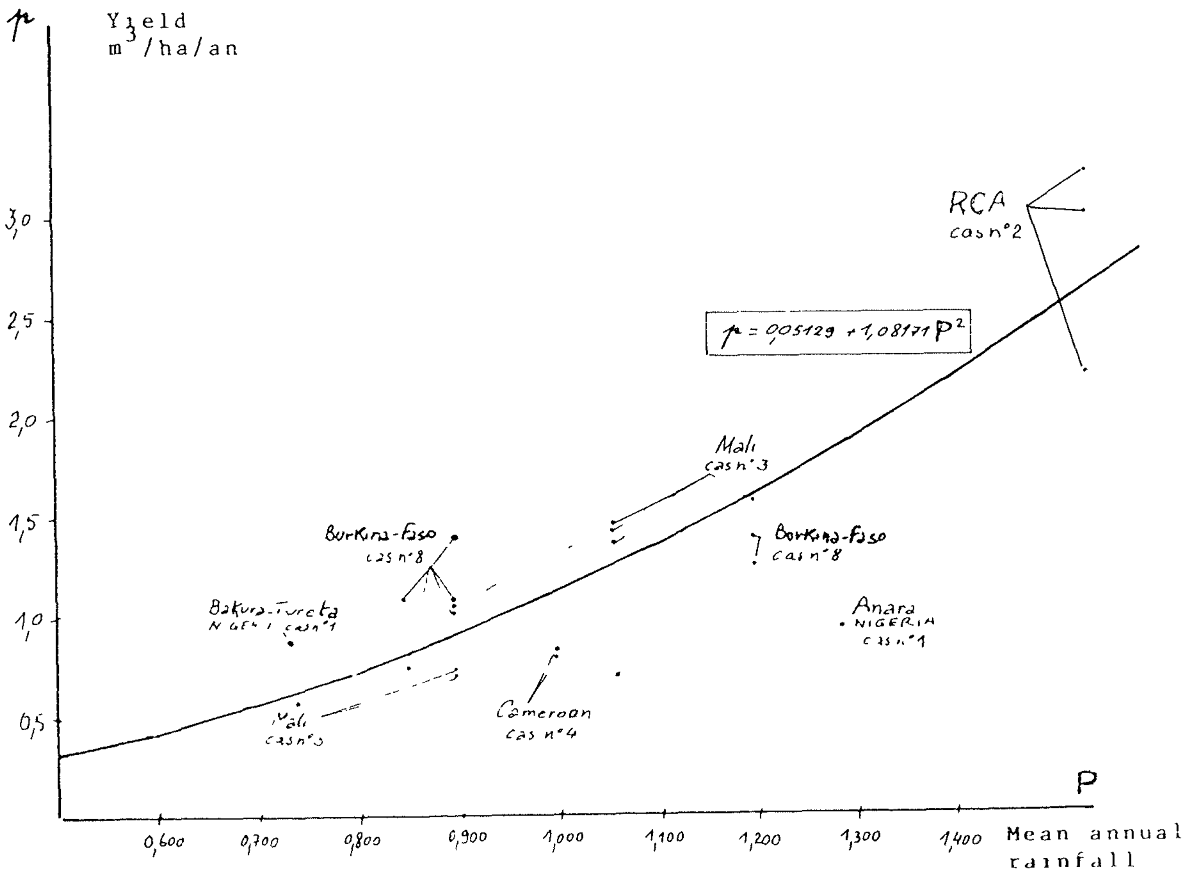
$$p = 0.05129 + 1.08171\ P^2$$

where P is expressed in meters (of precipitation).

This expression of yield omits the age, i.e. it assumes that the optimum age for exploitation is already known. For most of the experiments on which this formula is based the exploitation age was of the order of 20 years.

Graph no.5

Yield observed as a function of rainfall
(from report by Clément)



出典

FAO (1989) Studies on the volume and yield of tropical forest stands
1 Dry forest formations FAO Forestry Paper 51/1 51-56

天然林　南米　ブラジル

ブラジル：Commercial、Potential、Non-commercialの区分によるアマゾン森林の樹種別の直径成長解析。

データ採取地の立地環境

THE STUDY AREA

The study was carried out in a 64 *ha* plot located in the Tapajos National Forest, 67 *km* south of Santarem, state of Park, Brazil (longitude 55° 00' W, latitude 2° 45' S) (Figure 1)

The forest is a typical dry land ('terra firme') high forest with rare occurrence of palms Average volume of all species above 45 *cm* dbh is about 150 m^3 *ha* (Brazil unpublished) although in some patches volumes as high as 220 m^3*ha* have also been found (Silva *et al.* 1985).

Some of the species of the emergent layer are *Bertholletia excelsa, Couratari* spp. (Lecythidaceae), *Dinizia excelsa, Pithecellobium* spp., Parkia spp. *Hymenaea courbaril* (Leguminosae), *Manilkara huberi* (Sapotaceae), and *Tabebuia serratifolia* Bignoniaceae (Silva *et al*. 1985). The understorey is generally open with high occurrence of *Rinorea flavescens* and *R guianensis* (Violaceae), and *Duguetia echinophora* (Annonaceae).

The climate of the region is classified as Ami according to Koppen's system. This type is characterized by a short dry season for two to three months, with less than 60 *mm* rain per month, but with an annual rainfall over 2000 *mm*. It occurs in 41% of the Legal Amazon area (Bastos 1982). Climatic data from Belterra, situated about 35 *km* north of the experimental area show an average annual temperature of 25°*C* and a mean relative humidity of 86%. Annual rainfall is 2100 *mm* with 182 rainy days through the year. Maximum rainfall occurs in March (24 days), April (23 days) and May (26 days) whereas the minimum occurrence is in August (7 days), September (7 days) October (7 days) and November (4 days). Mean annual insolation is about 2150 hours (Carvalho 1982).

The relief where the experiment was set up is flat and the soil is rather homogeneous It is classified as Distrophic Yellow Latosol in the Brazilian classification. This type is denominated Ferrasol according to FAO classification and Oxisol according to the United States Soil Taxonomy classification (Jordan 1985).

Information gathered from local people revealed that the area had suffered light exploitations 30-40 years ago especially of *Cordia goeldiana*, *Cedrela odorata* and *Aniba duckei*. the last for extraction of linanol oil. This probably explains the existence in the area of large clumps of *Bixa arborea*, a very fast growing pioneer species which rapidly colonizes big gaps, and is not encountered in undisturbed forests in big clumps. Some individuals are now more than 50 *cm* dbh.

Logging was carried out in 1979 using powersaws. An attempt was made at directional felling and a wheeled skidder was used operating in skidding trails previously opened by bulldozers.

The logging intensity applied was considered as relatively heavy by the normal standards of the Brazilian Amazon. An average of 16 trees per *ha* from 63 species were felled resulting in an average logged volume of 75 m^3ha^{-1}. Such a large number of species was exploited to create a condition where almost all harvestable timber was logged (see Costa Filho *et al.* 1980). The species comprised the traditionally commercial species in the Santarem market and also some of the potentially merchantable ones which at the time of logging had not a steady market.

Two minimum felling diameter limits were applied. In 25 *ha* south of the access road the felling diameter was 55 *cm* whereas in 39 *ha* north of the same road the minimum felling diameter was 45 *cm*. Despite those two felling diameters, no attempt was made in this study to investigate the influence of felling diameters on the growth rates of the residuals.

METHODS AND MATERIAL

The permanent plots procedure

Thirty six 0.25 *ha* permanent plots were established in 1981 two years after logging and have been remeasured since then, comprising five sets of measurements in six years

Eighteen plots were randomly located on the northern part of the research area where the felling limit was 45 *cm* and the same number in the southern part where the felling limit was 55 *cm* (Figure 2).

The plots are square in shape and comprise 25 sub-plots of 10 X 10 *m* where all trees 5 *cm* dbh are recorded Five smaller plots of 5 X 5 *m* were randomly located within each plot for measurement of saplings and within each sapling plot one triangular plot of 5 X 3.525 X 3.525 *m* was also randomly located for seedling counting (see details in Figure 3).

Measurement procedures and variables measured are fully described in Hutchinson (1982) and also in Silva & Lopes (1984). The procedures are the same adopted in the FAO project in Sarawak (MAL/76/008) with slight adaptations for the Brazilian conditions.

Dawkins' crown illumination scores (Dawkins 1958) were used to classify trees according to the quantity of light received by crowns:

- Scores1 & 2: crowns receiving full overhead light;
- Score 3: crowns partially shaded but receiving some overhead light; and
- Scores 4 & 5: crowns receiving only side light or only diffuse light.

Trees were divided into the following diameter classes:

Class	dbh (*cm*)	Class	dbh (*cm*)
1	5-14.9	5	45-54.9
2	15-24.9	6	55-64.9
3	25-34.9	7	65-74.9
4	35-44.9	8	75+

成長・収穫に関する表，図，式など

Table 2. Periodic annual increment of dbh (cm) of a sample of species (Six years of observations for trees standing and alive, and all crown illumination classes)

Species	No. Trees	PAI	SD	Range	CV%
	Commercial				
Astronium gracile	21	0.3	0.3	0.0-1.2	100
Carapa guianensis	145	0.6	0.3	0.0-1.6	50
Cordia bicolor	69	0.4	0.3	0.0-1.5	75
Dialium guianensis	14	0.3	0.2	0.1-0.6	67
Didymopanax morototoni	23	0.9	0.5	0.0-2.0	56
Goupia glabra	13	0.6	0.4	0.0-1.2	67
Holopyxidium jarana	42	0.2	0.2	0.0-0.7	100
Jacaranda copaia	67	0.9	0.6	0.0-2.2	67
Manilkara huberi	26	0.4	0.3	0.0-1.0	75
Nectandra	68	0.3	0.3	0.0-1.6	100

Potential

Alexa grandiflora	56	0.2	0.3	0.0-1.3	150
Bixa arborea	299	0.9	0.6	0.0-2.5	67
Brosimum guianensis	20	0.3	0.4	0.0-1.3	133
Cordia alliodora	68	0.2	0.2	0.0-0.9	100
Couratari oblongifolia	145	0.3	0.3	0.0-2.2	100
Helicostylis pedunculata	36	0.4	0.2	0.0-1.0	50
Hevea sp.	44	0.4	0.3	0.0-1.3	75
Iryanthera juruensis	32	0.2	0.2	0.0-0.6	100
Maquira sclerophylla	30	0.2	0.2	0.0-0.9	100
Ocotea spp.	211	0.3	0.3	0.0-1.5	100
Perebea guianensis	31	0.3	0.2	0.0-0.7	67
Pouteria bilocularis	21	0.3	0.2	0.0-0.8	67
Sclerolobium chrysophyllum	65	0.9	0.9	0.0-3.3	100
Tachigalia sp.	94	0.3	0.3	0.0-1.6	100
Tapirira guianensis	41	0.8	0.5	0.1-2.2	62
Virola cuspidata	48	0.3	0.2	0.0-0.8	67
Virola melinonii	85	0.5	0.4	0.0-2.0	80

Non-commercial

Cecropia leucoma	73	1.4	0.9	0.2-3.3	64
Cecropia sciadophylla	159	2.1	0.9	0.2-3.9	43
Coussarea spp.	200	0.1	0.1	0.0-0.8	100
Crudia glaberrima	118	0.2	0.2	0.0-1.0	100
Duguetia echinophora	28	0.1	0.1	0.0-0.3	100
Esch iweilera amara	91	0.2	0.2	0.0-1.1	100
Esch weilera blanchetiana	99	0.2	0.1	0.0-0.6	50
Esch weilera odora	120	0.1	0.2	0.0-1.2	200
Guatteria poeppigiana	88	0.3	0.3	0.0-1.7	100
Inga spp.	419	0.9	0.7	0.0-3.5	78
Miconia sp.	73	0.3	0.3	0.0-1.1	100
Neea sp.	53	0.3	0.2	0.0-1.1	67
Ormosia sp.	47	0.3	0.3	0.0-1.3	100
Pausandra densiflora	70	0.1	0.1	0.0-0.3	100
Porouma longipendula	56	0.8	0.6	0.0-2.2	75
Protium apiculatum	446	0.3	0.2	0.0-1.5	67
Rinorea flavescens	142	0.1	0.1	0.0-0.3	100
Rinorea guianensis	358	0.2	0.1	0.0-0.6	50
Sapotaceae (*)	385	0.2	0.2	0.0-1.2	100
Sloanea sp.	468	0.5	0.3	0.0-1.9	60

(*)Genera Pouteria, Micropholis, Phrieurella and Sarcaulus.

Table 3. Periodic annual increment of dbh (cm) of all species by dbh classes (Trees standing and alive, all crown illumination classes)

Measurement period	Diameter Classes 1	2	3	4	5	6	7	>7	Average
1981 - 1982 (*)	188	136	101	77	49	22	14	14	
	0.4	0.6	0.7	0.7	0.8	0.7	0.7	1.0	0.6
1981 - 1983	187	136	100	77	48	22	14	14	
	0.4	0.6	0.7	0.6	0.7	0.6	0.6	0.8	0.6
1981 - 1985	185	134	99	75	45	22	14	13	
	0.3	0.5	0.6	0.6	0.7	0.6	0.6	0.7	0.5
1981 - 1987	185	132	98	72	44	20	14	13	
	0.3	0.5	0.6	0.6	0.7	0.7	0.6	0.7	0.5
1983 - 1987	191	132	103	72	49	21	14	14	
	0.2	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.4

(*) Number of species in each diameter class.

Table 4. Periodic annual increment of dbh (cm) of commercial species by dbh classes (Trees standing and alive, all crown illumination classes)

Measurement period	Diameter Classes 1	2	3	4	5	6	7	>7	Average
1981 - 1982 (*)	28	21	17	12	11	5	-	3	
	0.5	0.7	0.7	0.6	0.7	0.6	-	0.2	0.6
1981 - 1983	28	21	17	12	11	5	-	3	
	0.5	0.7	0.7	0.6	0.6	0.6	-	0.2	0.6
1981 - 1985	28	21	16	11	10	5	-	3	
	0.4	0.6	0.6	0.6	0.5	0.6	-	0.2	0.5
1981 - 1987	28	21	17	11	10	5	-	3	
	0.3	0.6	0.6	0.6	0.6	0.7	-	0.2	0.5
1983 - 1987	28	21	19	13	10	5	-	3	
	0.2	0.5	0.6	0.7	0.7	0.8	-	0.3	0.5

(*) Number of species in each diameter class.

Table 5. Periodic annual increment of dbh (cm) of potential species by dbh classes (Trees standing and alive, all crown illumination classes)

Measurement period	Diameter Classes 1	2	3	4	5	6	7	>7	Average
1981 - 1982 (*)	53	39	35	32	20	10	9	9	
	0.4	0.7	0.8	0.9	1.1	0.9	0.9	1.3	0.8
1981 - 1983	53	39	34	31	20	10	9	9	
	0.4	0.6	0.8	0.8	0.9	0.8	0.8	0.9	0.7
1981 - 1985	53	39	35	30	20	10	9	8	
	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.8	0.6
1981 - 1987	53	38	34	29	19	9	9	8	
	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.9	0.6
1983 - 1987	53	40	33	28	21	9	9	9	
	0.2	0.5	0.6	0.8	0.6	1.0	0.8	0.8	0.5

(*) Number of species in each diameter class

Table 6. Periodic annual increment of dbh (cm) of non-commercial species by dbh classes (Trees standing and alive, all crown illumination classes)

Measurement period	1	2	3	4	5	6	7	>7	Average
	Diameter				Classes				
4981 - 1982 (*)	107	76	49	33	18	7	5	2	
	0.4	0.6	0.6	0.5	0.5	0.4	0.3	1.0	0.5
1981 - 1983	106	76	49	34	17	7	5	2	
	0.3	0.5	0.6	0.4	0.4	0.4	0.3	0.9	0.4
1981 - 1985	104	74	48	34	15	7	5	2	
	0.3	0.5	0.5	0.4	0.4	0.4	0.2	0.8	0.4
1981 - 1987	104	73	47	32	15	6	5	2	
	0.3	0.4	0.5	0.4	0.5	0.5	0.2	1.0	0.4
1983 - 1987	110	71	51	31	18	7	5	2	
	0.2	0.4	0.5	0.3	0.4	0.8	0.2	1.0	0.3

(*) Number of species in each diameter class

Table 7. Periodic annual dbh increment (cm) of all species by dbh classes in the period 1981-1987 (All crown illumination classes)

Dbh class	Nr. trees	PAI	SD	Range	CV%
1	4803	0.4	0.6	0.0-3.9	150
2	1040	0.4	0.4	0.0-2.9	100
3	416	0.6	0.5	0.0-3.3	83
4	210	0.6	0.5	0.0-2.8	83
5	74	0.7	0.7	0.0-4.0	100
6	26	0.6	0.4	0.1-2.1	67
7	15	0.6	0.6	0.1-2.3	100
>7	16	0.8	0.5	0.0-1.6	62

Table 8. Periodic annual increment of diameter by species group and crown illumination classes in the period 1981-1987

Crown Illum. Classes	1	2	3	4	5	6	7	>7	Average
1&2	0.8	0.6	0.7	0.7	0.7	0.6	0.7	0.8	0.7
3	0.5	0.5	0.5	0.6	0.6	0.7	0.5	0.4	0.5
4&5	0.3	0.4	0.4	0.5	0.4	-	0.3	-	0.3
1&2	0.6	0.8	0.7	0.8	0.8	0.7	-	0.4	0.7
3	0.4	0.6	0.7	0.5	0.4	0.7	-	0.2	0.5
4&5	0.3	0.4	0.6	-	0.7	-	-	-	0.4
1&2	0.5	0.7	1.0	0.8	0.7	0.6	0.9	0.8	0.8
3	0.6	0.6	0.9	0.8	0.7	0.7	0.5	-	0.7
4&5	0.4	0.6	0.7	0.6	0.3	-	-	-	0.5
1&2	1.0	0.5	0.5	0.5	0.6	0.5	0.2	-	0.6
3	0.4	0.4	0.4	0.4	0.4	-	-	-	0.4
4&5	0.2	0.3	0.3	0.4	0.3	-	0.3	-	0.2

出典

Silva, J N M., J.O P de Carvalho and J do C.A. Lopes (1989). Growth of a logged-over tropical rain forest of the Brazilian Amazon. Growth and yield in tropical mixed/moist forests (1989) Kuala lumpur, Malaysia.

天然林　大陸間をまたがるもの

Neotropics, Asia, Africaを対象広葉樹種（群）、森林タイプ別のＰＡＩ。

Table 1. Reported growth rates of tropical forests in several countries

Location	Species/ Group	Forest Type	Disturbance Status	PAI cm	Period Years	Source
Neotropics						
Brazil						
Tapajos	All species	High Forest	Logged	0.5	6	*
	Commercial	High Forest	Logged	0.5	6	*
Puerto Rico						
St. Just	All species	Early Secondary	Thinned	0.5	2	1
Cambalache	All species	Lower slope Sec.	Undisturbed	0.1	26	1
Cambalache	All species	Ridge Secondary	Undisturbed	0.1	26	1
Caribbean For.	All species	Upper Montane	Thinned	0.2	27	2
Surinam						
Sarwa	All species	High Forest	Lightly logged	0.4	9	3
"	Commercial	High Forest	Lightly logged	0.3	9	3
Tonka	Commercial	High Forest	Undisturbed	0.4	2	4
Venezuela						
Merida	All species	High Forest	Lightly logged	0.5	8	5
Amazonas	All species	High Forest	Undisturbed	0.2	4	5
S.C. Rio Negro	All species	High Forest	Undisturbed	<0.1	4	6
	Understory trees	High Forest	Undisturbed	<0.1	4	6
	Emergent trees	High Forest	Undisturbed	0.1	4	6
Asia						
Indonesia	All species	Dipterocarp	Undisturbed	0.5	6	7
P. Malaysia	Dipterocarps	Hill Forest	Logged	0.5	1	8
	Dipterocarps	Lowland Forest	Regenerating	0.8	5	8
	Non Dipterocarps	Hill Forest	Logged	0.4	1	8
	Non Dipterocarps	Lowland Forest	Regenerating	0.5	5	8
Sarawak	Commercial	Hill Forest	Undisturbed	0.3	2	9
	Commercial	Hill Forest	Logged + LT[a]	0.7	2	9
	All species	Hill Forest	Logged	0.6	4	10
Africa						
Ghana	Commercial	Celtis/Triplochiton	Logged + SS[b]	0.6	6	11
Ivory Coast	Commercial	Evergreen and Transition	Undisturbed	0.4	4	12
	Commercial	Evergreen and Transition	Thinned	0.7	4	12
	Commercial	Semi-deciduous	Logged	0.4	4	12
Nigeria	Commercial	High Forest	Logged + TSS[c]	0.6	5	13

1) Weaver (1979); 2) Schimdt & Weaver (1981); 3) Graaf (1986); 4) Jonkers (1987) 5); Veillon (1985); 6) Heuvelop & Newman (1983); 7) Miller (1981); 8) Tang (1987); 9) Hutchinson (1987); 10)

Bryan (1981); 11) Osafo (1970); 12) Maitre (1987); 13) Mevart (1972, 1974).

(*) This study; a) Liberation Thinning; b) Selection System;
c) Tropical Shelterwood System

出典

Silva, J N M , J.O P de Carvalho and J do C A Lopes (1989) Growth of a logged-over tropical rain forest of the Brazilian Amazon Growth and yield in tropical mixed/moist forests (1989) Kuala lumpur, Malaysia

樹種：PINACEAE（マツ科）
Pinus caribaea（カリビアマツ）、*P. oocarpa*（オーカルパマツ）
国：インド

データ採取地の立地環境

Materials and Methods

Location: For the present study, four locations were selected. Of these Gudalur in the Nilgiris and Mahendragiri in Kanyakumari District are situated at an elevation of about 1,000 m above msl, and receive approximately 2,700 mm average annual rainfall Perumalmalai in Kodaikanal Hills is situated about 1,600 above msl and receives approximately 1,400 mm of annual rainfall. Kolli Hills in Salem District is situated at an altitude of 1,200 m and receives about 1,400 mm of average annual rainfall (Table 1).

Species and Provenances: Pinus caribaea provenance from Poptun, Guatemala (FRI-649) was raised at Kolli Hills and Perumalmalai during 1979 and at Mahendragiri and Gudalur during 1981. Pinus oocarpa provenance FRI-650 from Malpase Zacapa, Guatemala, was raised at Perumalmalai and Kolli Hills during 1979. Pinus oocarpa provenances FRI-650 from Lima Zacapa, Guatemala and FRI-761 from Canacoste, Guatemala were also raised at Kolli Hills, Perumalmalai and Gudalur during 1979.

Growth Rate: Height growth of each plant was measured annually. The relative growth rate (RGR) was calculated using the formula ICO $(H_1-H_0)/H_0$, where, H_0 is the seedling height and H_1 is the height recorded yearly. On the other habd, the Annual growth rate (AGR) was calculated as $100(H_f-H_i)/H_i$, where H_i is the initial height and H_f is the height after expiry of one year. The values reporied are the average values of at least 25 plants.

Soils: Soils from each location were collected and analysed for particle size distribution, pH, exchang able Na, K, Ca, Mg, C.E.C, base saturation, available P_2O_5 and organic carbon as per the method outlined by Jackson (1958). The results are exhibited in Table 2.

Table 1

Details of Trial of Sites.

Site	Location	Elevation (m msl)	Average annual rainfall (mm)	Physiography
Mahendragiri	Kanyakumari Dist. Tamil Nadu	1000	2700	Gentle slope North to Westerly aspect.
Kolli Hills	Salem District Tamil Nadu	1200	1400	Gentle to steep slope Westerly & Easterly aspect.
Gudalur	Nilgiris Dist Tamil Nadu	1000	2700	Gentle slope Westerly and Southerly aspects
Perumalmalai	Kodaikanal Hills Anna District Tamil Nadu	1600	1400	Gentle slope Southerly and Westerly aspect.

Table 3

Height growth (cm) of P caribaea provenance FRI-649.

Year	Range	Mean	±	Standard Deviation	AGR (%)	RGR (%)
			Perumalmalai			
1979*	19—46	31 92	±	8 42		
1980	34—125	84 24	±	21 50	164	164
1981	121 - 240	168 96	±	42.91	101	429
1982	270—460	328.84	±	42 74	95	930
1983	360—580	416 20	±	81.55	27	1203
1984	520—750	635.20	±	104 81	53	1890
			Kolli Hills			
1979*	19—60	31 52	±	8 93		
1980	51 140	83 76	±	27 29	165	165
1981	119—286	177.16	±	51.13	111	462
1982	215- 515	321 32	±	76 26	81	919
1983	320—650	505 00	±	94.99	57	1502
1984	570—1300	841.20	±	171 06	67	2569

*Seedlings

Table 4

Height growth (cm) of P. caribaea provenance FRI-649.

Year	Range	Mean	±	Standard Deviation	AGR (%)	RGR (%)
			Mahendragiri			
1981*	10—40	19.8	±	6 2		
1982	21—54	32 4	±	9 4	64	64
1983	69—140	94 0	±	20.8	190	375
1984	100—210	152 0	±	33 1	62	668
			Gudalur			
1981*	21—67	35.7	±	9.1		
1982	40—97	66 1	±	14.3	85	85
1983	70—200	124 4	±	36 0	88	248
1984	220—425	303.4	±	55.3	144	750

*Seedlings

Table 5

Height growth (cm) of P. oocarpa provenance FRI-650 at medium altitude.

Year	Range	Mean	±	Standard Deviation	AGR (%)	RGR (%)
		Perumalmalai				
1979*	22- 45	33.7	±	7.5		
1980	41-93	67.1	±	13.6	99	99
1981	80-190	150.5	±	30.1	124	347
1982	170 -311	247.1	±	46.3	64	633
1983	270—450	361 2	±	40.9	46	972
1984	490—880	673 2	±	89 9	86	1898
		Kolli Hills				
1979*	15 -45	28 2	±	8 2		
1980	24 - 120	65 8	±	23 4	133	133
1981	43 -267	135 3	±	51 9	106	380
1982	135 -54	304.7	±	99 7	125	980
1983	220—750	505 0	±	144 7	66	1690
1984	450 - 1250	817.0	±	213 8	62	2797

*Seedlings

Table 6

Height growth (cm) of P oocarpa provenance FRI-760

Year	Range	Mean	±	Standard Deviation	AGR (%)	RGR (%)
		Perumalmalai				
1981*	34 -79	55 8	±	12.6		
1982	50 200	90.1	±	31.1	61	61
1983	90-260	143.3	±	41.3	59	157
1984	200 -380	272.4	±	42.8	90	388
		Kolli Hills				
1981*	18-69	55.8	±	12 6		
1982	26 - 80	63.6	±	12.4	14	14
1983	58—325	191.1	±	85.4	200	242
1984	150—415	317.2	±	88.5	66	468
		Gudalur				
1981*	27—92	71.7	±	19 8		
1982	90—225	128 6	±	37.7	79	79
1983	170 300	218.0	±	63.3	70	204
1984	225 - 550	374.2	±	90.8	72	422

*Seedlings

Table 7

Height growth (cm) of P oocarpa provenance FRI-761.

Year	Range	Mean	±	Standard Deviation	AGR (%)	RGR (%)
		Perumalmalai				
1981*	40−86	65 4	±	12.7		
1982	45 145	96.6	±	23 1	48	48
1983	120 245	165 7	±	46 5	72	153
1984	180−475	281 2	±	91.0	70	330
		Kolli Hills				
1981*	31−68	49.6	±	11.0		
1982	42−87	63 6	±	12.4	28	28
1983	55 335	191.1	±	85 4	200	285
1984	110 - 450	317.2	±	88.5	66	540
		Gudalur				
1981*	25 87	43 8	±	14.7		
1982	43−116	77.2	±	18 5	77	77
1983	80 - 240	144 8	±	41 6	87	231
1984	190−395	291.4	±	46 37	101	566

*Seedlings

出典

P.A. **Abdul** Bari and K.G. **Prasad** (1987). Growth of Tropical pines **in Tamil** Nadu in relations to Soil Properties. Indian For., 113 : 53-60.

樹種：PINACEAE（マツ科）

Pinus caribaea var. hondurensis　（カリビアマツ）

国　：マレーシア

データ採取地の立地環境

III）マレーシア　　Smart（1972）はスンガイブロー地区周辺の試験地の資料をもとにして、パルプ材生産を前提にした次表のような立木蓄積表を作成した。この表は8フィート×8フィートの間隔で植栽された無間伐林のもので、平均値

成長・収穫に関する表，図，式など

マレーシアの立木蓄積表（パルプ材生産）

㎥／ha

林齢	総材積			平均生長量		
	平均	上限	下限	平均	上限	下限
9	176	210	145	196	233	161
10	202	242	166	202	242	166
11	226	271	184	206	24.6	167
12	248	298	203	207	24.8	169
13	267	320	219	205	24.6	168
14	284	341	231	203	24.4	165
15	299	362	243	19.9	24.1	16.2

注　1）材積は皮付末口径3インチまでの皮内材積

2）立木材積は断面積合計と樹高から推定された

3）総材積の上限は、断面積合計と樹高が平均より10％上回る場合であり、下限は10％下回る場合の推定値である。

を中心にして上限と下限の材積が併記されているが、各プロットの資料はほとんどこの範囲に入るという。平均生長量が最大になるのは12年であるが、この12年がパルプ材生産の最適輪伐期になるとはかぎらない。乾燥重量の平均生産は15年生あたりで最大になっている。一方繊維長は12年で極大値に達するので、輪伐期をきめるには他の条件を考慮して、さらに詳しく検討されるべきであろう。なお本表の15年生の材積299㎥は、平均樹高25 3m、断面積合計41.3㎡を仮定した数値である。

無間伐造林地では、断面積合計の平均生長は7年生の266㎡あたりから落ち始める。したがってこの林齢で間伐を開始するのが合理的であろう。すなわち断面積合計が298㎡に達したとき、間伐後の断面積が23㎡になるまで間伐するやり方が考えられ、3年経過して第2回の間伐を実行し、その後は間伐間隔が少しずつ長くなる。Smartはこうした前提で次のような製材用材の暫定的な収穫

マレーシアでの暫定収穫表（製材用材の生産）

ha当り

林齢	主林木樹高	断面積合計	材積	間伐後の断面積計	収穫材積	総生産量	平均生長量
	m	㎥	㎥	㎥	㎥	㎥	㎥
8	171	298	152	230	32	152	189
11	215	298	188	23.0	41	221	200
14	245	287	205	218	46	279	199
19	271	275	217	207	51	337	177
25	296	264	227	0	227	397	159

表を作製した。伐期を２５年生とした場合、末口直径 7.5 ㎝以上の総生産量は３９７㎥となり、このうち２０％が合板用材、３０％が製材用材、 残りの５０％がパルプ用材にふりむけられると予測した。この推定で注意しなくてはならないのは、伐期平均生産量がかなり早い時期に極大に達することで、前例の国々では１２年生で最大になる例はなく、かなり遅れると予測されていることである。したがって２０年生以降の高齢級の総収穫量が相当低くなっている。これは利用された資料がすべて１５年生以下の林分からとられたもので、他の国々の収穫表と同様に高齢級の林分の数値は大胆な推測にもとずいていることと、推定の仕方が異なるためであろう。

出典

海外農林業開発協力センター（昭和52年3月） 昭和51年度 カリヒアマツの造林マニュアル 27-32

樹種：PINACEAE（マツ科）

Pinus caribaea var. hondurensis　（カリビアマツ）

国　：タイ

データ採取地の立地環境

1. Moisture and temperature

Table 1　The mean, maximum and minimum monthly relative humidity

Region		Mean monthly relative humidity percentage											
		Jan	Feb	Mar	Apr.	May	Jun	July	Aug.	Sep	Oct.	Nov.	Dec
Chiengmai	Max	96.3	93.1	88.8	91.3	92.5	93.9	94.3	95.8	95.6	95.5	96.0	95.9
(North)	Min	45.3	37.0	33.5	46.0	56.6	62.2	65.0	69.5	67.5	64.2	60.0	53.8
Nakornrajasima	Max	93.0	89.1	89.2	91.5	94.0	92.1	93.0	93.7	93.4	96.3	94.9	94.6
(North-East)	Min	43.0	42.1	41.6	51.3	59.4	59.7	58.7	59.7	66.0	64.0	58.0	51.5

Table 2　The mean temperature and rainfall (Samapuddhi, 1963)

Region	Mean annual temperature			Mean annual rainfall	
	Mean	Max	Min	In	Days
Chiengmai (North)	24.8 – 26.0	31.0 – 32.3	18.5 – 19.9	36 – 100	52 – 211
Nakornrajasima (North-East)	26.0 – 27.2	32.0 – 33.6	20.8 – 21.9	24 – 86	41 – 137

2. Soils

Hod district, Chiengmai province—Reddish Brown Lateritic Soils clayey, derived from gneiss and granite

Pakchong district, Nakornrajasima province—Rendzina Soil clayey to loamy, crumb structure derived from limestone, shale and slate

成長・収穫に関する表，図，式など

Growth pattern

10-year mean annual height increment of *P. caribaea var. hondurensis* as compared with *P. kesiya, P. merkusii* and *P. patula*

Region	10 yr mean annual height increment/m			
	P. caribaea	*P. kesiya*	*P. merkusii*	*P. patula*
Chiengmai	1.19	0.89	0.72	0.75
Nakornrajasima	1.23	–	0.84	–

There is no difference in growth of *P. caribaea* between both regions and an annual height increment estimated at 1.21 m. is reasonable.

Actually, trials performed in the southern and the central regions showed that trees grew quite well in the south but did not yield seeds. This was also true in the northern region where seeds were not produced.

The above figures show that *P. caribaea* thrives better than *P. kesiya* and *P. merkusii* as indigenous species and even better than *P. patula* as the exotic one.

The diameter increment has not been estimated yet, since the spacing of 2/2 m. is rather close. However, in the coming year the change in diameter could be studied.

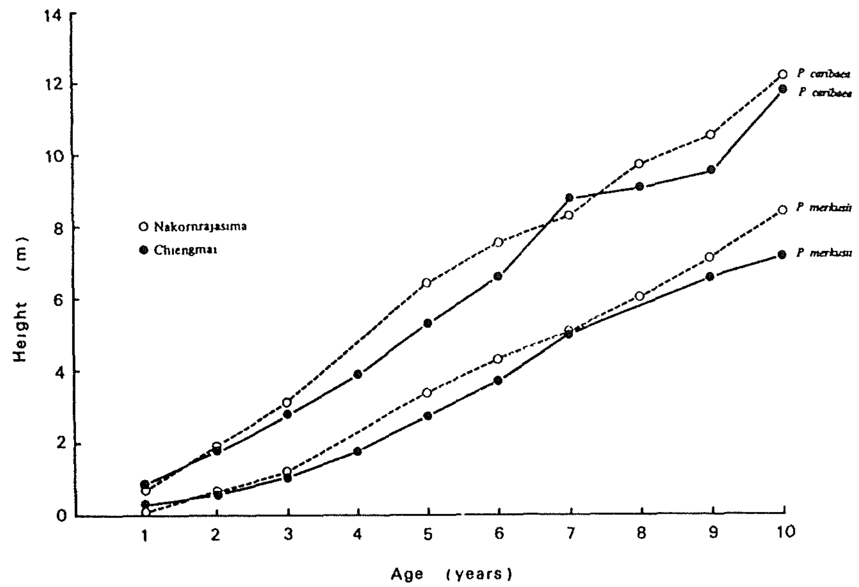


Fig. 1 Comparison of height increment of *Pinus* species growing at different sites

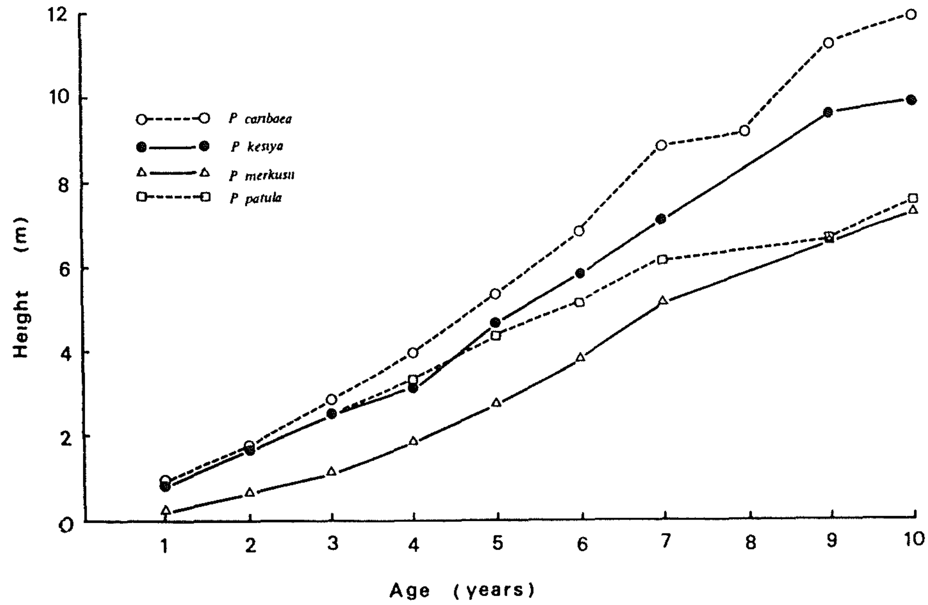


Fig. 2 Growth patterns of *Pinus* species at Hod district, Chiengmai Province

出典

Bhodthipuks, P (1979) Height Increment of *Pinus caribaea var.hondurensis* in Thailand, Symposium on Silvicultural Technologies Tropical Aguriculture Research Series No 12, 7-9

樹種：PINACEAE（マツ科）
Pinus caribaea var、hondurensis（カリビアマツ）
国　：オーストラリア

データ採取地の立地環境

i）オーストラリア　オーストラリアの北東部のクイーンズランドは、かなり古いカリビアマツの植栽経験をもっているが、北クイーンズランドの植栽地での成績は次の表のようである。２４の調査地の間の成績の差異はきわめて大きく、たとえばプロット１の１８年生林分は総材積５６ m³、平均生長量３１ m³であるのにたいし、プロット１６の１７年生林分では総材質６２５ m³、平均生長量３6.7 m³と１０倍以上の差がある。この両者の平均生長量は、各地でこれまで調査されたもののうちで、最大値と最小値にあたるという。

プロット１と２は、砂質の沿岸平野で地表面から３０～５０cmのところに不透性の粘土層があり、前植生はMelaleuca の低木林であった。プロット１６は沖積地に位置し、降雨量が比較的多い。おなじように生長のよいプロット１１は深い砂地にある。ただし生長が早いためにその樹形はよくない。もしも種子の選抜による形状の改良と地拵えの改善がおこなわれるなら、当地の var hondurensis のカリビアマツは、南オーストラリアの特等地でのラジアータマツに匹敵するか、それを凌駕するだろうといわれている。いままで得られたデータによると、カリビアマツの連年生長量は年平均生長量を相当に上回っており、平均生長量は１５年生でなおその極大値に達していない。１１個のプロットの平均生長量は19.3 m³であったが、過去３年間の連年生長量は４２ m³を越える。

東南クイーンズランドの沿岸平地ではスラッシュマツとの比較調査がおこなわれた。ともに１６年生の造林地で、土壌はラテライトのポドゾールであるが、下にみるように平均値ではカリビアマツが優れている。

	材積（m³/ha）	平均生長量（m³/ha）
Pinus caribaea var. hondurensis	228.5	143
Pinus eliottii var. eliottii	143.9	90

成長・収穫に関する表，図，式など

北クイーンズランドの植栽地の調査結果（1970）

プロット	地位指数	林齢 年	雨量 mm	本数 本/ha	平均樹高 m	平均胸高直径(皮付) cm	断面積合計 m²/ha	総皮内材積 m³/ha	平均総生長量 m³/ha
1	60	18	2,108	869	1234	158	172	561	312
2	65	18	2108	1045	1630	186	293	1352	757
3	70	15	1,143	783	1578	200	246	1163	775
4	80	17	2,108	865	1951	226	349	2096	1233
5	85	17	2,108	879	2063	246	419	2636	1550
6	90	15	1,143	741	2054	222	288	1763	1175
7	95	15	1,143	741	2161	219	280	1849	12.33
8	100	18	2,108	815	2438	268	460	3592	19.96
9	100	20	2,108	694	2713	31.7	549	4534	2267
10	100	15	1,651	776	2322	219	292	195.4	1303
11	105	18	2,108	593	2694	31.7	466	5080	28.22
12	105	15	1,651	872	23.74	222	339	2569	17.30
13	110	15	1,651	808	2484	225	322	2598	1732
14	115	13	1,829	1,129	2313	253	567	3895	2996
15	115	10	3,302	1,294	1920	21.8	48.6	2689	26.89
16	115	17	2,286	1,749	27.40	238	77.6	624.7	3675
17	125	10	3,556	1,082	2091	21.3	388	2344	2344
18	95	17	1,524	573	2377	269	32.8	329.1	1936
19	105	17	1,524	823	2600	27.2	47.9	386.3	2272
20	105	15	2,057	889	2328	29.6	421	2905	1937
21	110	14	1,524	1,047	23.31	258	548	373.3	2666
22	110	15	2,057	743	24.38	274	44.1	3342	2228
23	115	15	2,057	640	2527	28.9	420	337.1	22.47
24	125	17	2,007	319	3078	33.2	27.6	524.2	30.84

注　1）プロット1～17はCoastal Lowland（標高0～75m）のもので、18～24はTableland（標高300～740m）のものである。

2）地位指数は、25年生における20本（エーカー当り）の最大樹高木の平均高（フィート）で示す。

3）樹高は上記20本の平均

4）プロット2,5,6,10,12には施肥がなされている。

出典

海外農林業開発協力センター（昭和52年3月）　昭和51年度　カリビアマツの造林マニュアル　27-32

樹種：PINACEAE（マツ科）
Pinus caribaea var. hondurensis　（カリビアマツ）
国　：フィジー

データ採取地の立地環境

ⅱ）フイジー　Wright（1971）はフイジーの2地域で、var. hondurensis の固定試験地と造林地の結果を分析して次表のような収穫表を作成した。

製材用材をとるには、皮内の胸高直径が51cmになっていなければならず、造林木では23～32年を要するだろうと推定している。この場合、間伐収穫を含む総収穫量は420～720㎥、平均生長量は13～28㎥の範囲としている。

パルプ材生産の場合は、輪伐期を15年とし、この時点での平均生長量を16～34㎥と予測している。平均的な樹高24.4m、断面積合計45.9㎡の林分で、15年生の立木材積は366㎥、平均生長量は24.4㎥となる。しかしこれらの推定は、イ）若い林分の調査結果を外挿して引き伸していることと、ロ）地位が平均より良いことと、ハ）材積が総量であって末口径の小さい廃材や伐出でのロスを考慮していないので注意が必要である。事業的に使える予想表にするには、年平均生長量を30％程度落す必要があり、製材用材の輪伐期で21㎥、パルプ用材の輪伐期で17.5㎥位であろう。

フイジーの平均的な地位での年平均生長量は21～24.5㎥となっており、これはスリナムでの生長量と似ているが、それよりも土壌条件の悪い、トリニダードの場合、末口7.5cm以上の皮用材積の年平均生長量は地位のよいところで20㎥以下、悪いところでは9～11㎥とはるかに低く、フィジーは土地条件において恵まれていることが解る。

成長・収穫に関する表，図，式など

フイジーの収穫表

ha当り

場所	林齢	間伐前 本数	間伐前 断面積合計	間伐前 直径	間伐前 樹高	間伐前 材積（皮内） 総計	間伐前 材積（皮内） 末口7.5cm	間伐前 材積（皮内） 15cm	間伐前 材積（皮内） 20cm	間伐 本数	間伐 総皮内材積	総生産量	平均生長量
			㎡	cm	cm	㎥	㎥	㎥	㎥		㎥	㎥	㎥
Drasa	6.5	(1,161)	17.2	137	107	665	492	−	−	(420)	192	665	102
	105	741	25.3	20.8	18.3	1659	153.3	829	184	296	483	1851	176
	165	445	39.0	33.5	24.4	342.9	330.9	297.3	2504	193	1310	4104	249
	26	237	500	50.8	305	5244	507.6	5024	4824	−	−	7229	278
Seaqaqa	5.5	(1,161)	145	12.7	8.2	44.4	303	−	−	(420)	158	444	80
	95	741	218	19.3	16.2	126.0	114.1	51.3	−	296	366	1418	149
	17	445	390	33.5	223	312.9	302.0	271.3	2284	193	1188	3653	215
	27	237	500	50.8	28.7	4929	477.2	430.2	4535	−	−	6641	246

出典

海外農林業開発協力センター（昭和52年3月） 昭和51年度 カリヒアマツの造林マニュアル 27-32

樹種：PINACEAE（マツ科）
Pinus caribaea var. hondurensis　（カリビアマツ）
国　：フィジー

データ採取地の立地環境

フィジー諸島調査対象地域：ビチレブ島

年平均降水量：1,890㎜

年間平均気温：25.5℃

ハリケーン：11～4月

森林火災：8～10月

〔1〕　ビチレブ島

Ra　Tomanivi山（1,323m）の北西部に続くNandarivatu Plateau（標高800m前後）を中心とした地区

Lololo：島西北部にあるNalawelo山（480m）からKarawa山（827m）にかけての標高300m前後の丘陵地帯

Nadi：島の中央西部よりに広がるNausori Highland（600m前後）及びKoromba山（1,075m）に至る標高400m前後の地域

Nabou：南西部のTambungguto山（379m）、Lua山（334m）を中心として広がる標高200m前後の丘陵地帯

〔2〕　バヌアレブ島

Bua　島北西部Navotuvotu山（842m）の北側山麓にあるNdelainaronga（147m）を中心とする標高100m前後の丘陵地帯

4－2－1　造林の現況と計画

1954年からのカリビアマツ（主にPinus caribaea variety hondurensis約98％）の植林が開始された。

当初は、試験植林的性格のものであった。漸次年度当りの植林規模が拡大されてきた。このカリビアマツの80％を占めるFPCの植林地は、大きく5つに区分されている。すなわち、ビチレブ島にはLololo, Ra, Nabau, Nadiの4植林地、バヌアレブ島にはBuaの植林地の合計5植林地となっており、その規模は表4－2のとおりである。

4－3－1　候補地の自然環境

土　　壌

カリビアマツ植林対象地であるGrass landの土壌は、主として次の3つのタイプからなっている。

Ferruginous Latosols－酸性の強い土壌

Humic Latosols－比較的酸性の強い土壌

Nigrescent Soils－適度に酸性の土壌か、或いは弱アルカリ性の土壌

植　　生

対象となる土地は過去の火災から草原と化し、Grass Landと称しビチレブ島西部に約180千haの土地が存する。

この内、植林適地は120千ha、さらに経済的に可能なものは70％程度とみなされる。

このGrass Landは次の種の植生により占拠されていたが、今やこの30％がカリビヤマツの植林にとって変っている。

① Mission Grass（Pennisetum polystachyon）

1920年P.N.Gより移植したもので、他の雑草を駆逐する目的で植えられたものである。

牛はまずこのMission Grassを食し、無くなるとその後次のReed Grassへと食を移す。

② Reed Grass（Miscanthus floridulus）

概して湿潤地帯に現れるが、Mission Grassが外来種であるのに比して、このReed Grassはこの地固有の雑草てあり、これは放っておくと植林木を駆逐する結果となる。

成長・収穫に関する表，図，式など

4－2－4　林木成長状況

(1)　林令と樹高

図4－1は、ビチレブ島に於ける標準地の林令別樹高をプロットしたものであり、カリビアマノは15年生で19～28 m、20年生で21～26 m の成長を示している。参考までに、他地域のマツ植林地の状況を図示した。

A－バヌアレブ島 Seaqaqa の植林地

B－ニュージーランドカインガロアのラジァターパイン

C－ニュージーランドアイアウェルのラジァターパイン

D－マレーシア王子試験植林地カリビアマツ（平均）

上記4カ所をプロットしてみた。

FPCは現在の植林木の成績から各地区の植林地のシュミレーションを行っているが、各々㋑㋺㋩にプロットした。

㋑　Lololo 植林地の1967年植林木のシュミレーション

㋺　Lololo 植林地の1962年植林木のシュミレーション

㋩　Nausori highland の1961年植林木のシュミレーション

この図からみると㋑㋺は妥当であるが、㋩は過大なような気もしないではない。

これから判断して、カリビアマツの場合は15～17～20年位迄は、ニュージーランドカインガロア国有林のラジァターパインと同じ上長成長を示すが、それ以降は成長力が下る傾向にある。

ビチレブ島カリビアマツの樹高は、20年位迄は成長の良いバヌアレブ島 Seaqaqa とニュージーランドアイア ウェルのラジァターパインとの中間の上長成長を示している。

ただし、25年以降はラジァターパインの樹高が上まわることが予想される。

図４－１　林令と樹高

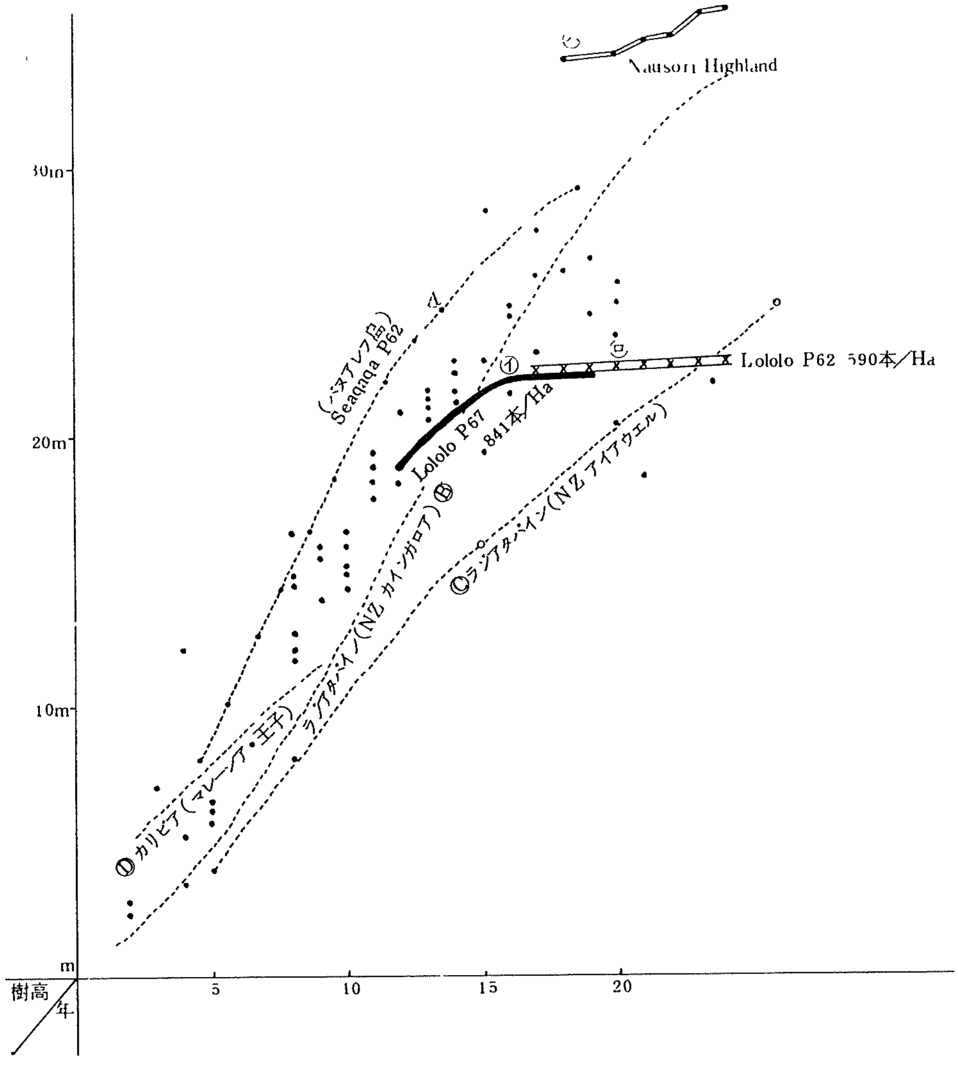
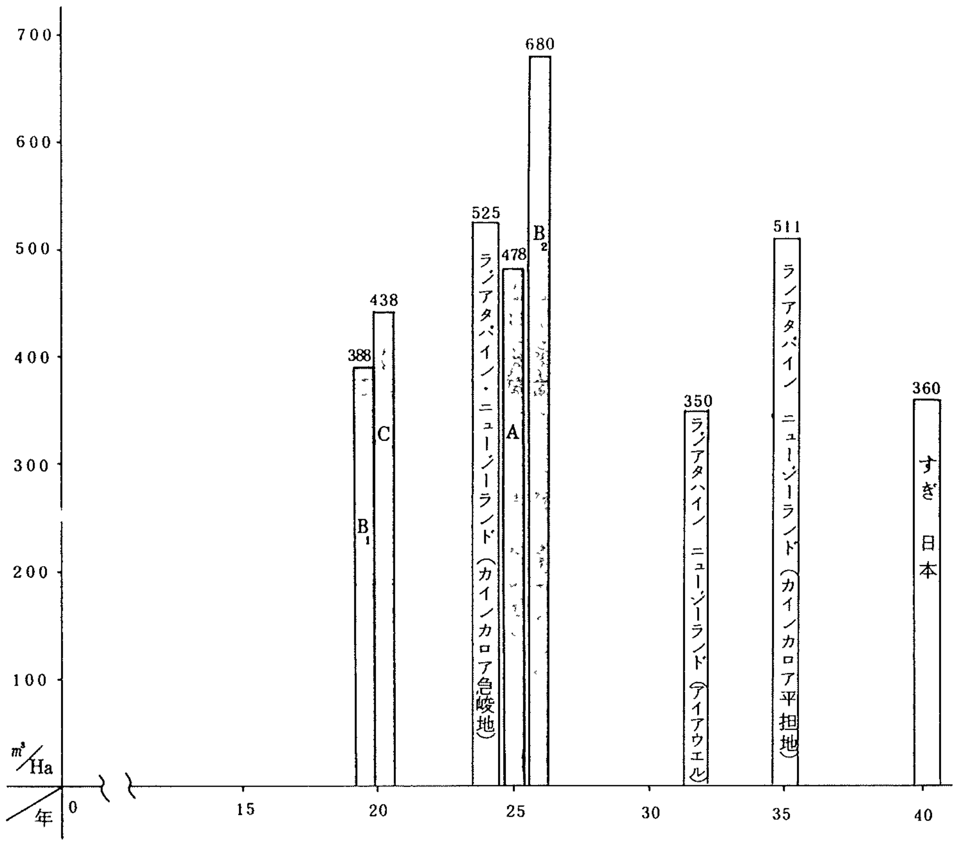

Lololo P62 590本/Ha
Lololo P67
841本/Ha
Seaqaqa P62
30m
20m
10m
m
樹高
年
5
10
15
20

図4－2　主伐材積の比較



注1　フイノー島のカリヒアマノの主伐材積は黒棒グラフ部分

2　A－Lololo植林地（1962年植林）FPCシュミレーションによる24年目主伐予想

3　B_1　－Nausori Highland植林地19年目主伐実績

4　B_2　－Nausori Highland　FPCシュミレーションによる25年目の主伐予想

（最適植林地）

5　C－Seaqaqa（バヌアレフ島）植林地20年目標準地材質

6　年平均成長量　カリビアマノ

A　－1 9 9 6 m³／ha（24年伐採）

B_1 －2 0.4 2 m³／ha（19年伐採）

B_2 －2 7.2 1 m³／ha（25年伐採）

C　－2 1 9 0 m³／ha（20年伐採）

7　年平均成長量　ラジアターパイン（平均値）

カインガロア（急峻地）2 1 8 7 m³／ha（最高3 4 9 7 m³／ha）

カインガロア（平坦地）1 4 6 0 m³／ha

アイアウェル　1 0.9 4 m³／ha

日　本　杉　9.0 m³／ha

檜　5 5 m³／ha

松　5 5 m³／ha

表３－３　カリビアマツの成長予想

植栽本数（本/ha）	林令（年）	胸高直径（cm）	樹高（m）	経済的蓄積（m³/本）	利用材積（m³/ha）	用材材積（m³/ha）	経済的平均成長量（m³/ha/年）
1,098	9	1849	1448	01140	159	76	177
	11	2039	1664	01709	227	128	206
	13	2202	1895	02431	303	190	233
	15	2346	2113	03025	385	261	257
	17	2476	2353	03714	484	348	285
902	9	1989	1484	01406	150	70	167
	11	2179	1697	02026	211	121	192
	13	2342	1927	02809	278	181	214
	15	2487	2146	03445	352	249	235
	17	2617	2418	04582	439	328	258
832	9	1968	1484	01406	136	64	151
	11	2158	1697	02026	191	110	174
	13	2321	1927	02809	251	163	193
	15	2466	2146	03445	321	226	214
	17	2596	2386	04187	399	297	235

出典

南方造林協会（昭和58年3月）　フィシーにおけるカリヒアマツの開発輸入促進調査及ひ造林投資基礎調査報告書

樹種：PINACEAE（マツ科）
Pinus caribaea（カリビアマツ）
国：ジャマイカ

データ採取地の立地環境

Locality:	Mt. Airy, central, northern and southern region
Altitude:	600 - 1 200 m
Rainfall:	1 200 - 2 500 mm
Soil:	very fertile with parent rock igneous and sedimentary shales
Data source:	temporary sample plots
Size of plots:	500 m^2 (circular)
Number of plots:	495
Stocking density:	from 792 stems/ha to 1 024 stems/ha from poor to better sites respectively
Measurement specification:	15 cm diameter under bark

Site index equation at reference age 15 years:

$$\log S = \log Hd - 16.439\ (\bar{A}^{\ 1.4} - \bar{15}^{\ 1.4}) \qquad (r^2 = 0.58)$$

where: S = site index
Hd = dominant height in metre
A = stand age in years

Yields for 15, 20, 25, 30 and 35 site indices are as follows:

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site index and age 1/

Age (years)	Site index classes				
	15	20	25	30	35
	.... m^3/ha				
6	0.2	1.9	4.6	8.2	12.4
8	2.1	6.0	11.4	18.1	25.2
10	3.5	8.8	15.9	24.0	31.8
12	4.3	10.3	18.0	26.3	33.3
14	4.7	10.9	18.7	26.4	31.8
16	4.8	10.9	18.4	25.4	28.8
18	4.7	10.7	17.7	23.7	25.2
20	4.6	10.2	16.8	21.8	21.5
22	4.3	9.7	15.8	19.8	17.7
24	4.0	9.2	14.7	17.8	14.1
25	3.9	8.9	14.2	16.8	12.4

Remarks: No thinning was done, but there was progressive decrease of stocking with age. Mean site index for all the plots and all ages was 23.21.

1/ Plantation of Pinus caribaea var. hondurensis.

出典

(2) Lamb, A.F.A.; Pinus caribaea; University of Oxford, Department of
1973 Forestry, Commonwealth Forestry Institute

(3) FAO The Profitability of Forest Plantations in Jamaica.
1972 Technical Report No.6, FO:SF/JAM.5.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
Pinus caribaea var. *hondurensis*（カリビアマツ）
国　：トリニダード

データ採取地の立地環境

2.5.2 Regeneration with Pine (*Pinus caribaea* var. *hondurensis*)

58. Pine was first raised in Trinidad in 1948, experiments on nursery and plantation techniques began in 1950 and the first routine plantations were formed in 1956. Available information and experimental plots showed that the best growth was obtained on sandy soils with a pH in the range 4.8 to 5.5 but reasonably good growth was also obtained on silts and on quartzite sands and gravels. All forest reserves in Trinidad have a suitable rainfall pattern and the pine has grown well in areas of 1 500 mm to 2 600 mm annual precipitation. Topography does not seem to have a discernible influence on results and growth on sites varying from flat to steeply sloping has been good. Areas planted are all below 300 m elevation. It became quickly obvious that the species was strongly fire-resistent especially after the age of four years which, as shown in paragraph 42, is a factor of great importance given the frequency of dry season fires in Trinidad.

59. Planting of pine is not yet done under formal working plan control and plantations are formed as fast as funds will permit, there being large areas of degraded forest available and suitable for conversion to pine plantations. Control of all work involved in establishment and maintenance of the plantations is effected through annual programmes drawn up for each plantation centre.

60. In the nursery, seed are broadcast in germination boxes filled with medium grade sand and germination takes place in about 5 days. Seedlings are transplanted into 7.5 cm diameter black polyethylene bags filled with a topsoil mix to which 10% mycorrhizal soil has been added. The transplants are hardened-off under sarlon netting during a two-week period, the netting is then removed and watering and weeding carried out as necessary. Sowing commences in October of the year prior to planting and is continued as necessary until about February and the ideal product is a plant of about 23 cm with a high root to shoot ratio.

61. Site preparation is similar to that for teak, i e merchantable timber is sold in the year prior to planting, the area under-brushed, clear-felled, fire-traced then burned towards the end of the dry season. Planting is carried out at 2.5 m x 2.5 m spacing and weeding carried out as required. The annual programme is similar to that shown above for teak plantations at Table 1 and the cost in man days/ha up to the end of the first 5 years is shown at Table 3.

62. Data concerning growth rates are sparse but twelve permanent sample plots have been laid down and measurements made at regular intervals. Height-age classes have been identified and are shown at Figure 4, mean annual increments for these classes are shown at Figure 5 and it will be noted that at age 20, the mean annual increments of the classes have not reached peaks. At age 20 the mean annual increments vary from a low of 11 m^3/ha to a high of 18 m^3/ha. Thinning schedules are still under discussion with the question of an assured market for the thinnings being a problem still to be solved.

Figure 4

P. caribaea in Trinidad

Provisional Height Classes

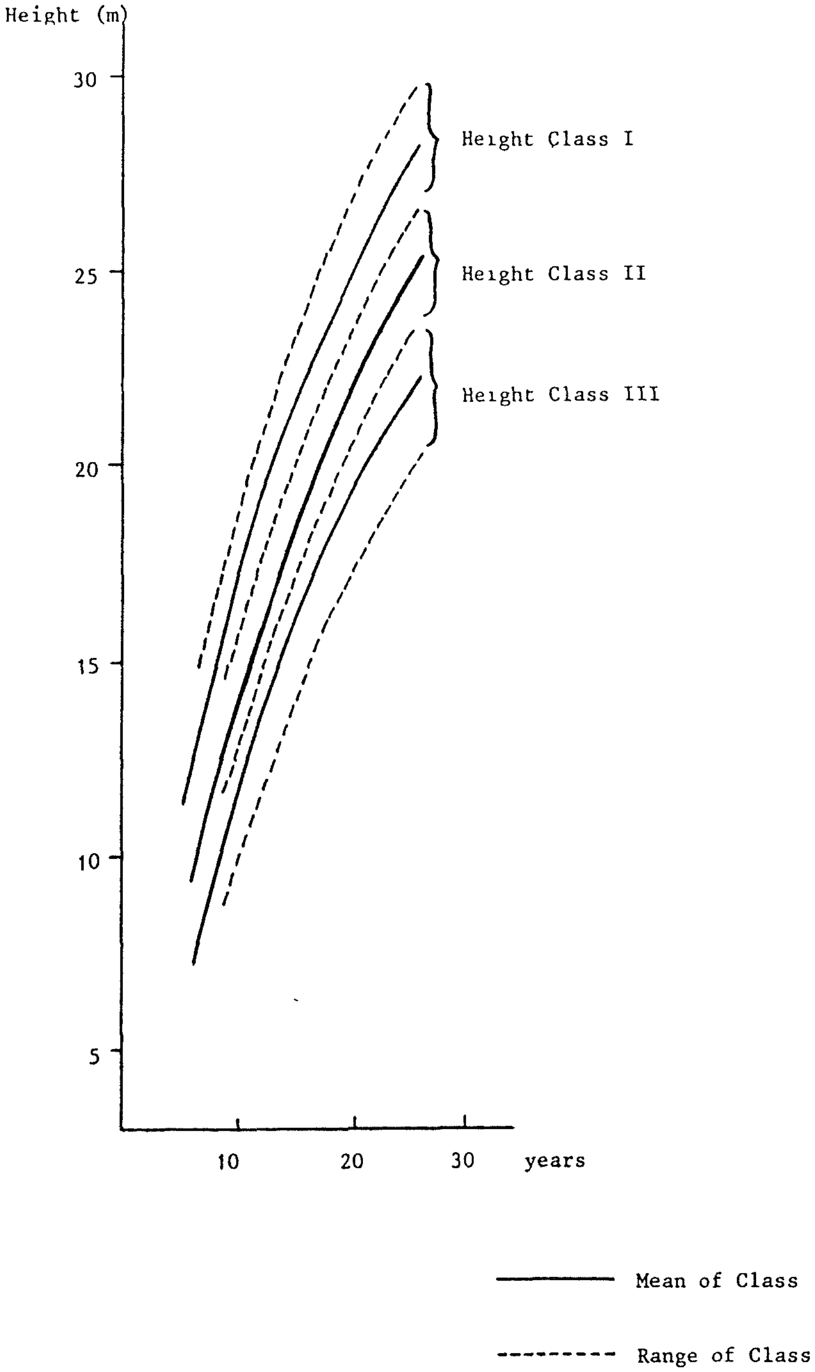
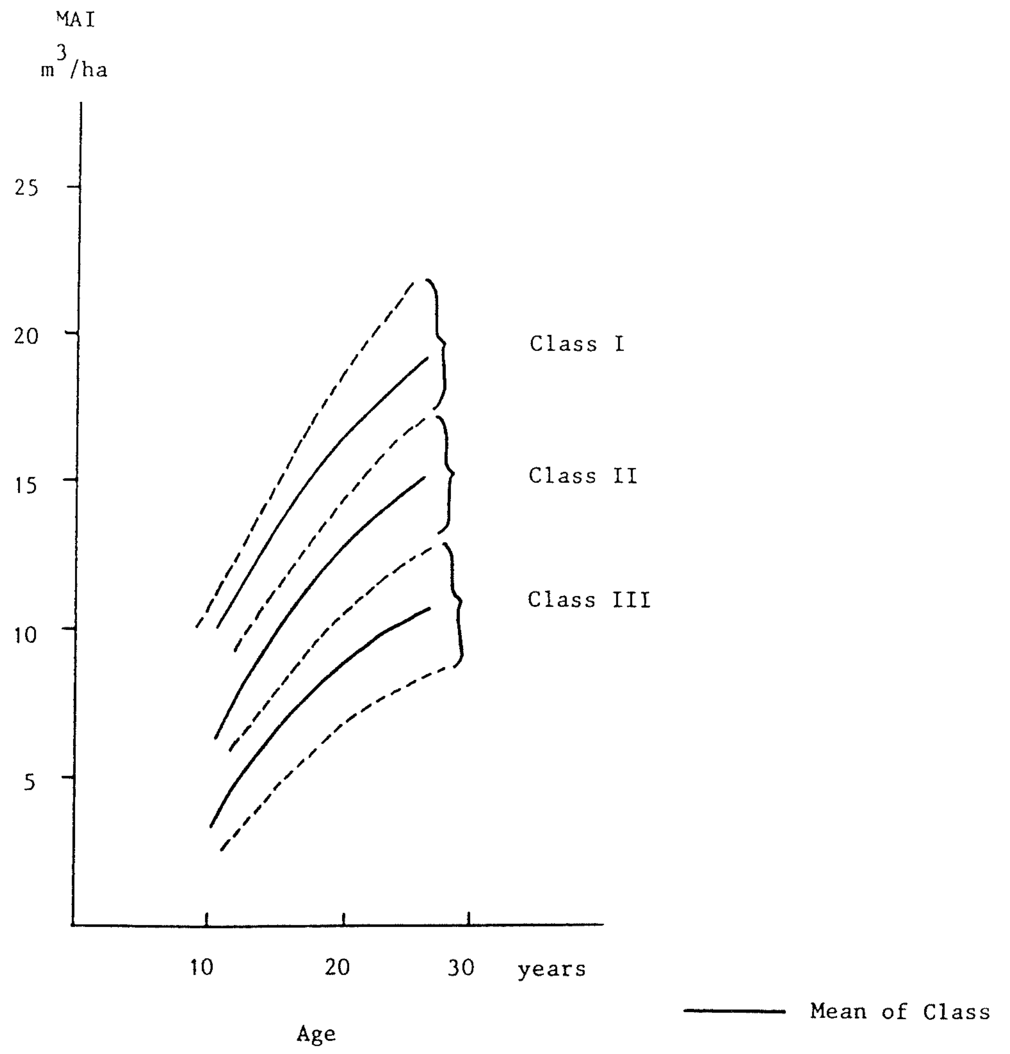


Figure 5

P. caribaea in Trinidad

Mean Annual Increment-Age



出典

FAO (1985). Intensive multiple-use forest management in the tropics ; Analisis of case studies from India, Africa, Latin America and the Caribbean. FAO Forestry Paper 55.

樹種：PINACEAE（マツ科）

Pinus caribaea　（カリビアマツ）

国　：スリナム

データ採取地の立地環境

SURINAM (1)

Locality:	55°28'30" W and 5°18'5" N (Coebiti)
Altitude:	0 to 100 m
Soil:	slightly loamy sand
Other characters:	mesophytic high forest
Data source:	permanent sample plot (controlled conditions)
Size of plots:	1 600 m^2
Number of plots:	36 (4 blocks of 3 x 3 Latin square design)
Measurement specification:	7.5 cm top diameter under bark, excluding 10 cm stump

成長・収穫に関する表，図，式など

MAI (m^3/ha) by stand density and age

Age (years) \ Stems/ha	1600	1111	816	
	......	m^3/ha	....	
5.3	1.9	1.9	1.5	
8.0	8.4	7.9	6.1	)
11	12.3	11.2	8.8	) low thinning
8	9.9	7.8	6.5	)
11	13.4	11.2	9.4	) medium thinning

出典

(1) De Vries, P.G.; Hilderbrand, J.W.; and De Graaf, N.R. Analysis of 1978 the 11 year old caribaea pine in a replicated graeco-latin square spacing - thinning experiment in Surinam. Mededelingen Landbouwhogeschool Wageningen.

ダイジェストデータ．Pandrey, D　Growth and yield of plantation species in the tropics, FAO 1983　所収

樹種：PINACEAE（マツ科）

Pinus caribaea var. hondurensis （カリビアマツ）

国 ：多国籍［ブラジル、タンザニア、ジャマイカ、トリニダードトバゴ、マレーシア］

データ採取地の立地環境

成長・収穫に関する表，図，式など

Details \ Countries	Brazil	Tanzania	Jamaica	Trinidad	Malaysia
Reference	(2)	(2)	(2)	(2)	(4)
Locality	lower Amazon Basin	Lake Victoria	-	-	West Malaya
Altitude in m	-	1200	300–1200	0–200	50–1600
Rainfall, mm	-	1500	1000–3000	2000–2500	-
Soil	-	granite sandy loam	sandy soil	-	-
Other characters	high forest stand	-	-	-	-
Data source	T.S.P.	P.S.P.	T.S.P.	-	P.S.P.
No. of plots	7	8	-	-	22
Size of plots	-	-	-	-	-
Measurement specification	5 cm u.b.	total vol. u.b.	10 cm u.b.	7.6 cm u.b.	7.6 cm u.b.
MAI (m^3/ha)					
(A1) 1/	19.1 (12) 2/	31.5 (8.5) 2/	-	14.08 (10) 2/	18.9 (8) 2/
(A2)	17.7 (11)	28.0 (11.6)	-	17.4 (15)	20.0 (11)
(A3)	18.3 (10)	25.6 (9.2)	-	19.3 (20)	19.9 (14)
(A4)	11.6 (9)	-	16.7 (20) 2/	20.0 (25)	17.7 (19)
(A5)	26.4 (12)	-	-	-	15.9 (25)
(A6)	16.2 (11)	-	-	-	-
(A7)	17.2 (10)	-	-	-	-
Remark	thinning included	-	thinning included	height class I thinning included	crop thinned at 8, 11, 16 and 19 age

1/ Stand age in years.

2/ Figures in brackets indicate age in years

6.4.4 Comments

On average sites, 15 - 20.0 m^3/ha MAI seems to be achieved between 14 - 18 years' age provided stocking is full.

出典

(2) De Vries, P.G.; Hilderbrand, J.W.; and De Graaf, N.R. Analysis of the 1978 11 year old caribaea pine in a replicated graeco-latin square spacing - thinning experiment in Surinam. Mededelingen Landbouwhogeschool Wageningen.

(4) Smart, J.B. Analysis of cost and economics of proposed pine pulpwood 1972 plantation in West Malaysia. FO:SF/MAL 67/512 Working Paper 21.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
　　Pinus kesiya　（カシアマツ）
国　：マレーシア（マラヤ）

データ採取地の立地環境

Malaysia
Aung Din (1958), Mitchell (1962, 1963) and Vincent et al. (1965) reported on the growth of the oldest plot of P.kesiya of Philippines provenance in Malaya which was planted in January, 1932, on a site at 1500 m in the Cameron Highlands. The soil, derived from granite, underlies a mantle of peat and the annual rainfall, which is distributed fairly evenly round the year, averages 2640 mm. The growth of this 0.12 ha plot, which was thinned to about 1360 stems per ha at age 5, is summarized in Table 6.11.

成長・収穫に関する表，図，式など

Table 6 11 Growth of *P kesiya* at Mentigi F R , Cameron Highlands, Malaya (After Mitchell, 1963)

	Stand after thinning			Thinnings						
Age (yrs)	Stems ha	Mean diam b h (cm)	Volume (m^3)	Stems ha	Mean diam (cm)	Volume (m^3)	Total yield (m^3)	Mean Annual increment (m^3)	Current annual increment (m^3)	Mean top height (m)
15	380	27 1	52	535	27 0	70	122	8 2		
21	360	33 1	86	57	32 4	14	161	7 7	6 5	
25	270	36 2	83	116	31 3	25	192	7 7	7 6	
30	270	39 5	101				210	7 0	3 6	37 7

(Data refer to stems 8 inches diameter b ht and over)

出典

Armitage, F B. and Burley, J (1980). Tropical forestry papers No.9. Department of Forestry, Commonwealth Forestry Institute, University of Oxford.

樹種：PINACEAE（マツ科）
Pinus kesiya（カシアマツ）
国：フィリピン

データ採取地の立地環境

(3) P. kesiya

調査林分は，ルソン島北部山岳地帯バギオ近郊の標高約 760mにある針葉樹研究センターの試験林（ビンガー）と標高1400mのベンゲット管理林業の造林地（ボボック）およびパンタバンガンの草生地に植林された林分である。ビンガーでは1969年植栽の林分に，ボボックでは1962年植栽の林分の緩斜面上部および下部と天然林に調査地を設けた。そしてパンタバンガンでは1977年植栽の林分に調査区を作った。なお，ビンガーとボボックの暖かさの指数を調べたところ，各々 208月・℃, 161・℃となった。それ故，積算温度からみれば，ビンガーは亜熱帯，ボボックは暖温帯と亜熱帯の境界付近に位置していることになる。

ビンガーでは1983年４月に大きさが 225㎡の調査区を設定し，またボボックでは斜面上部と下部の人工林および天然林に各々調査区（ 400㎡， 255㎡， 400㎡）を設けた。そして1986年まで毎年２月に調査区内の全ての立木の胸高直径と標本木の樹高を劇定した。1984年２月にはボボックの斜面下部とビンガーの調査区外で，サンプル木を各々８本，13本伐採した。そしてサンプル木の相対生長関係を用いて，幹と幹材積については1983年および1984年から1986年までの現存量を，また葉と枝については1984年のビンガーとボボック斜面下部の現存量を推定した。パンタバンガンでは立木密度が異なる４つの林分を選び，各々１つの調査区（ 100㎡）を儲け調査区内の全立木の胸高直径と樹木を1984年から毎年３月に1986年まで劇定した。また1985年，1986年には立木密度がもっとも高く林冠が閉鎖している林分の調査区外でサンプル木を各々８本， ６本伐採し，サンプル木の相対生長関係から1984年－1986年の葉現存量，幹材積，1985年，1986年の葉現存量と枝現存量を推定した。

成長・収穫に関する表，図，式など

表４ *Pinus kesiya* 林の林分概況と現存量

Pinus kesiya（ビノガー）

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	材積 (m^3/ha)
1983	5110	9 2	8 7	—	—	79	—	186
1984	4990	9 6	8 9	8 7	20 9	85 3	115	200
1985	4760	10	9 6	—	—	95 2	—	223
1986	4290	10 8	10 3	—	—	104	—	244

Pinus kesiya（ボボック斜面上部）

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 幹量 (ton/ha)	材積 (m^3/ha)
1984	1730	15 5	11 5	87	203 3
1985	1730	15 8	11 6	91 8	214 5
1986	1640	16 5	12 4	99 2	232 1

Pinus kesiya（ボボック斜面下部）

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量				
				葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	材積 (m^3/ha)
1984	1960	16 4	12 3	9 2	22 9	112	144 3	262
1985	1910	16 8	113	—	—	120	—	280
1986	1840	17 5	14 2	—	—	134	—	315

Pinus kesiya（ボボック天然林）

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量	
				幹量 (ton/ha)	材積 (m^3/ha)
1984	560	30 1	24 9	200	475
1985	560	30 4	25 1	206	489
1986	560	30 8	25 5	213	506

表5 *Pinus kesiya*（ハンタバンガン）の林分概況と現存量

p-1

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量				
				葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	材積 (m^3/ha)
1984	2600	8 1	4 4	—	—	17 5	17 5	42 8
1985	2600	9 1	4 8	7	12 7	23 1	42 8	56
1986	2600	9 7	5 1	8 1	15 5	26 9	50 5	64 9

p-2

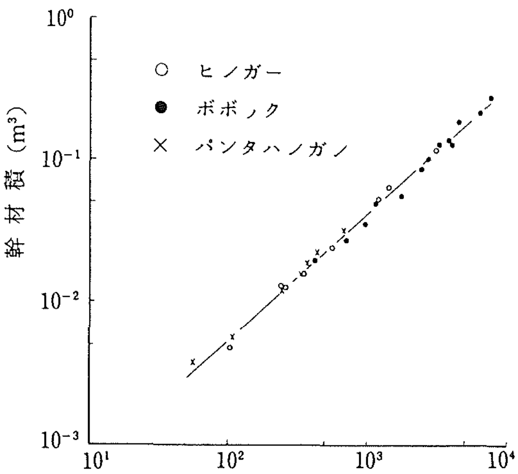
調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量	
				幹量 (ton/ha)	材積 (m^3/ha)
1984	2000	7 7	4 3	12 7	31
1985	2000	9	4 8	18	43 6
1986	2000	9 7	5 2	21	52 4

p-3

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量	
				幹量 (ton/ha)	材積 (m^3/ha)
1984	1400	8 2	4 2	9 5	23 3
1985	1400	9 4	4 7	12 9	31 4
1986	1400	10 4	4 9	16	38 6

p-4

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量	
				幹量 (ton/ha)	材積 (m^3/ha)
1984	500	10 8	5	5 8	14 1
1985	500	13	5 7	8 7	20 8
1986	500	14 7	5 9	11 5	27 1



(DBH)²·H (cm²·m)
H 樹高 (m)
DBH 胸高直径 (cm)
V 幹材積 (m²)

図4 幹材積と (DBH)²·H との相対生長関係

（幹の現存量）

各調査地の *P kesıya* の標本木について幹材積と D²H との相対生長関係を調へたところ，図4に示したようなきれいな直線関係が得られた。

回帰式は

$$V=0\ 000085(D^2H)^{0\ 899}\ \ (r^2=0\ 993)$$

（V 材積，D²H （胸高直径)²×樹高）

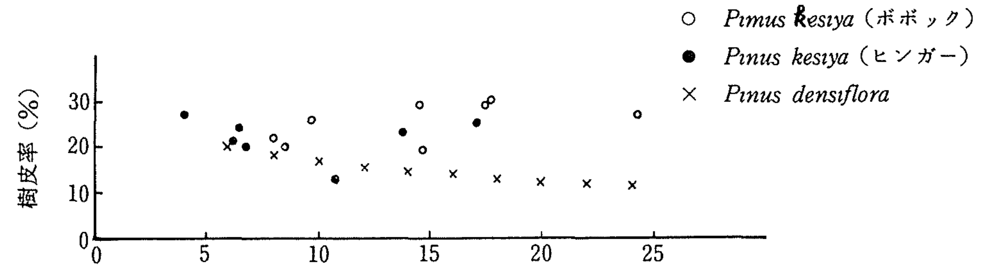
て近似てきた。

各調査地は林况，地况とも大きく異なり海抜高は200～1400 m，林齢は8～22年生てあった。このような広範囲の林分てきれいな直線関係が得られたことからこの回帰式はルソノ島中北部に成立している多くの *P kesıya* 林に適用てきると仮定して，この式をもとにして *P kesıya* の材積表を作成した（表6)。

各調査地の *P kesıya* 林は後述するようにルソン島北部山岳地帯の天然林と比へて中一下の生長をしているとみられるが，いずれの調査地ても幹材積は地位1等地の同齢の日本アカマツ林より大きかった（表4，5)。

表6 *Pınus kesıya* の幹材積表 (m³)

直径(cm) ＼ 樹高(m)	2	4	6	8	10	12	14	16	18	20
2	0 0006	0 0010	0 0015	0 0019	0 0023	0 0028	0 0032	0 0036	0 0040	0 0044
4	0 0019	0 0036	0 0051	0 0067	0 0081	0 0096	0 0110	0 0124	0 0138	0 0152
6	0 0040	0 0074	0 0107	0 0138	0 0169	0 0199	0 0229	0 0258	0 0286	0 0315
8	0 0067	0 0124	0 0179	0 0232	0 0283	0 0334	0 0383	0 0432	0 0480	0 0528
10	0 0100	0 0186	0 0267	0 0346	0 0423	0 0498	0 0573	0 0646	0 0718	0 0789
12	0 0138	0 0258	0 0371	0 0480	0 0587	0 0692	0 0795	0 0896	0 0996	0 1095
14	0 0182	0 0340	0 0489	0 0634	0 0775	0 0913	0 1048	0 1182	0 1314	0 1445
16	0 0232	0 0432	0 0622	0 0806	0 0985	0 1160	0 1333	0 1503	0 1671	0 1837
18	0 0286	0 0534	0 0769	0 0996	0 1217	0 1434	0 1647	0 1857	0 2065	0 2270
20	0 0346	0 0646	0 0929	0 1204	0 1471	0 1733	0 1991	0 2245	0 2496	0 2743
22	0 0411	0 0766	0 1103	0 1429	0 1746	0 2057	0 2363	0 2664	0 2962	0 3256
24	0 0480	0 0896	0 1290	0 1671	0 2042	0 2406	0 2763	0 3116	0 3464	0 3808
26	0 0555	0 1035	0 1490	0 1929	0 2358	0 2778	0 3191	0 3598	0 4000	0 4397
28	0 0634	0 1182	0 1702	0 2204	0 2694	0 3174	0 3646	0 4111	0 4570	0 5024
30	0 0718	0 1338	0 1927	0 2496	0 3050	0 3593	0 4127	0 4654	0 5173	0 5687



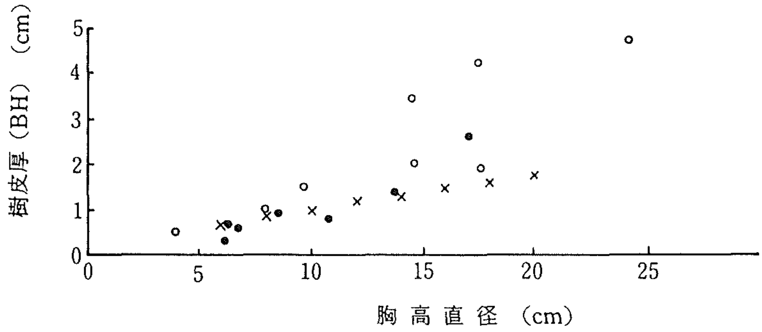


図5　幹の樹皮率，樹皮厚と胸高直径との関係

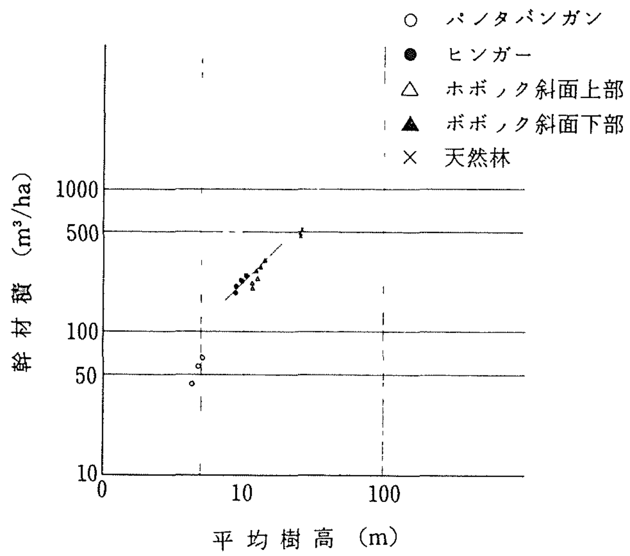


図6　幹材積と樹高との関係

表7　*Pinus kesiya* 林の生長

ビノガー

期 間（年）	年 生 長 量		年平均生長量	
	幹 現 存 量 (ton/ha·year)	幹 材 積 (m³/ha·year)	林 齢 (年)	幹 材 積 (m³/ha·year)
1983－1984	6 3	14 8	14	13 3
1984－1985	9 9	23 1	15	13 4
1985－1986	8 7	20 3	16	14 0
			17	14 3

ボボノク（斜面上部）

期 間（年）	年 生 長 量		年平均生長量	
	幹 現 存 量 (ton/ha·year)	幹 材 積 (m³/ha·year)	林 齢 (年)	幹 材 積 (m³/ha·year)
1984－1985	4 8	11 2	22	9 2
1985－1986	7 4	17 6	23	9 3
			24	9 7

ボボノク（斜面下部）

期間（年）	年生長量		年平均生長量	
	幹現存量 (ton/ha・year)	幹材積 (m^3/ha・year)	林齢 (年)	幹材積 (m^3/ha・year)
1984－1985	7 3	17 4	22	11 9
1985－1986	14 9	35 2	23	12 2
			24	13 1

ボボノク（天然林）

期間（年）	年生長量	
	幹現存量 (ton/ha・year)	幹材積 (m^3/ha・year)
1984－1985	6	14 4
1985－1986	6 9	16 5

パノタパノガノ（p-1）

期間（年）	年生長量		年平均生長量	
	幹現存量 (ton/ha・year)	幹材積 (m^3/ha・year)	林齢 (年)	幹材積 (m^3/ha・year)
1984－1985	5 6	13 2	7	6 1
1985－1986	3 8	8 9	8	7 0
			9	7 2

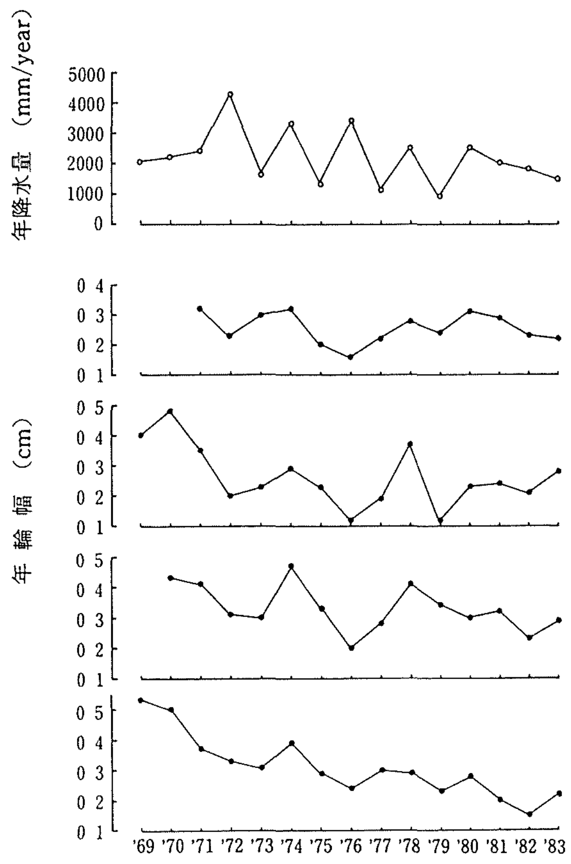


図7　年輪幅と年降水量

出典

加茂皓一、石塚森吉、大住克博：早生樹種林とマツ林の生長解析、熱帯農業集報　No. 65、65～79．（1989）

樹種：PINACEAE（マツ科）
Pinus kesiya（カシアマツ）
国　：フィリピン

データ採取地の立地環境

Published data on rates of growth of natural stands of P. kesiya are not plentiful. Jacalne and Lizardo (1958) gave the information shown in Table 6.7 for a series of natural and planted stands across an altitudinal gradient of 800 m in Baguio, Philippines.

The same authors stated that mature trees had breast height diameters of 40-80 cm and heights of 20-30 m; the average annual increment in natural stands was said to be 2.1%.

成長・収穫に関する表，図，式など

Table 6.7 Rates of growth of *P. kesiya* stands in Baguio City, Philippines (After Jacalne and Lizardo, 1958)

Altitude (m)	Age (years)	Breast height diameter: Mean (cm)	Breast height diameter: Mean annual increment (cm)	Mean height (m)	Remarks
1600		28.9	0.94	13.5	Natural On slope
1600		25.8	2.14	12.8	Natural Bottom of slope
1600	11-25	16.0	0.99	13.1	Plantation
1600	13	14.2	1.08	12.5	"
800	14	9.5	0.66	6.8	"
800	22	12.1	0.55	8.7	"

出典

Armitage, F.B. and Burley, J. (1980). Tropical forestry papers No.9. Department of Forestry, Commonwealth Forestry Institute, University of Oxford.

樹種：PINACEAE (マツ科)
Pinus kesiya (カシアマツ)
国：フィリピン

データ採取地の立地環境

Locality:	Bagnio City (Bargnet Province)
Altitude:	1 480 m
Rainfall:	2 200 mm
Data source:	temporary sample plots (point sampling)
Number of plots:	156
Measurement specification:	stem timber up to merchantable height reckoned from the first main branch

成長・収穫に関する表，図，式など

(a) Site index equation at reference age 40 years:

$$\log S = \log H + 0.84555 (\log 40 - \log A) \qquad (r^2 = 0.857)$$

where:
S = site index
H = average height in m of at least five dominant and co-dominant trees around the point
A = stand age in years

(b) Yield equation:

$$\log V = b_{31} + b_{32} \log A + b_{33} \log S + b_{34} PBA + b_{35}/RD \qquad (r^2 = 0.9425)$$

where:
V = stand volume in m^3/ha
b_{31} = − 9.1992
b_{32} = 3.7725
b_{33} = 4.6798
b_{34} = − 0.015521
b_{35} = − 0.048355
PBA = predicted basal area m^2/ha obtained by equation
$\log (BA + 4)/4 = b_{21} + b_{22} \log A \log S + b_{23} A + b_{24} S$
and RD = actual basal area/predicted basal area

1/ Natural even-age stand.

MAI (m^3/ha) by site index for mean density class (RD = 1)

Age (years) \ Site index	15	20	25	30	35
10	0.1	0.4	1.0	2.1	4.4
15	0.3	0.9	2.2	4.7	9.2
20	0.5	1.5	3.6	7.2	13.1
25	0.8	2.2	4.9	9.0	15.4
30	1.1	3.0	6.0	10.3	16.0
35	1.6	3.8	7.0	10.9	15.7
40	2.0	4.7	7.9	11.3	14.9
45	2.7	5.7	8.8	11.6	13.9
50	3.4	6.8	9.8	11.8	13.1
55	4.3	8.0	10.9	12.2	12.5

Remark: No thinning predicted.

出典

(3) Revilla, A.V. *et al.* A yield prediction model for natural Bengnet pine
1976 stands. Sylvatrop. Philippine Forestry Research Institute Journal
1:116-127.

ダイジェストデータ Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
Pinus kesiya（カシアマツ）
国　：マラウイ

データ採取地の立地環境

Malawi
High rates of volume production have been demonstrated and maintained for up to 30 years in several P. kesiya stands at elevations from 730-1770 m (1000-1900 mm annual rainfall) in Malawi. They are illustrated by data provided by Theron (1971) and shown in Table 6.17.

成長・収穫に関する表，図，式など

Table 6 17 Summary growth data for older *P kesiya* plots in Malawi (From Theron, 1971)

Seed origin	Forest	Altitude (m)	Mean annual rainfall (mm)	Age (yrs)	Stems per ha	Mean top height (m)	Mean height (m)	Mean diameter breast height (cm)	Basal area (m^2/ha)	Total volume under bark (m^3/ha)	Mean annual increment (m^3/ha)*	Current annual increment (m^3/ha)*
Burma	Likabula	730	1140	8	1330	11 3	10 4	16 2	27 7	—	—	—
				13	1135	16 3	14 9	17 5	27 5	119	9 1	—
Burma	Likabula	730	1140	8	1210	9 9	9 4	15 8	23.9	—	—	—
				13	1090	13 2	12 9	17 3	26 9	90 9	6 9	—
Burma	Cholomwani	730	1525	10	890	16 7	16 3	22 0	33 8	186 8	18 6	—
				12	960	19 8	17 8	24 7	46 2	287 5	23 9	50 3
				15	940	23 1	20 8	27 0	54 1	414 2	27 6	42 1
Malagasy	Ndirande	1310	1020	9	1010	12 3	10 0	17 6	24 8	—	—	—
ex-Zomba	Zomba slopes	1220	1525	6	1360	10 5	7 8	13 3	19 0	—	—	—
Java	Zomba slopes	1340	1525	21	250	28 4	28 7	37 3	27 1	288 2	13 7	—
				25	370	30 6	28 7	38 2	42 5	452 7	18 1	—
				28	220	32 5	32 1	43 9	33 7	396 7	14 2	—
Java	Zomba Plateau	1675	1900	24	295	24 8	25 8	39 1	35 7	331 6	13 8	—
				26	270	26 8	27 4	44 9	43 1	417 7	16 0	43 0
				28	250	32 1	31 3	44 6	38 7	445 7	15 9	—
				29	250	33 2	33 1	45 7	40 5	496 0	17 0	50 3
Java	Dedza	1645	1190	24	370	29 8	29 0	41 7	50 6	533 1	22 2	—
				27	270	32 0	30 7	42 6	38 8	438 0	16 2	—
				29	270	33 8	31 3	44 5	42 3	485 5	16 7	23 7
Burma	Chikangawa	1770	1270	10	2050	13 3	11 3	18 2	53 4	170 7	17 0	—
				12	1140	14 4	13 1	22 7	46 0	195 9	16 3	12 5
				13	1140	15 1	13 7	23 8	50 6	232 3	17 8	36 3
Burma	Luwawa	1675	1015	10	790	14 9	12 6	23 5	34 3	140 6	14 0	—
				13	790	16 5	15 0	26 2	42 6	216 9	16 6	25 3

* Excluding thinnings

出典

Armitage, F.B. and Burley, J. (1980). Tropical forestry papers No.9 Department of Forestry, Commonwealth Forestry Institute, University of Oxford.

樹種：PINACEAE（マツ科）
Pinus kesiya （カシアマツ）
国　：ナイジェリア

データ採取地の立地環境

Nigeria
The oldest trial plots of P.kesiya of Philippines origin on the Jos Plateau (1250 m; 1160 mm mean annual rainfall, eutrophic brown soil from basalt parent material) were reported upon by Kemp (1970) at 6.5 years and Iyamabo et. al. (1972) at 9.5 years. Growth was illustrated by the data in Table 6.15.

成長・収穫に関する表，図，式など

Table 6 15 Growth of *P kesiya* on Jos Plateau Nigeria (After Kemp, 1970 and Iyambo *et al* (1972))

Plot No	Age (years)	Mean height (m)	Mean diameter b h (cm)	Volume over bark (m^3/ha)	Mean annual Volume increment (m^3/ha)
1	6 5	8 6	11 7		
	9 5	12 8	15 7	166	17 47
2	6 5	6 0	9 4		
	9 5	10 4	12 6	84	8 84

出典

Armitage, F.B. and Burley, J (1980). Tropical forestry papers No.9. Department of Forestry, Commonwealth Forestry Institute, University of Oxford.

樹種：PINACEAE（マツ科）
Pinus kesiya（カシアマツ）
国：ザンビア

成長・収穫に関する表，図，式など

Yield table

Age	Mean dbh o.b. cm	Thinning vol.[h] (m^3/ha)	MAI (m^3/ha) u.b.
4	9.6	-	4.8
6	14.5	9.8	7.8
8	18.5	27.3	12.7
12	25.9	46.0	15.4
16	31.7	-	17.0
21	38.6	108.6	19.5
25	43.9	-	20.2
30	49.8	-	21.4

Remarks: Thinning yield has been included in MAI calculation. No details about locality and data source have been indicated.

出典

(2) Markila, L. Preliminary appraisal of prospects of pulp and paper
1970 industry in Zambia. FO:SF/ZAM 5. FAO. Rome.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）

Pinus kesiya （カシアマツ）

国　：ブラジル

データ採取地の立地環境

Veiga (1974) referred to unpublished Brazilian Forest Service yield tables for pines when he described for several tropical pines, including P.kesiya, how annual volume increment decreases between thinnings although both standing volume and volume extracted at each thinning increase throughout the rotation. To illustrate his point for P. kesiya he gave the generalized data shown in Table 6.14.

The plots were planted at 2.4 ×2.4 m. Stocking at the times of measurement were not given.

成長・収穫に関する表，図，式など

Table 6 14 Yields of *P kesiya* in Brazil (From Veiga, 1974)

Age (years)	Volume before thinning (m^3/ha)	Volume of thinnings (m^3/ha)	Mean annual increment (m^3/ha)
7	320	75	45 7
14–17	480	106	40 0
18–25	509	127	34 4
35–40	636	153	25 4
		636	19 7
		Total 1097	

出典

Armitage, F.B and Burley, J. (1980). Tropical forestry papers No.9. Department of Forestry, Commonwealth Forestry Institute, University of Oxford

樹種：PINACEAE（マツ科）
Pinus elliottii（スラッシュマツ）
国：インド

データ採取地の立地環境

Method

The detailed method of sampling, harvesting and collection of basic data as well as the plantation details have been published earlier (Kaul *et al.*, 1982). Needle area was calculated as per regression equation $y = 19.03 + 0.38$ where y is leaf area and x is leaf weight (Gurumurti and Srivastava, 1982); leaf area index by Horn (1971); leaf efficiency by Satoo (1967); NAR, LAR and RGR by Noggle and Fritz (1976).

成長・収穫に関する表，図，式など

Table 1

Mean Oven Dry Weight of different components of tree in kg.

Components	Age-Years			
	10	20	30	40
Wood	31.41	154.34	272.85	494.82
Bark	9.59	27.95	82.53	58.91
Branch	9.76	33.43	80.33	114.32
Twig	7.19	13.79	27.42	33.04
Needle	13.13	19.81	23.33	33.07
Cone	—	0.56	0 32	0.65
Root	16.51	53 27	84 14	132.44
Total	87.59	303.02	530 97	868.25

Table 2

Growth Parameters of Pinus elliottii

Parameter	Age-Years			
	10	20	30	40
Total Biomass (kg)	87.59	303.020	530.970	868 250
Needle Biomass per tree (kg)	13.130	19.810	23.330	33.070
Needle area (m^2)	88.610	141.460	162 920	243.750
LAI	9.290	14.560	11.000	13.190
MAI (kg year^{-1})	8.759	15.151	17.699	21.705
Leaf efficiency	6.670	15.300	22.759	25.483

Table 3

Growth Indices of Pinus elliottii

Growth index	Age-Years		
	10-20	20-30	30-40
NAR (kg $m^{-2}yr^{-1}$)	0.191	0.150	0.168
NAR (kg $kg^{-1}yr^{-1}$)	1.327	1.059	1.189
LAR (m^2 kg^{-1})	0.650	0 374	0.292
LWR (kg kg^{-1})	0.094	0.053	0.041
RGR	0.124	0.056	0.049

出典

Gurumurti, K , Srivastava, V K (1984) Studies on Growth Correlations in *Pinus elliottii*, Indian Forester 1984 vol 110, No 3, 269-273

樹種：PINACEAE（マツ科）
Pinus elliottii（スラッシュマツ）
国：南アフリカ

データ採取地の立地環境

成長・収穫に関する表，図，式など

Locality:	Border project C 11
Altitude:	1 067 m
Rainfall:	945 mm
Soil:	deep loam
Data source:	-
MAI at 35 years (m^3/ha):	22.6

6.5.4 Comments

Even on median site, growth rate is more than 25 m^3/ha/annum at 13 years of age, but it is difficult to infer MAI culmination and rotation age from the existing data.

出典

(2) Poynton, R.J. 1979 The pines, tree planting in South Africa. Vol. I.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）

Pinus elliottii（スラッシュマツ）

国：ブラジル

データ採取地の立地環境

Locality:	São Paulo, Paraná, Santa Catarina and Rio Grande do Sul
Altitude:	0 to 600 m
Rainfall:	1 200 to 2 000 mm (marked dry weather absent)
Soil:	red yellow sandy latosol
Other characters:	grassland savannah; medium temperature 22°C
Data source:	permanent sample plots
Number of plots:	537
Size of plots:	100 m^2 to 400 m^2

成長・収穫に関する表，図，式など

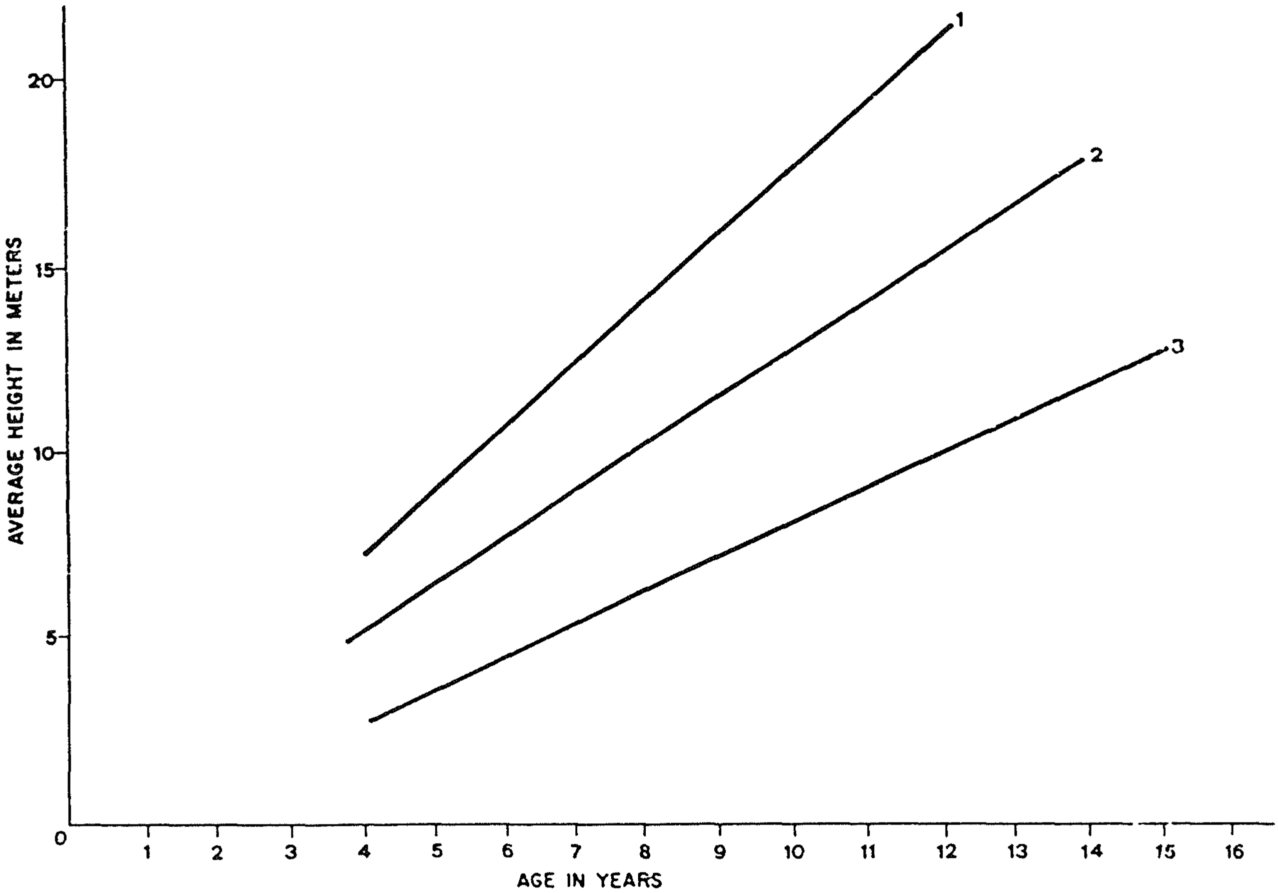
MAI (m^3/ha) by site class and age
(initial stocking 2 300 stems/ha)

Age (years) \ Site class	I	II	III
3	13.7	5.3	-
4	19.3	8.5	2.3
5	24.8	11.6	4.0
6	26.8	14.7	5.4
7	29.8	15.8	6.8
8	33.7	17.6	8.3
9	38.2	19.8	9.6
10	39.9	22.3	9.9
11	42.3	23.3	10.5
12	-	24.6	11.3
13	-	26.5	12.2

Remarks: Volume calculated is under bark. Crop has been thinned by 40 percent at 5th and 9th year in site class I; 7th and 11th year in site class II; and 10th and 14th year in site class III and thinning yield has been included in MAI. Most of the sample plots were between 5 to 13 years' age. Reference (1) also includes yield for climatic region Cwa and Cwb (according to Köppen's classification), i.e. with one dry winter.

Pinus elliottii - Brazil (1)

Site index curves



出典

(1) Faber, P.J. *et al.* Growth research and preliminary yield tables of *Pinus elliottii* (Englem.) for southern Brasil. Dorschkamp Research Institute of Forestry and Landscape Planning, Wageningen, Netherlands.
1975

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO 1983. 所収

樹種：PINACEAE（マツ科）
Pinus luchuensis（リュウキュウマツ）
産地：台灣

データ採取地の立地環境

適応地域　　台湾北部
使用プロット数　187

成長・収穫に関する表，図，式など

第 1—1 表　各郷鎮各林齢標區分佈表
Table. 1—1　Distribution of sample plots at different counties

林齢＼地名	坪林郷	頭城鎮	礁溪郷	大同郷	汐止鎮	貢寮郷	三星郷	三峡鎮	石碇郷	新店鎮	瑞芳鎮	合計
8						(1) 2		(2) 3	(2) 3	(1) 2	(3) 5	(9)15
10	(1) 2		(1) 2			(2) 4		(1) 2	(1) 2	(3) 6	(3) 6	(10)24
12	(4) 7	(2) 4	(2) 4	(1) 2	(1) 2	(1) 2	(1) 2		(5)12	(5) 7	(1) 2	(23)44
14	(2) 5	(4)11	(1) 2		(5)11		(3) 5		(2) 3	(3) 5	(4) 8	(24)50
16	(4) 7	(1) 1				(1) 2			(1) 3			(7)13
18		(1) 1	(2) 4							(2) 5		(5)10
20	(1) 2	(3) 5										(4) 7
22	(2) 4											(2) 4
24	(1) 2	(1) 3	(1) 2									(3) 7
26		(1) 2							(1) 2			(2) 4
28		(1) 2							(2) 4			(3) 6
30		(2) 3										(2) 3
合計	(13)29	(16)32	(7)14	(1) 2	(6)13	(5)10	(4) 7	(3) 5	(14)29	(14)25	(11)21	(94)187

註：（　）；林分數

第 1—2 表　調査地點一覧表
Table. 1—2　Locations of sample plots survey

郷鎮	坪林郷	頭城鎮	礁溪郷	大同郷	汐止鎮	貢寮郷	三星郷	三峡鎮	石碇郷	新店鎮	瑞芳鎮
村里	粗屈 金瓜寮 水徳	金面里 金盈里 二城里 大里 港口里 石空子 福星里	林尾 大忠	寒溪	八連里 拱北里 保長坑	貢寮 福隆	天山	加添里	烏塗 格頭	双城里 龜山里 五城里	金瓜石 焿子寮 三爪子 四脚亭

第 1—3 表　各海拔高有效標區分佈表
Table. 1—3　Distribution of available sample plots by various altitudes

海拔高 (m)	50以下	100	200	300	400	500	600	700	800	900	合計
標區數	0	24	20	42	45	24	14	7	8	3	187

第 1—4 表 各不同坡度有效樣區分佈表

Table 1—4 Distribution of available sample plots by different slops

坡度	0°	5°	10°	15°	20°	25°	30°	35°	40°	合計
樣區數	3	5	31	19	60	32	23	8	6	187

第19表 臺灣北部琉球松林分收穫表

Table. 19 Yield Tables of Luchu Pine in North Taiwan

地位級: I Site class: I

林齡	主林木每公頃							副林木				
	胸高直徑 cm	樹高 m	株數	胸高斷面積 m²	材積 m³	連年生長 m³	平均生長 m³	胸高直徑 cm	樹高 m	株數	對全林木之比率 %	胸高斷面積 m²
8	10.99	5.87	1,712	10.36	81 32	19 79	10.17	7.58	4.35	568	24.91	1 45
12	14.26	10.82	1,381	13 37	160 48	24.12	13 37	8 77	5 56	395	22.24	2 12
16	17 26	14.62	1,171	15.82	256.94	27.02	16.06	10 28	6 99	310	20 93	2.33
20	19.99	16.59	1,002	17 82	365.01	28.75	18 25	12 13	8.84	235	19.00	2.30
24	22 50	17.60	865	19.50	480 00	30.03	20 00	14.40	10.87	174	16.75	2 16
(28)	24.80	18.13	761	20.81	600.12		21.43	17.16	12 96	116	13.23	1.97
10	12.66	7.75	1,506	11 96	118.28	22.18	11.83	8.14	4.93	454	23.16	1 88
14	15.79	13 03	1,266	14.65	207.00	25.67	14.79	9.49	6 28	358	22.04	2 28
18	18.64	15.77	1,076	16.86	309.67	27.99	17.20	11.16	7.87	272	20.18	2 33
22	21.26	17.18	929	18.70	421.61	29.44	19.16	13.22	9.85	204	18.01	2.24
(26)	23.67	17.91	813	20.23	539.37	30.49	20.75	15.71	11.94	146	15.22	2.07
(30)	25.93	18.29	719	21.52	661.32		22.04	18.74	13.87	71	8.99	1 87

副林木每公頃					主副林木每公頃						林齡
材積 m³	對全林木之比率 %	幹材積累計 m³	對主林木之比率 %	對總收穫之比率 %	株數	胸高斷面積 m²	材積 m³	連年生長 m³	平均生長 m³	總收穫 m³	
5 93	6 80	5.93	7 29	6.80	2,280	17 53	87.25	22.71	10 91	87 25	8
11.66	6.77	17.59	10.96	9.88	1,776	24.72	172.14	28 21	14 35	178.07	12
16.36	5.98	33.95	13.21	11.67	1,481	31.13	273 30	32.04	17.08	290.89	16
20.08	5.21	54.03	14.80	12.89	1,237	37.10	385.09	34.50	19.25	419.04	20
23.00	4.57	77.03	16 05	13.83	1,039	42.81	503.00	36.38	20.96	557.03	24
25.39	4.06	102.42	17.07	14.58	877	48.27	625.51		22.34	702.54	28
8.89	7.00	8.89	7.52	6.99	1,960	21.26	127.17	25.72	12.72	127.17	10
14.15	6.40	23.04	11.13	10.02	1,624	28.00	221.15	30.25	15 80	230.04	14
18.32	5.59	41.36	13.36	11.78	1,348	33.88	327 99	33.39	18.22	351.03	18
21.61	4.88	62.97	14.94	12.99	1,133	39.99	443.22	35 50	20.15	484.58	22
24.25	4.30	87.22	16 17	13.92	959	45.60	563.62	37.09	21.68	626 56	26
26.42	3.84	113.64	17.18	14.66	790	51.09	687.74		22.94	774.96	30

地位級: II Site class: II

林齡	主林木每公頃 胸高直徑 cm	樹高 m	株數	胸高斷面積 m²	材積 m³	連年生長 m³	平均生長 m³	副林木 胸高直徑 cm	樹高 m	株數	對全林木之比率 %	胸高斷面積 m²
8	9.96	4.57	1,855	13.28	65.80		8.23	7.46	3.57	809	30.37	1.90
						16.56						
12	13.00	8.42	1,566	18.12	132.05		11.00	8.52	4.55	560	26.34	2.70
						20.31						
16	15.80	11.38	1,393	22.72	213.27		13.33	9.86	5.73	430	23.59	3.03
						22.70						
20	18.36	12.92	1,256	26.84	304.07		15.20	11.49	7.25	322	20.41	3.11
						23.98						
24	20.70	13.70	1,145	30.75	400.00		16.67	13.50	8.91	238	17.21	3.08
						24.85						
28	22.86	14.11	1,057	34.50	499.38		17.84	15.96	10.62	162	13.29	2.98
10	11.51	6.03	1,671	15.71	96.62		9.66	7.96	4.04	648	27.94	2.39
						18.65						
14	14.43	10.15	1,470	20.42	171.20		12.23	9.16	5.15	499	25.34	2.92
						21.60						
18	17.10	12.27	1,315	24.81	257.58		14.31	10.63	6.45	375	22.19	3.09
						23.44						
22	19.55	13.37	1,196	28.83	351.35		15.97	12.45	8.08	279	18.92	3.11
						24.46						
26	21.80	13.89	1,103	32.68	449.19		17.28	14.67	9.79	200	15.35	3.03
						25.13						
30	23.87	14.24	1,022	36.44	549.70		18.32	17.37	11.37	106	9.40	2.92

每公頃 材積 m³	對全林木之比率 %	幹材積累計 m³	對主林木之比率 %	對總收穫之比率 %	主副林木每公頃 株數	胸高斷面積 m²	材積 m³	連年生長 m³	平均生長 m³	總收穫 m³	林齡
4.23	6.04	4.23	6.43	6.04	2,664	15.10	70.03		8.75	70.03	8
								18.83			
9.06	6.42	13.29	10.06	9.14	2,126	20.82	141.11		11.76	145.34	12
								23.48			
12.68	5.61	25.97	12.18	10.86	1,823	25.75	225.95		14.12	239.24	16
								26.52			
15.27	4.78	41.24	13.56	11.94	1,578	29.95	319.34		15.97	345.31	20
								28.23			
17.00	4.08	58.24	14.56	12.71	1,383	33.83	417.00		17.38	458.24	24
								29.39			
18.17	3.51	76.41	15.30	13.27	1,219	37.48	517.55		18.48	575.79	28
7.00	6.76	7.00	7.24	6.76	2,319	18.10	103.62		10.36	103.62	10
								21.40			
11.03	6.05	18.03	10.53	9.53	1,969	23.34	182.23		13.02	189.23	14
								25.12			
14.08	5.18	32.11	12.47	11.08	1,690	27.90	271.66		15.09	289.69	18
								27.50			
16.21	4.41	48.32	16.94	12.09	1,475	31.94	367.56		16.71	399.67	22
								28.87			
17.64	3.78	65.96	20.40	12.80	1,303	35.71	466.83		17.96	515.15	26
								29.77			
18.57	3.27	84.53	23.49	13.33	1,128	40.36	568.27		18.94	634.23	30

地 位 級：Ⅲ Site class：Ⅲ

林齡	主林木每公頃 胸高直徑 cm	樹高 m	株數	胸高斷面積 m²	材積 m³	連年生長 m³	平均生長 m³	副林木 胸高直徑 cm	樹高 m	株數	對全林木之比率 %	胸高斷面積 m²
8	8 43	3 09	2,029	15.35	45.43		5 68	7 31	2 75	1,168	36 53	2 18
						12 33						
12	11 12	5 69	1,791	21 65	94.75		7 90	8 21	3 50	803	30 96	3 07
						15 30						
16	13 61	7 69	1,662	27.66	155.96		9 75	9 32	4 41	603	26 62	3 47
						17.03						
20	15 91	8 72	1,563	33.47	224.09		11 20	10 68	5 58	415	22 16	3 63
						17 73						
24	18 00	9 25	1,485	39 15	295 00		12 29	12 35	6 86	328	18 09	3 66
						18.04						
(28)	19 94	9 53	1,418	44 64	367.18		13 11	14 42	8 17	227	13 80	3 63
10	9 80	4 07	1,872	18.54	68.19		6 82	7 73	3 11	938	33 38	2 72
						14 01						
14	12 38	6 85	1,717	24.68	124 24		8 87	8 74	3 97	702	29 02	3 32
						16 25						
18	14 78	8 29	1,606	30 31	189.23		10 51	9 97	4 97	524	24 60	3.57
						17 48						
22	16 98	9 03	1,519	36.33	259.15		11 78	11 48	6 22	384	20 18	3 66
						17 92						
(26)	19 01	9 42	1,455	41.95	330.84		12 72	13 33	7 54	278	16 04	3.65
						18 09						
(30)	20 85	9 61	1,391	47.49	403.20		13 44	15 62	8.75	159	10.26	3.60

每公頃 材積 m³	對全林木之比率 %	幹材積累計 m³	對主林木之比率 %	對總收穫之比率 %	主副林木每公頃 株數	胸高斷面積 m²	材積 m³	連年生長 m³	平均生長 m³	總收穫 m³	林齡
1 80	3.81	1 80	3.96	3.81	3,197	11 81	47 23		5.90	47.23	8
								13 45			
4 49	4 52	6.29	6 64	6.23	2,594	15.49	99 24		8 27	101 04	12
								17 02			
6 85	4 21	13 14	8 43	7.77	2,265	18 15	162 81		10 18	169 10	16
								18 95			
7 65	3 30	20.79	9 28	8.48	2,008	21 12	231 74		11 59	245 06	20
								19 60			
7 50	2 48	28.29	9.59	8.75	1,813	21 66	302 50		12 60	323.29	24
								19 73			
6 73	1 80	34 66	9.44	8 63	1,645	22 78	373 91		13 35	401 84	28
3 49	4 87	3 49	5.12	4 87	2,810	13 84	71 68		7 17	71.68	10
								15 53			
6.06	4 65	9 55	7 69	7.14	2,418	16 93	130 30		9 31	133 79	14
								18 08			
7.36	3 74	16 91	8 94	8 20	2,130	19 19	196 59		10 92	206.14	18
								19 40			
7 66	2 87	24.57	9 48	8 66	1,903	20 94	266 81		12 13	283 72	22
								19 72			
7 18	2 12	31 75	9 60	8 76	1,733	22 30	338 02		13 00	362.59	26
								19 63			
6 14	1 50	37 89	9 40	8.59	1,550	23 39	409 34		13 61	441.09	30

出典

Shen-Haiao Liu and Tzu-Yu Lin (1970). Yield tables and volume tables of Luchu Pine in north Taiwan Technical Bulletion, Dept. of Forestry, Collage of Agriculture, National Chung Hsing University, Taiwan.

樹種：PINACEAE（マツ科）
Pinus luchuensis（リュウキュウマツ）
[illegible]：台灣

台湾
プロット数　193

データ採取地の立地環境

要因項目	適用種類之範圍
土性	細砂壤土或砂質壤土均可適宜種植。
標高	適於 200m～600m 之範圍。
土壤有效深度	最適合之有效深度在 21cm～50cm 以上之表土。
林地部位	最適宜於山腹地帶。
枯枝葉層	要求度不大，有無均無大影響。
土壤濕潤度	影響力不大，但須排水良好之處。
方位	不適合在南、北向；東、東西、西南或東南各方向均可。
坡度	適於 5°～30° 之緩斜面林地。
鬱閉度	鬱閉程度不要過疏，中庸者爲最適宜。

成長・収穫に関する表，図，式など

表 10.　無間伐林林分收穫預測表

Table 10.　Estimated of stand-yield table for unthinning forest.

樹　種：琉球松
栽植株數：3300株

地位級	齢階	平均樹高 $\bar{H}$ (m)	平均幹距 S	相對幹距 S_r (%)	每公頃立木株數 N	斷面積平均木直徑修正值 d'_b (cm)	每公頃斷面積合計 B′ (m²)	每公頃林分材積合計 V (m³)
I	10	10.83	1.86	17.18	2,891	10 1	23.16	164.67
	14	13.17	1.92	14.58	2,713	11 0	25.78	212.14
	18	15.35	1.99	12.96	2,525	12 1	29 04	272.42
	22	17.37	2.06	11.86	2,357	13 1	31.77	332.52
	26	19.25	2.13	11.07	2,204	14.0	33.93	389.31
	30	21.00	2.20	10.48	2,066	14.9	36.02	447.17
	10	7.28	1.79	24 59	3,121	8 3	16.89	73.93
	14	9.80	1.83	18.67	2,986	9.6	21.61	123.70

Ⅱ	18	12 10	1.89	15.62	2,800	10.9	26.13	182.15
	22	14.22	1.96	13.78	2,603	12.1	29.93	243 29
	26	16.19	2.03	12.54	2,427	13.0	32.21	296.24
	30	18.00	2.10	11.67	2,268	13.9	34.42	350.67
Ⅲ	10	3.73	1.76	47.19	3,228	7.5	14.26	24.80
	14	6.42	1.78	27.73	3,156	8.8	19.20	61.92
	18	8.86	1.82	20.54	3,019	10.0	23.71	108.27
	22	11.08	1.86	16.79	2,891	11.1	27.98	162.19
	26	13.12	1.92	14.63	2,713	12.2	31.72	219.53
	30	15.00	1.99	13.27	2,525	13.2	34.55	275.07

表 11. 間伐林 (S_r=15%) 林分收穫預測表

Table 11. Estimated of stand-yield table for thinning forest (S_r=15%)　　(樹種：琉球松)

地位級	齡階	平均樹高 $\bar{H}$ (m)	15% 間距 S	副林木株數 $N_{副}$	主林木株數 $N_{主}$	主副林木株數 $N_{主副}$	備考 (間伐次數)	斷面積平均木直徑矯正値 主林木 $\bar{d}'_{b主}$ (cm)	斷面積平均木直徑矯正値 主副林木 $\bar{d}'_{b主副}$ (cm)	副林木斷面積合計 $B'_{副}$ (m²)	主林木斷面積合計 $B'_{主}$ (m²)	主副林木斷面積合計 $B'_{主副}$ (m²)	副林木材積 $V_{副}$ (m³)	主林木材積 $V_{主}$ (m³)	主副林木材積合計 $V_{主副}$ (m³)	副林木材積累計 $V_{副累}$ (m³)	總收穫 V (m³)	備註 (副林木直徑) $\bar{d}_{b副}$ (cm)
Ⅰ	10	10.83	1.86			2,891			10.1			23.16			164.67		164.67	
	14	13.17	1.98	661	1,890	2,551	第1次間伐	12.6	11.5	2.93	23.57	26.50	24.11	193 95	218.06	24.11	218.06	7.5
	18	15.35	2.30	422	1,468	1,890	第2次間伐	14.5	13.7	3.62	24.24	26.86	33.96	227.39	261.35	58.07	285.46	10.5
	22	17.37	2.61	271	1,197	1,468	第3次間伐	16.5	15.8	3.19	25.59	28.78	33.39	267.83	301.22	91.46	359.29	12.2
	26	19.25	2.89	189	1,008	1,197	第4次間伐	18.7	17.9	2.44	27.68	30.12	28.00	317.59	345.59	119 46	437.05	12 8
	30	21.00	3.15	0		1,008	主伐		19.9			31 35			389.19		508 65	
Ⅱ	10	7.28	1.79			3,121			8.3			13.93			73 93		73.93	
	14	9 80	1.83			2,986			9.6			123.70			123 70		123 70	
	18	12.10	1.89			2,800			10.9			182.15			182 15		182 15	
	22	14.22	2.13	496	1,708	2,204	第1次間伐	13.8	13.2	4.61	25 55	245 16	37 47	207 69	245 16	37 47	245 16	10.9
	26	16.19	2.42	336	1,372	1,708	第2次間伐	15 8	15.1	3.69	26.90	281.35	33.94	247 41	281 35	71 41	318.82	11.8
	30	18.00	2.70	0		1,372	主伐		17 2			324.69			324 69		396.10	
Ⅲ	10	3.73	1 76			3,228			7.5			24 80			24.80		24 80	
	14	6 42	1.78			3,156			8.8			61.92			61.92		61.92	
	18	8.86	1 82			3,019			10.0			108 27			108 27		108 27	
	22	11.08	1.86			2,891			11.1			162.19			162 19		162.19	
	26	13.12	1.97	602	1,975	2,577	第1次間伐	12.8	12.5	6.22	25 41	218.91	43.05	175.86	218.91	43.05	218.91	11.5
	30	15 00	2.25	0		1,975	主伐		14.4			256 13			256.13		299.18	

表 12. 間伐林 (S_r=18%) 林分收穫預測表

Table 12. Estimated of stand-yield table for thinning forest (S_r=18%)

(樹種：琉球松)

地位級	齢階	平均樹高 $\bar{H}$ (m)	18% 間距 S	副林木株數 $N_{副}$	主林木株數 $N_{主}$	主副林木株數 $N_{主副}$	備考 (間伐次數)	斷面積平均木直徑矯正值 主林木 $\bar{d}'_{主}$ (cm)	斷面積平均木直徑矯正值 主副林木 $\bar{d}'_{主副}$ (cm)	副林木斷面積合計 $B'_{副}$ (m²)	主林木斷面積合計 $B'_{主}$ (m²)	主副林木斷面積合計 $B'_{主副}$ (m²)	副林木材積 $V_{副}$ (m³)	主林木材積 $V_{主副}$ (m³)	主副林木材積合計 $V_{主副}$ (m³)	副林木材積累計 $V_{副累}$ (m³)	總收穫 V (m³)	備註 (副林植徑) $\bar{d}_{b副}$ (cm)
I	10	10.83	1.95	850	1,780	2,630	第1次間伐	12.0	10.6	3.08	20.13	23.21	21.90	143.13	165.02	21.90	165.02	6.8
	14	13.17	2.37	467	1,313	1,780	第2次間伐	15.1	13.9	3.50	23.51	27.01	28.80	193.46	222.26	50.70	244.16	9.8
	18	15.35	2.76	292	1,021	1,313	第3次間伐	18.0	16.9	3.47	25.98	29.45	32.55	243.72	276.27	83.25	326.97	12.3
	22	17.37	3.13	190	831	1,021	第4次間伐	20.7	19.5	2.52	27.97	30.49	26.38	292.74	319.12	109.63	402.37	13.0
	26	19.25	3.47	131	700	831	第5次間伐	23.7	22.4	1.87	30.88	32.75	21.46	354.31	357.77	131.09	485.40	13.5
	30	21.00	3.78	0		700	主伐		24.8			33.81		419.73			550.82	
II	10	7.28	1.79			3,121			8.3			16.89			73.93		73.93	
	14	9.80	1.83			2,986			9.6			21,61			123.70		123.70	
	18	12.10	2.18	578	1,526	2,104	第1次間伐	13.6	13.2	6.62	22.17	28.79	46.15	154.54	200.69	46.15	200.69	12.1
	22	14.22	2.56	345	1,181	1,526	第2次間伐	16.4	15.8	4.96	24.96	29.92	40.32	202.89	243.21	86.47	289.36	13.5
	26	16.19	2.91	228	953	1,181	第3次間伐	19.5	18.6	3.63	28.46	32.09	33.39	261.75	295.14	119.86	381.61	14.2
	30	18.00	3.24	0		953	主伐		21.5			34.60			352.51		472.37	
III	10	3.73	1.76			3,228			7.5			14.26			24.80		24.80	
	14	6.42	1.78			3,156			8.8			19.20			61.92		61.92	
	18	8.86	1.82			3,019			10.0			23.71			108.27		108.27	
	22	11.08	1.99	729	1,796	2,525	第1次間伐	12.7	12.0	5.86	22.75	28.[illegible]	33.97	131.87	165.84	33.97	165.84	10.1
	26	13.12	2.36	424	1,372	1,796	第2次間伐	16.0	14.9	3.73	27.59	31.32	25.81	190.95	216.76	59.78	250.73	10.6
	30	15.00	2.70	0		1,372	主伐		17.6			33.79			269.02		328.80	

出典

Tzu-Yu Lin (1974) Estimation of productivity and yield of Luchu Pine woodland. Technical Bulletion No.122, Dept of Forestry, Collage of Agriculture, National Chung Hsing University, Taiwan.

樹種：PINACEAE（マツ科）
Pinus luchuensis（リュウキュウマツ）
國　：台湾

暫定試験地　147プロット
標高　50～1,200m
標準地面積　0.05～0.3ha

成長・収穫に関する表，図，式など

第五表　臺灣琉球松收穫表（一）　Tab 5　Yield Table of the Luchu pine in Taiwan (1)

林齢 Age	主伐木 Main crop 平均 Average 直径 bhd	樹高 Height	形数 Form factor	毎公頃 Per ha 株数 Number of trees	底面積 Basal area	幹材積 Volume	連年生長 Current growth	平均生長 Annual growth	疏伐木 Thinnings 平均 Average 直径 bhd	樹高 Height	形数 Form factor	毎公頃 Per ha 株数 Number of trees	對全林木之比率 Percent to total	底面積 Basal area	幹材積 Volume	對全林木之比率 Percent to total	幹材積累計 Sum total of volume	對主林木之比率 Percent to main crop	對總收穫之比率 Percent to total yield	主疏木合計 Total crop 毎公頃 Per ha 株数 Number of trees	底面積 Basal area	幹材積 Volume	連年生長 Current growth	平均生長(A) Annual growth (A)	平均生長(B) Annual growth (B)	生長率 Increment percent	總收穫 Total yield
年 (Years)	cm	m			m²	m³	m³	m³	cm	m			%	m²	m³	%	m³	%	%		m²	m³	m³	m³	m³	%	m³
									地位指数 24	Site index 24																	
10	13.3	13.1	0.510	1,850	25.7	171.7	—	17.2	8.4	9.7	0.519	855	31.6	4.7	23.7	12.1	23.7	13.8	—	2,705	30.4	195.4	—	19.5	—	—	195.4
15	19.8	17.1	0.493	1,339	41.2	347.7	36.7	23.2	12.2	12.7	0.507	511	27.6	6.0	38.5	10.0	62.2	17.9	15.2	1,850	47.2	386.2	44.4	27.3	25.7	14.6	409.9
20	26.8	20.3	0.481	985	55.6	542.4	38.9	27.1	15.7	15.0	0.496	354	26.4	6.9	51.5	8.6	113.3	20.9	17.3	1,339	62.5	593.5	49.2	32.8	29.7	9.0	655.7
25	33.6	23.0	0.471	800	71.0	768.7	45.3	30.7	19.3	17.0	0.488	185	18.8	5.4	43.0	5.3	156.3	20.3	16.9	985	76.4	811.7	53.9	37.0	32.5	6.5	925.0
30	39.5	25.0	0.464	675	82.7	959.2	38.1	32.0	23.1	18.5	0.483	125	15.6	5.2	45.0	4.5	201.3	21.0	17.3	800	87.9	1,001.2	47.1	38.7	33.5	4.4	1,160.5
35	44.6	26.4	0.460	575	89.8	1,090.7	26.3	31.2	27.0	19.5	0.479	100	14.8	5.7	53.5	4.7	254.8	23.4	18.9	673	95.5	1,144.2	37.0	38.4	32.7	2.7	1,345.5
40	48.7	27.2	0.459	495	92.2	1,151.3	12.1	28.8	30.7	20.1	0.477	80	14.0	5.9	56.8	4.7	311.6	27.1	21.3	575	98.1	1,208.1	23.5	36.6	30.2	1.1	1,462.9
45	52.0	27.8	0.459	443	94.1	1,200.6	9.9	26.7	34.5	20.6	0.475	52	10.5	4.9	47.6	3.8	359.2	30.0	23.0	495	99.0	1,248.2	19.4	34.7	27.7	0.7	1,559.8
									地位指数 22	Site index 22																	
10	12.8	12.0	0.514	1,960	25.3	160.0	—	16.0	7.5	8.5	0.523	850	30.2	3.7	16.6	9.4	—	10.4	—	2,810	29.0	176.6	—	17.7	—	—	176.6
15	19.0	15.6	0.498	1,405	40.0	310.0	30.0	20.7	10.6	11.1	0.511	555	28.3	4.9	27.7	8.2	44.3	14.3	12.5	1,960	44.9	337.7	35.5	23.6	22.5	13.9	354.3
20	25.6	18.5	0.485	1,035	53.3	478.3	33.7	24.0	13.7	13.1	0.500	370	26.3	5.4	35.6	6.9	79.9	16.7	11.3	1,405	58.7	513.9	40.8	27.9	25.7	8.8	558.2
25	32.2	21.0	0.475	840	68.4	682.1	40.8	27.3	16.8	14.9	0.492	195	18.8	4.3	31.7	4.4	111.6	16.4	14.1	1,035	72.7	713.8	47.1	31.7	28.6	6.8	793.7
30	38.3	22.8	0.468	705	81.2	866.6	36.9	28.8	20.0	16.2	0.487	135	16.1	4.2	33.4	3.7	145.0	16.7	14.3	840	85.4	900.0	43.6	33.7	30.0	4.9	1,011.6
35	43.1	24.0	0.464	605	88.3	983.0	23.3	28.1	23.4	17.1	0.483	100	14.2	4.3	35.5	3.5	180.5	18.4	15.5	705	92.6	1,018.5	30.4	33.2	29.1	2.5	1,163.5
40	47.0	24.8	0.462	522	90.6	1,037.7	10.9	25.9	26.5	17.6	0.481	83	13.7	4.6	38.8	3.6	219.3	21.1	17.4	605	95.2	1,076.5	18.7	31.4	26.9	1.1	1,257.0
45	50.3	25.2	0.462	466	92.6	1,078.0	8.1	24.0	29.3	17.9	0.479	56	10.7	3.8	32.4	2.9	251.7	23.3	18.9	522	96.4	1,110.4	14.5	29.5	24.7	0.6	1,329.7
									地位指数 20	Site index 20																	
10	12.3	11.2	0.519	2,057	24.5	142.3	—	14.2	6.4	7.6	0.528	888	30.2	2.8	11.4	7.4	—	8.0	—	2,945	27.3	153.7	—	15.4	—	—	153.7
15	18.2	14.2	0.503	1,485	38.6	275.8	26.7	18.4	9.0	10.0	0.516	572	27.8	3.7	18.9	6.4	30.3	11.0	9.9	2,057	42.3	294.7	30.5	20.4	19.6	13.9	306.1
20	24.6	17.0	0.491	1,087	51.4	429.4	30.7	21.5	11.6	11.7	0.505	402	27.1	4.3	25.2	5.5	55.5	12.9	11.4	1,485	55.7	454.6	35.8	24.2	22.7	9.1	484.9
25	30.8	19.4	0.480	890	66.3	617.4	37.6	24.7	14.2	13.4	0.497	193	17.8	3.0	20.3	3.2	75.8	12.3	10.9	1,083	69.3	637.7	41.6	27.7	25.5	7.0	633.2
30	36.9	21.0	0.473	750	80.2	796.4	35.8	26.5	17.0	14.5	0.492	140	15.7	3.2	22.7	2.8	98.5	12.4	11.1	890	83.4	819.1	40.3	29.8	27.3	5.1	891.9
35	41.6	22.2	0.468	638	86.7	900.8	20.9	25.7	19.9	15.3	0.488	112	14.9	3.5	26.0	2.8	124.5	13.8	12.1	750	90.2	926.8	26.1	29.3	26.5	2.5	1,025.3
40	45.4	22.8	0.466	550	89.0	946.1	9.1	23.7	22.5	15.7	0.486	88	13.8	3.5	26.7	2.7	151.2	16.0	13.8	638	92.5	972.8	14.4	27.4	24.3	1.0	1,097.3
45	48.2	23.3	0.466	493	90.0	978.9	6.6	21.8	25.1	16.0	0.484	57	10.4	2.8	21.8	2.2	173.0	17.7	15.0	550	92.8	1,000.7	10.9	25.6	22.2	0.6	1,151.9

第五表 臺灣琉球松收穫表（二） Tab. 5 Yield Table of the Luchu pine in Taiwan (2)

林齢 Age	主林木 Main crop: 平均 Average: 胸高直径 d.b.h.	樹高 Height	形数 Form factor	毎公頃 Per ha: 本数 Number of trees	胸高断面積 Basal area	幹材積 Volume	連年生長 Current growth	平均生長 Annual growth	疏伐木 Thinnings: 平均 Average: 胸高直径 d.b.h.	樹高 Height	形数 Form factor	毎公頃 Per ha: 本数 Number of trees	対全本数割合 Percent to total	胸高断面積 Basal area	幹材積 Volume	対全材積割合 Percent to total	幹材積合計 Sum total of volume	対主林木割合 Percent to main crop	対総収穫割合 Percent to total yield	主副林木合計 Total crop: 毎公頃 Per ha: 本数 Number of trees	胸高断面積 Basal area	幹材積 Volume	連年生長 Current growth	平均生長 (A) Annual growth (A)	平均生長 (B) Annual growth (B)	生長率 Increment percent	総収穫量 Total yield
年 (Years)	cm	m			m²	m³	m³	m³	cm	m			%	m²	m³	%	m³	%	%		m²	m³	m³	m³	m³	%	m³
												地位指数 18 Site index 18															
10	11.8	9.8	0.525	2,160	23.5	121.1	—	12.1	5.8	6.8	0.534	940	30.3	2.5	8.9	6.8	—	7.3	—	3,100	26.0	130.0	—	13.0	—	—	130.0
15	17.6	12.7	0.510	1,560	37.9	245.5	24.9	16.4	8.1	8.9	0.522	600	27.8	3.1	14.5	5.6	23.4	9.5	8.7	2,160	41.0	260.0	27.8	17.9	17.3	14.9	268.9
20	23.6	15.0	0.497	1,155	50.5	376.3	26.2	18.8	10.5	10.5	0.511	405	26.0	3.5	18.9	4.8	42.3	11.2	10.1	1,560	54.0	395.2	29.9	20.9	19.8	8.7	418.6
25	29.4	17.1	0.487	940	63.8	531.5	31.4	21.3	12.9	12.0	0.503	215	18.6	2.8	17.0	3.1	59.3	11.2	10.0	1,155	66.6	548.5	34.4	23.6	21.9	6.8	590.8
30	35.4	18.6	0.479	789	77.6	691.7	32.0	23.1	15.4	13.0	0.498	151	16.1	2.8	18.2	2.6	77.5	11.2	10.1	940	80.4	709.9	35.7	25.6	23.7	5.3	769.2
35	40.0	19.6	0.474	675	84.8	788.3	19.3	22.5	18.0	13.7	0.494	114	14.4	2.9	19.7	2.4	97.2	12.3	11.0	789	87.7	808.0	23.3	25.3	23.1	2.6	835.5
40	43.8	20.1	0.472	577	87.0	824.9	7.3	20.6	20.4	14.1	0.492	98	14.5	3.2	22.2	2.6	119.4	14.5	12.6	675	90.2	847.1	11.8	23.6	21.2	1.0	944.3
45	46.5	20.6	0.471	517	87.8	851.8	5.4	18.9	22.8	14.4	0.490	60	10.4	2.4	17.3	2.0	136.7	15.9	13.8	577	90.2	869.1	8.8	22.0	19.3	0.5	988.5
												地位指数 16 Site index 16															
10	11.2	8.8	0.533	2,275	22.5	105.6	—	10.6	5.4	6.1	0.543	1,045	31.5	2.4	8.0	7.0	—	7.6	—	3,320	24.9	113.6	—	11.4	—	—	113.6
15	16.8	11.3	0.517	1,645	36.5	213.3	21.5	14.2	7.6	8.0	0.529	630	27.7	2.8	12.0	5.3	20.0	9.4	8.6	2,275	39.3	225.3	23.9	15.6	15.0	14.7	233.3
20	22.4	13.4	0.504	1,220	48.1	324.6	22.3	16.2	9.9	9.5	0.518	425	25.8	3.3	16.1	4.7	36.1	11.1	10.0	1,645	51.4	310.7	25.5	18.0	17.0	8.6	360.7
25	28.0	15.2	0.494	1,000	61.6	462.5	27.6	18.5	12.2	10.9	0.510	220	18.0	2.6	14.3	3.0	50.4	10.9	9.8	1,220	64.2	476.8	30.4	20.5	19.1	7.0	512.9
30	33.8	16.6	0.486	830	74.5	600.6	27.6	20.0	14.6	12.0	0.504	170	17.0	2.8	17.2	2.8	67.6	11.3	10.1	1,000	77.3	617.8	31.1	22.3	20.6	5.3	668.2
35	38.4	17.5	0.481	710	82.2	692.1	18.3	19.8	17.0	12.6	0.500	120	14.5	2.7	17.2	2.4	84.8	12.3	10.9	830	84.9	709.3	21.7	22.2	20.3	2.8	776.9
40	41.8	18.0	0.479	610	83.7	721.6	5.9	18.0	19.3	12.9	0.498	100	14.1	2.9	18.8	2.5	103.6	14.4	12.6	710	86.6	740.4	9.7	20.6	18.5	0.8	825.2
45	44.2	18.4	0.478	550	84.4	742.1	4.1	16.5	21.5	13.1	0.496	60	9.8	2.2	14.2	1.9	117.8	15.9	13.7	610	86.6	756.3	6.9	19.1	16.9	0.4	859.9
												地位指数 14 Site index 14															
10	10.6	7.8	0.542	2,438	21.5	90.7	—	9.1	5.0	5.7	0.552	1,202	33.0	2.4	7.6	7.7	—	8.4	—	3,640	23.9	98.3	—	9.8	—	—	98.3
15	16.0	10.2	0.525	1,735	34.9	186.7	19.2	12.4	7.2	7.2	0.538	703	28.8	2.9	11.2	5.7	18.8	10.1	9.1	2,438	37.8	197.9	21.4	13.7	13.2	15.0	205.5
20	21.4	12.0	0.512	1,295	46.6	286.4	19.9	14.3	9.4	8.6	0.527	440	25.4	3.0	13.8	4.6	32.6	11.4	10.2	1,735	49.6	300.2	22.7	16.0	15.0	8.7	319.0
25	26.6	13.7	0.502	1,067	59.3	408.0	24.3	16.3	11.6	9.9	0.518	228	17.6	2.4	12.4	2.9	45.0	11.0	9.9	1,295	61.7	420.4	26.8	18.1	16.8	7.0	453.0
30	32.0	14.9	0.494	880	70.8	520.8	22.6	17.4	13.9	10.8	0.512	187	17.5	2.8	15.7	2.9	60.7	11.7	10.4	1,067	73.6	536.5	25.7	19.4	17.9	5.0	581.5
35	36.4	15.6	0.489	750	78.1	595.6	15.0	17.0	16.2	11.4	0.508	130	14.8	2.7	15.5	2.5	76.2	12.8	11.3	880	80.8	611.1	18.1	19.2	17.5	2.6	671.8
40	39.6	16.1	0.487	645	79.5	623.1	5.5	15.6	18.3	11.7	0.505	105	14.0	2.8	16.3	2.5	92.5	14.8	12.9	750	82.3	639.4	8.8	17.9	16.0	0.2	715.6
45	42.0	16.5	0.486	575	79.6	638.6	3.1	14.2	20.4	11.9	0.503	70	10.9	2.3	13.7	2.1	106.2	16.6	14.3	645	81.9	652.3	5.9	16.6	14.5	0.1	744.8

第五表 臺灣琉球松收穫表（三） Tab. 5 Yield Table of the Luchu pine in Taiwan (3)

林齡 Age	主伐木 Main crop								疏伐木 Thinnings											主疏木合計 Total crop							
	平均 Average			每公頃 Per ha					平均 Average			每公頃 Per ha								每公頃 Per ha							
	直徑 b.h.d.	樹高 Height	形數 Form factor	林數 Number of trees	底面積 Basal area	幹材積 Volume	連年生長 Current growth	平均生長 Annual growth	直徑 b.h.d.	樹高 Height	形數 Form factor	林數 Number of trees	對全林木之比率 Percent to total	底面積 Basal area	幹材積 Volume	對全林木之比率 Percent to total	幹材積累計 Sum total of volume	對主林木之比率 Percent to main crop	對總收穫之比率 Percent to total yield	林數 Number of trees	底面積 Basal area	幹材積 Volume	連年生長 Current growth	平均生長(A) Annual growth (A)	平均生長(B) Annual growth (B)	生長率 Increment percent	總收穫 Total yield
年 (Years)	cm	m			m²	m³	m³	m³	cm	m			%	m²	m³	%	m³	%	%		m²	m³	m³	m³	m³	%	m³
	地位指數 12 Site index 12																										
10	10.0	6.8	0.550	2,600	20.5	76.8	—	7.7	4.7	5.2	0.563	1,450	35.8	2.5	7.2	8.6	—	9.4	—	4,050	23.0	84.0	- -	8.4	—	—	84.0
15	15.0	8.8	0.534	1,872	33.1	155.7	15.8	10.4	6.9	6.8	0.548	728	28.0	2.7	10.0	6.0	17.2	11.0	9.9	2,600	35.8	165.7	17.8	11.5	11.0	11.6	172.9
20	20.3	10.4	0.521	1,391	45.1	244.2	17.7	12.2	8.9	8.0	0.536	481	25.7	3.0	12.8	5.0	30.0	12.3	10.9	1,872	48.1	257.0	20.3	13.7	12.9	10.7	274.2
25	25.3	12.0	0.511	1,135	57.1	350.1	21.2	14.0	11.0	9.2	0.527	256	18.4	2.4	11.8	3.3	41.8	11.9	10.7	1,391	59.5	361.9	23.5	15.7	14.5	5.7	391.9
30	30.0	13.0	0.503	945	66.8	436.9	17.4	14.6	13.1	10.0	0.521	190	16.7	2.6	13.4	3.0	55.2	12.6	11.2	1,135	69.4	450.3	20.2	16.4	15.0	4.5	492.1
35	34.0	13.7	0.498	802	72.8	496.8	12.0	14.2	15.1	10.5	0.516	143	15.1	2.6	13.9	2.7	69.1	13.9	12.1	945	75.4	510.7	14.8	16.2	14.6	2.6	565.9
40	37.2	14.1	0.495	685	74.5	519.7	4.6	13.0	17.2	10.8	0.513	117	14.6	2.7	15.0	2.8	84.1	16.2	13.9	802	77.5	534.7	7.1	15.1	13.4	0.9	603.8
45	39.8	14.4	0.494	600	74.6	531.0	2.7	11.8	19.0	11.0	0.511	85	12.4	2.4	13.6	2.5	97.7	18.4		685	77.0	541.6	5.0	14.0	[illegible]	0.4	[illegible]
	地位指數 10 Site index 10																										
10	9.1	5.6	0.562	2,855	18.6	58.4	-	5.8	4.3	4.8	0.575	1,750	38.0	2.6	7.0	10.7	- -	12.0	—	4,605	21.2	65.4	-	6.5	—	- -	63.4
15	14.0	7.3	0.545	2,013	31.0	123.3	13.0	8.2	6.4	6.3	0.560	842	29.5	2.7	9.5	7.2	16.5	13.4	11.8	2,855	33.7	132.8	14.9	9.3	8.9	15.2	139.8
20	19.0	8.6	0.530	1,508	42.8	195.2	14.4	9.8	8.4	7.4	0.547	505	25.1	2.8	11.2	5.4	27.7	14.2	12.4	2,013	45.6	206.4	16.6	11.1	10.3	9.2	222.9
25	23.8	9.8	0.520	1,225	54.5	277.8	16.5	11.1	10.2	8.4	0.537	283	18.8	2.3	9.7	3.4	38.2	13.8	12.1	1,508	56.8	287.5	18.6	12.6	11.5	6.9	316.0
30	28.0	10.6	0.513	1,025	63.1	343.3	13.1	11.4	12.2	9.1	0.530	200	16.3	2.3	12.4	3.5	50.6	14.7	12.8	1,225	65.4	355.7	15.0	13.1	11.9	4.4	393.[illegible]
35	31.8	11.2	0.508	860	68.3	388.5	9.1	11.1	14.0	9.6	0.525	165	16.1	2.5	12.8	3.2	63.4	16.3	14.0	1,025	70.8	401.3	11.6	12.9	11.5	2.5	451.9
40	35.0	11.5	0.506	730	70.2	408.6	4.0	10.2	15.9	10.0	0.522	130	15.1	2.6	13.5	3.2	76.9	18.8	15.8	860	72.8	422.1	6.7	12.1	10.6	1.0	485.5
45	27.2	11.8	0.504	640	69.6	413.7	1.0	9.2	17.8	10.2	0.520	90	12.3	2.2	11.9	2.8	88.8	21.5	17.7	730	71.8	425.6	3.1	14.2	9.5	0.2	502.5

第六表　琉球松每公頃各地位級幹材積收穫表

Tab 6 Volume yield of Luchu pine in site class per ha

林齡 Age (years)	主林木幹材積 Main crop (m^3)	副林木幹材積 Thinnings (m^3)	主副林木幹材積合計 Total crop (m^3)	總收穫 Total yield (m^3)
		Ⅰ 等 地　Site class Ⅰ		
10	157 0	17 6	174 6	174 6
15	311 8	28 7	340 5	358.0
20	485 9	38 2	524 1	570 3
25	693 1	31 7	724.8	809 1
30	877 8	33 9	911 7	1,027.7
35	995 8	39 8	1,035 5	1,185 4
40	1,048 7	41 8	1,090 5	1,280 1
45	1,089 8	34 7	1,124 5	1,355 9
		Ⅱ 等 地　Site class Ⅱ		
10	105 9	8.3	114.2	114.2
15	216.1	12 9	229 0	237.2
20	331.4	16.4	347.7	368 8
25	469 8	14.7	484.5	521.9
30	606 3	17.0	623 2	675.4
35	692 0	17 6	709 6	778 7
40	724 0	19 3	743 3	830.0
45	745 2	15 5	760.7	866.7
		Ⅲ 等 地　Site class Ⅲ		
10	67 2	7.1	74 7	74 7
15	139 5	9 8	149 3	156 4
20	219 7	12 0	231.7	248 6
25	314 0	10 8	324 7	354 0
30	390 1	12 9	403 0	443 0
35	442 7	13 4	456 0	508 9
40	464.2	14 3	478 4	544.7
45	472 4	12 8	485 1	565 6

第七表　琉球松每公頃各地位指數去皮幹材積收穫表（一）

Tab 7. Yield table (in bark) of Luchu pine in site index per ha.

林 齡 Age (years)	主木幹材積 Main crop m³	副木幹材積 Thinnings m³	副木幹材積累計 Total thinnings m³	主副林木合計 Total Crop 幹材積 Volume m³	連年生長 Current g. m³	平均生長 (A) Annual g. (A) m³	平均生長 (B) Annual g. (B) m³	總收穫 Total yield m³
				地位指數 24 Site index 24				
10	153.9	21.2	21.2	175.2		17.5	17.5	175.2
15	318.5	35.3	57.0	353.8	40.0	25.0	23.6	375.5
20	505.0	47.6	105.5	552.6	46.8	30.5	27.6	610.5
25	722.4	40.4	146.9	762.8	51.6	34.8	30.5	869.3
30	905.2	42.5	190.0	947.7	45.1	36.5	31.6	1095.2
35	1035.1	50.8	241.8	1085.8	36.1	36.5	31.0	1276.9
40	1093.7	54.0	296.0	1147.7	22.5	34.7	28.7	1389.8
45	1140.6	45.2	341.2	1185.8	18.4	32.9	26.4	1481.8
				地位指數 22 Site index 22				
10	143.4	14.9		158.3			15.8	158.3
15	284.0	25.4	40.6	309.4	33.2	21.6	20.6	324.6
20	445.3	33.1	74.4	478.4	38.9	26.0	23.9	519.7
25	641.0	29.8	104.9	670.8	45.1	29.8	26.8	745.9
30	817.8	31.5	136.8	849.3	41.7	31.8	28.3	954.6
35	932.9	33.7	171.3	966.6	29.8	31.5	27.6	1104.2
40	985.8	36.9	208.3	1022.7	18.0	29.9	25.6	1194.2
45	1024.1	30.8	239.1	1054.9	13.8	28.1	23.4	1263.2
				地位指數 20 Site index 20				
10	127.6	10.2		137.8			13.8	137.8
15	252.7	17.3	27.8	270.0	28.5	18.7	18.0	280.4
20	399.8	23.5	51.7	423.2	34.1	22.6	21.2	451.4
25	580.2	19.1	71.2	599.3	39.9	26.0	24.0	651.4
30	751.6	21.4	93.0	773.0	38.6	28.2	25.8	844.5
35	854.9	24.7	118.2	879.5	25.6	27.8	25.1	973.0
40	898.8	25.4	143.6	924.5	13.9	26.1	23.1	1042.4
45	930.0	20.7	164.4	950.7	10.4	24.3	21.1	1094.3
				地位指數 18 Site index 18				
10	108.6	8.0		116.5			11.7	116.5
15	224.9	13.3	21.4	238.2	25.9	16.4	15.9	246.3
20	350.3	17.6	39.4	367.9	28.6	19.5	18.4	389.7
25	449.5	16.0	55.7	515.5	33.0	22.2	20.6	555.2
30	652.8	17.2	73.1	669.9	34.1	24.2	22.3	725.9
35	748.1	18.7	92.2	766.8	22.8	24.0	21.9	840.3
40	783.7	21.1	113.4	804.7	11.3	22.4	20.1	897.1
45	809.2	16.4	129.9	825.6	8.4	20.9	18.3	939.1

第七表　琉球松每公頃各地位指數去皮幹材積收穫表（二）

Tab. 7 Yield table (in bark) of Luchu pine in site index per ha

林齡 Age (years)	主木幹材積 Main crop m^3	副木幹材積 Thinnings m^3	副木幹材積累計 Total thinnings m^3	主副林木合計 Total crop: 幹材積 Volume m^3	連年生長 Current g. m^3	平均生長 (A) Annual g. (A) m^3	平均生長 (B) Annual g. (B) m^3	總收穫 Total yield m^3
地位指數 16 Site index 16								
10	94.7	7.2		101.8			10.2	101.8
15	193.4	11.0	18.3	206.4	22.3	14.2	13.8	213.7
20	302.2	15.0	33.6	317.2	24.4	16.8	15.9	335.8
25	434.2	13.4	47.4	448.1	29.2	19.3	17.9	482.0
30	566.8	16.2	63.8	583.0	29.8	21.0	19.4	630.6
35	656.8	16.3	80.5	673.1	21.3	23.9	19.2	737.3
40	685.5	17.9	98.4	703.4	9.3	19.6	17.6	783.9
45	705.0	13.5	111.9	718.5	6.6	18.2	16.0	816.9
地位指數 14 Site index 14								
10	81.3	6.8		88.1			8.8	88.1
15	171.0	10.3	17.2	181.3	20.0	12.5	12.1	188.3
20	266.6	12.8	30.4	279.5	21.7	14.9	14.0	297.0
25	383.4	11.7	42.2	395.1	25.7	17.0	15.8	425.7
30	491.5	14.8	57.3	506.3	24.6	18.3	16.9	548.8
35	565.2	14.7	72.3	579.9	17.7	21.1	16.6	637.5
40	591.9	15.5	87.8	607.4	8.4	17.0	15.2	679.8
45	606.7	13.0	100.9	619.7	5.6	15.7	13.8	707.6
地位指數 12 Site index 12								
10	68.8	6.5		75.3			7.5	75.3
15	142.6	9.2	15.8	151.8	16.6	10.6	10.1	158.4
20	227.4	11.9	27.9	239.3	19.3	12.8	12.0	255.3
25	329.0	11.1	39.3	340.1	22.5	14.7	13.6	368.3
30	412.3	12.6	52.1	424.9	19.2	15.5	14.2	464.4
35	471.5	13.2	65.6	484.7	14.5	15.3	13.8	537.0
40	493.7	14.3	79.9	508.0	7.3	14.3	12.7	573.0
45	504.5	12.9	92.8	517.4	4.7	13.3	11.5	597.3
地位指數 10 Site index 10								
10	52.4	6.3		58.6			5.9	58.6
15	113.0	8.7	15.1	121.7	13.9	8.5	8.1	128.1
20	181.7	10.4	25.8	192.2	15.8	10.4	9.6	207.5
25	261.1	9.1	35.9	270.2	17.7	11.9	10.8	297.0
30	324.0	11.7	47.8	335.7	14.9	15.7	11.2	371.7
35	368.7	12.1	60.2	380.8	11.4	12.3	10.9	428.9
40	388.2	12.8	73.1	401.0	6.5	11.5	10.0	461.2
45	393.0	11.3	84.4	404.3	3.2	10.6	8.9	477.4

第八表　疏球松每公頃各地位級去皮幹材收穫表
Tab 8 Volume yield (in bark) of Luchu pine in site class per ha

林齡 Age (years)	主伐木幹材積 Main crop (m³)	疏伐木幹材積 Thinnings (m³)	疏伐木幹材積累計 Total thin (m³)	主伐木合計幹材積 Total crop (m³)	総收穫 Total yield (m³)
		I 等地 Site class I			
10	140 8	15 7	7 1	156 5	147 9
15	285 6	26 3	41 8	311 9	327 4
20	452 4	35 6	77 2	488 0	529 6
25	651 3	29 8	107 7	681 1	760 4
30	828 4	32 0	139 9	860 4	968 3
35	945 0	37 8	177 1	982 8	1122 1
40	966 3	39 7	216 0	1,036 0	1212 3
45	1,035 3	33 0	248 1	1,068 3	1283 4
		II 等地 Site class II			
10	95 0	7 4	—	102 4	95 0
15	198 0	11 8	19 0	209 8	217 0
20	308 5	15 2	34,5	323 7	343 0
25	441 5	13 9	48 4	455 4	489 9
30	572 5	16 0	64 7	588 5	637 2
35	656 7	16 7	81 7	673 4	738 4
40	687 8	18 3	99 9	706 1	787 7
45	708 0	14 7	114 2	722 7	822 2
		III 等地 Site class III			
10	60 6	6 4	—	67 0	60 6
15	127 8	9 0	15 5	136 8	143 3
20	204 6	11 2	26 9	215 8	231 5
25	295 1	10 1	37 6	305 2	332 7
30	368 2	12 2	50 0	380 4	418 2
35	420 1	12 7	62 9	432 8	483 0
40	441 0	13 6	76 5	454 6	517 5
45	448 8	12 1	88 6	460 9	537 4

第九表　疏球松材積生長與其他樹種之比較（每公頃）
Tab no 9 Volume growth of Luchu pine compared with other trees per ha

樹齡 Age (years)	地位級 Site Class	琉球松 Luchu pine (m³)	相思樹 Taiwan acacia (m³)	柳杉 Cryptomeria (m³)	馬尾松 Massons pine (m³)
20	I	570	267	269	249
	II	369	224	191	156
	III	249	168	135	110
	平均 Mean	396	220	193	172
	指数 Percentage	100	56	49	43

出典

Chi-Wang Huang (1968). Construction study of yield table of Luchu Pine in Taiwan. Bulletin of Taiwan Forestry Research Institute No.173, Taiwan.

樹種：PINACEAE（マツ科）
Pinus massoniana（タイワンアカマツ，馬尾松）
地域：中國福建省
成長・収穫に関する表，図，式など

馬尾松人工林収穫予測表　地位指数 8　初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量 連年成長量	成長量 総成長量	成長量 平均成長量	間伐木 ha当り本数	間伐木 平均胸径	間伐木 ha当り断面積	間伐木 ha当り幹材積	間伐木 材積間伐強度	間伐木 本数間伐強度	間伐木 累計間伐材積	間伐後 ha当り本数	間伐後 平均胸径	間伐後 ha当り断面積	間伐後 ha当り幹材積
8	4.17	3000	3 22	3.01	2 44	15 5	0.355	0 57	15.5	1.94											
9	4.26		3 30	3.09	2 57	16.1	0 359	1 23	16 1	1.79											
10	4.44		3.47	3.27	2 83	17.3	0.365	1 76	17 3	1.73											
11	4.68		3 70	3.51	3.22	19.1	0.375	2.21	19.1	1.74											
12	4.97		3 97	3 80	3.70	21 3	0 386	2 63	21.3	1.78											
13	5 30		4 27	4.12	4.29	23.9	0.399	3 00	23 9	1.84											
14	5 65		4 59	4.47	4 96	26 9	0.412	3.36	26.9	1.92											
15	6 02		4 92	4.83	5 70	30.3	0 427	3.71	30 3	2.02											
16	6 40		5 26	5.21	6 53	34.0	0 442	4.03	34 0	2.13											
17	6 79		5 61	5.60	7.43	38.0	0 458	4.25	38.0	2.24											
18	7 19		5.95	5 99	8 34	42 3	0 478	4 78	42 3	2.35											
19	7 59		6.33	6.39	9.43	47.1	0.491	4.97	47.1	2.48											
20	8.00		6.68	6 79	10 52	52 0	0 507	5.27	52.0	2 60											
21	8 41		7.04	7 20	11.67	57 3	0.524	5.53	57 3	2 73											
22	8 82		7.39	7 60	12 87	62 8	0.541	5.82	62.8	2.86											
23	9.22		7 74	8 00	14 12	68.7	0.558	6.09	68.7	2.99											
24	9.63		8.09	8 40	15 43	74 7	0 575	6.35	74 7	3 11											
25	10.03		8 44	8 80	16 77	81 1	0.592	6.61	81 1	3.24											
26	10.43		8 78	9 20	18 17	87.7	0 609	6 85	87 7	3.37											
27	10.83		9 12	9.59	19 60	94.6	0 627	7.09	94.6	3.50											
28	11.23		9 46	9.98	21.07	101.6	0 644	7.33	101.6	3.63											
29	11.62		9 79	10 37	22.58	109 0	0.661	7.56	109.0	3.76											
30	12.01		10.12	10.76	24 12	116.5	0.679		116.5	3.88											

馬尾松人工林収穫予測表　地位指数 10　初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量 連年成長量	成長量 総成長量	成長量 平均成長量	間伐木 ha当り本数	間伐木 平均胸径	間伐木 ha当り断面積	間伐木 ha当り幹材積	間伐木 材積間伐強度	間伐木 本数間伐強度	間伐木 累計間伐材積	間伐後 ha当り本数	間伐後 平均胸径	間伐後 ha当り断面積	間伐後 ha当り幹材積
8	4.84	3000	3.85	3.67	3.49	20.3	0.381	2.00	20.3	2.54											
9	5.10		4.09	3.93	3.93	22.3	0.391	2.73	22.3	2.48											
10	5.43		4.39	4.25	4.54	25.1	0.404	3.36	25.1	2.51											
11	5.81		4.74	4.63	5.29	28.4	0.419	3.92	28.4	2.58											
12	6.23		5.11	5.04	6.16	32.3	0.436	4.44	32.3	2.70											
13	6.67		5.51	5.48	7.15	36.8	0.453	4.95	36.8	2.83											
14	7.13		5.92	5.93	8.25	41.7	0.472	5.40	41.7	2.98											
15	7.60		6.33	6.40	9.44	47.1	0.491	5.85	47.1	3.14											
16	8.08		6.75	6.87	10.72	53.0	0.510	6.30	53.0	3.31											
17	8.56		7.17	7.34	12.10	59.3	0.530	6.71	59.3	3.49											
18	9.04		7.58	7.82	13.55	66.0	0.550	7.09	66.0	3.67											
19	9.52		8.00	8.29	15.07	73.1	0.571	7.50	73.1	3.85											
20	10.00		8.41	8.77	16.67	80.6	0.591	7.86	80.6	4.03											
21	10.48		8.82	9.24	18.32	88.4	0.612	8.23	88.4	4.21											
22	10.95		9.22	9.71	20.04	96.7	0.632	8.59	96.7	4.39											
23	11.43		9.62	10.18	21.81	105.3	0.653	8.91	105.3	4.58											
24	11.89		10.02	10.64	23.64	114.2	0.674	9.25	114.2	4.76											
25	12.36		10.41	11.10	25.51	123.4	0.695	9.58	123.4	4.94											
26	12.81		10.79	11.55	27.44	133.0	0.715	9.89	133.0	5.12											
27	13.27		11.17	12.00	29.40	142.9	0.736	10.19	142.9	5.29											
28	13.72		11.55	12.44	31.40	153.1	0.757	10.48	153.1	5.47											
29	14.16		11.91	12.88	33.45	163.6	0.778	10.76	163.6	5.64											
30	14.60		12.28	13.32	35.52	174.3	0.798		174.3	5.81											

馬尾松人工林収穫予測表　地位指数 12　初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量 連年成長量	成長量 総成長量	成長量 平均成長量	間伐木 ha当り本数	間伐木 平均胸径	間伐木 ha当り断面積	間伐木 ha当り幹材積	間伐木 材積間伐強度	間伐木 本数間伐強度	間伐木 累計間伐材積	間伐後 ha当り本数	間伐後 平均胸径	間伐後 ha当り断面積	間伐後 ha当り幹材積
8	5.52	3000	4.47	4.34	4.70	25.8	0.407	3.82	25.8	3.22											
9	5.94		4.85	4.76	5.55	29.6	0.424	4.66	29.6	3.29											
10	6.43		5 29	5 24	6.59	34 3	0.443	5.43	34.3	3.43											
11	6.95		5.75	5.75	7.80	39.7	0.464	6.13	39.7	3.61											
12	7.49		6.23	6.29	9.15	45.8	0.486	6.80	45.8	3.82											
13	8.05		6.72	6.84	10 65	52.6	0.509	7.43	52.6	4.05											
14	8.61		7.22	7.40	12.27	60.1	0.533	8.01	60.1	4.29											
15	9.18		7.71	7 96	14 00	68.1	0.556	8.59	68.1	4.54											
16	9.75		8.20	8 52	15.83	76.7	0.581	9.14	76.7	4.79											
17	10.32		8.68	9.09	17 77	85.8	0.605	9.67	85.8	5.05											
18	10.89		9.16	9.60	19.79	95.5	0.629	10.17	95.5	5.30											
19	11.45		9.64	10.20	21.89	105.6	0.654	10.66	105.6	5.56											
20	12 00		10.11	10.75	24 07	116.3	0.679	11.13	116.3	5.82											
21	12.55		10 57	11.29	26 32	127 4	0.703	11.59	127.4	6.07											
22	13.09		11.02	11.83	28.63	139.0	0.728	12.00	139.0	6.32											
23	13.63		11.47	12.35	31.00	151.0	0.753	12.46	151.0	6.57											
24	14.16		11.91	12.88	33.43	163 5	0.777	12.84	163.5	6.81											
25	14.68		12.34	13.39	35.90	176.3	0.802	9.52	176.3	7.05	1287	10.30	10.73	44.4	0 252	0.429	44.4	1713	13.68	25.18	131 9
26	15.19	1713	14.10	13.90	26 75	141.4	0.617	9.78	185.8	7.15											
27	15.70		14.52	14 41	28.35	151.2	0.633	10.00	195.6	7.25											
28	16 20		14.92	14.90	29.96	161.2	0.650	10.24	205.6	7.34											
29	16.70		15.32	15.39	31.59	171.4	0.667	10.46	215 8	7.44											
30	17.19		15.72	15.87	33.24	181.9	0.683		226.3	7.54											

馬尾松人工林収穫予測表　地位指数 14 初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量 連年成長量	成長量 総成長量	成長量 平均成長量	間伐木 ha当り本数	間伐木 平均胸径	間伐木 ha当り断面積	間伐木 ha当り幹材積	間伐木 材積間伐強度	間伐木 本数間伐強度	間伐木 累計間伐材積	間伐後 ha当り本数	間伐後 平均胸径	間伐後 ha当り断面積	間伐後 ha当り幹材積
8	6.19	3000	5.08	5.00	6.07	31.9	0.434	6.05	31.9	3.99											
9	6.79		5.61	5.59	7.42	38.0	0.458	7.06	38.0	4.22											
10	7.42		6.17	6.22	8.98	45.0	0.484	8.00	45.0	4.50											
11	8.08		6.75	6.87	10.74	53.0	0.510	8.87	53.0	4.82											
12	8.75		7.33	7.53	12.67	61.9	0.538	9.71	61.9	5.16											
13	9.42		7.92	8.20	14.76	71.6	0.566	10.49	71.6	5 51											
14	10 10		8.49	8.86	16.99	82.1	0 595	11.24	82.1	5.87											
15	10.77		9.06	9.53	19.35	93.4	0.624	11.97	93.4	6.22											
16	11.43		9.63	10.18	21.83	105.3	0 653	12.64	105.3	6.58											
17	12.09		10.18	10 83	24.41	118.0	0.682	13.28	118.0	6.94											
18	12.73		10.72	11.47	27.09	131.3	0.712	13.93	131.3	7.29											
19	13.37		11.26	12.10	29 85	145.2	0.741	14.52	145.2	7.64											
20	14.00		11.78	12.72	32.70	159.7	0.770	15.11	159.7	7.99											
21	14.62		12.30	13.34	35.62	174.8	0.799	15.65	174.8	8.33											
22	15.23		12.80	13.94	38 61	190.5	0 828	11.22	190.5	8.66	1381	10.84	12.74	52.5	0.276	0 460	52.5	1619	14 26	25.87	138 0
23	15.83	1619	14.75	14.53	27 67	149.2	0 619	11.55	201 7	8 77											
24	16.42		15.23	15.12	29.50	160.7	0.638	11.84	213.2	8 89											
25	17.00		15.68	15.69	31.34	172.6	0.657	12.13	225.1	9.00											
26	17.57		16.16	16.26	33.20	184.7	0 675	12.44	237.2	9 12											
27	18.14		16.61	16.81	35.08	197 1	0.694	12 68	249.7	9 25											
28	18.69		17.05	17.36	36 97	209 8	0 712	12.95	262.3	9.37											
29	19.24		17.48	17 89	38.87	222.8	0 730	13 18	275.3	9.49											
30	19.78		17.91	18.43	40 78	235 9	0.748		288.4	9 62											

馬尾松人工林収穫予測表　地位指数 16　初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量			間伐木							間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	6.86	3000	5.68	5 67	7 59	38.8	0.461	8.70	38.8	4.85											
9	7 63		6 36	6.43	9 52	47 5	0.492	9.95	47.5	5.28											
10	8.42		7 05	7 21	11.69	57.4	0.524	11.10	57.4	5.74											
11	9.21		7 73	7.99	14.09	68 5	0.558	12.20	68.5	6.24											
12	10.01		8 42	8 78	16.70	80.7	0.591	13.22	80.7	6.73											
13	10 80		9.09	9.56	19.49	93.9	0.626	14.21	93.9	7.23											
14	11.58		9.75	10.33	22.41	108 2	0.660	15.13	108.2	7.73											
15	12.35		10 40	11.09	25 48	123.3	0.694	16.02	123.3	8.22											
16	13.11		11.03	11 84	28.69	139 3	0.729	16.86	139 3	8.71											
17	13.85		11 66	12 57	32.00	156 2	0.763	17.64	156.2	9.19											
18	14.58		12 26	13 30	35.42	173.8	0.797	18.42	173.8	9.66											
19	15.30		12 86	14 00	38.93	192 2	0.832	13.23	192.2	10 12	1391	10.90	12 98	53.5	0.278	0.464	53.5	1609	14 33	25 95	138 7
20	16.00	1609	14.90	14.70	28 07	151 9	0 622	13.64	205.4	10.27											
21	16 69		15 46	15.38	30 21	165.6	0 644	14.01	219.1	10 43											
22	17.37		16 01	16 85	32.37	179.6	0.666	14.45	233.2	10.60											
23	18 03		16.54	16.71	34.56	194.1	0 688	14.80	247.6	10 77											
24	18.69		17 06	17 35	36.76	208 9	0.709	15.17	262.4	10.93											
25	19.33		17.57	17.99	38 99	224.1	0 731	15.50	277.6	11 10											
26	19 96		18 06	18.61	41 22	239.6	0.752	15.83	293.1	11.27											
27	20.57		18.55	19 22	43.47	255.4	0.773	16.13	308.9	11 44											
28	21.18		19 03	19.82	45 73	271.5	0.794	16.41	325.0	11.61											
29	21.78		19.49	20 41	48.00	287 9	0.815	16.72	341 5	11.77											
30	22.36		19.95	20 99	50.27	304.6	0.836		358.2	11.94											

馬尾松人工林収穫予測表　地位指数 18　初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量				間伐木						間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	7.53	3000	6.27	6 33	9.26	46.3	0.488	11.80	46.3	5.79											
9	8.47		7.09	7.26	11.85	58.1	0.527	13.33	58 1	6.46											
10	9.41		7.91	8.19	14.73	71.5	0.566	14.78	71.8	7.15											
11	10.35		8.71	9.11	17.86	86.2	0.606	16.11	86.3	7.84											
12	11.27		9.49	10.02	21.22	102.4	0.646	17.40	102.4	8.53											
13	12.17		10 25	10.92	24 77	119.8	0 686	18.60	119.8	9.21											
14	13.06		11 00	11.80	28.50	138.4	0.727	19.73	138 4	9 88											
15	13.93		11.72	12.65	32.38	158.1	0.767	20.82	158.1	10.54											
16	14.78		12.43	13.50	36.40	178.9	0.807	15.58	178.9	11.18	1305	10.40	11 09	45.9	0.257	0.435	45.9	1695	13.79	25.31	133 0
17	15.61	1695	14 47	14.32	27.86	148.6	0.627	16.22	194 5	11.44											
18	16.43		15.13	15.12	30.47	164.8	0 654	16.79	210.7	11.71											
19	17 22		15.77	15 91	33 11	181 6	0.680	17.35	227.5	11.97											
20	18.00		16.39	16 68	35.78	198.9	0.707	17.87	244.8	12 24											
21	18.76		17 00	17 43	38 48	216.8	0.733	18.37	262 7	12.51											
22	19.51		17.59	18 16	41 20	235.2	0.759	18.83	281.1	12.78											
23	20.24		18.17	18.89	43.94	254.0	0.784	19 28	299 9	13.04											
24	20.95		18.73	19 59	46.71	273.3	0.810	14.05	319.2	13.30	694	17.00	15.75	70.80	0.259	0.410	116.7	1001	19.85	30.96	202.5
25	21.65	1001	20 38	20 28	32.64	216.5	0.617	14.30	333.2	13.33											
26	22.34		20 90	20 96	34 32	230.8	0 634	14.54	347.5	13.37											
27	23.01		21.40	21 63	36.00	245.4	0 651	14.74	362 1	13 41											
28	23.67		21.90	22.28	37.68	260.1	0 668	14.99	376.8	13 46											
29	24.32		22.38	22.92	39.36	275 1	0 684	15.16	391.8	13 51											
30	24.95		22.85	23.55	41 04	290 3	0 700		407.0	13 57											

馬尾松人工林収穫予測表　地位指数 20　初植密度 3000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量			間伐木							間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	8.20	3000	6.86	6.99	11.09	54.6	0.516	15.37	54.6	6.83											
9	9.31		7.82	8.09	14.41	70.0	0.562	17.26	70.0	7.78											
10	10.41		8.76	9 17	18.08	87 3	0.609	19.02	87.3	8.73											
11	11.48		9.67	10 23	22.03	106 3	0.656	20.70	106.3	9.66											
12	12.53		10.55	11 27	26 23	127.0	0.702	22.26	127.0	10.58											
13	13.55		11.41	12.28	30 65	149 2	0.749	23.71	149.2	11.48											
14	14.55		12 23	13.26	35.26	173.0	0.795	25.08	173.0	12.35											
15	15.51		13 04	14 22	40 03	198 0	0.842	17 96	198.0	13.20	1426	11.11	13.82	56.9	0.287	0.475	56.9	1574	14.56	26.21	141.1
16	16.46	1574	15.32	15 15	29.04	159.1	0.629	18.70	216 0	13.50											
17	17.38		16.06	16.06	31.91	177.8	0.657	19 38	234 7	13.81											
18	18.27		16.78	16.95	34.81	197 1	0.688	20.03	254.1	14.12											
19	19.15		17.47	17 81	37.75	217 2	0.716	20.63	274.1	14 43											
20	20 00		18.15	18.65	40.71	237.8	0 744	21.21	294.7	14.74											
21	20 83		18.80	19.48	43 70	259.0	0.773	21.74	315.9	15 04											
22	21.64		19.43	20.28	46.70	280.7	0.800	16.07	337.7	15.35	621	17 72	15.32	70 26	0.250	0.395	127.2	953	20 47	31.38	210.5
23	22.44	953	21.07	21.06	33.24	226.5	0.619	16.37	353.7	15.38											
24	23 21		21.65	21.83	35.10	242 9	0.638	16.83	370.1	15.42											
25	23 97		22.22	22.58	36.95	259 6	0.656	16.93	386.8	15.47											
26	24.72		22.77	23.31	38.81	276.5	0 674	17.17	403.7	15.53											
27	25.44		23.31	24.03	40.66	293 7	0.693	17.43	420 9	15 59											
28	26.16		23.83	24.74	42.50	311.1	0.710	17 64	438.3	15.65											
29	26.85		24.34	25.43	44.34	328 7	0.728	17.87	455.9	15.72											
30	27.54		24.84	26.10	46.18	346.6	0.746		473.8	15.79											

馬尾松人工林収穫予測表　地位指数 8　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量 連年成長量	成長量 総成長量	成長量 平均成長量	間伐木 ha当り本数	間伐木 平均胸径	間伐木 ha当り断面積	間伐木 ha当り幹材積	間伐木 材積間伐強度	間伐木 本数間伐強度	間伐木 累計間伐材積	間伐後 ha当り本数	間伐後 平均胸径	間伐後 ha当り断面積	間伐後 ha当り幹材積
8	4.17	6000	1.75	3.01	1.45	20.1	0.460	0.77	20.1	2.51											
9	4.26		1.83	3.09	1.58	20.9	0.464	1.66	20.9	2.32											
10	4.44		2.00	3.27	1.88	22.5	0.474	2.38	22.5	2.25											
11	4.68		2.22	3.51	2.31	24.9	0.489	3.00	24.9	2.26											
12	4.97		2.47	3.80	2.88	27.9	0.505	3.58	27.9	2.33											
13	5.30		2.76	4.12	3.59	31.5	0.524	4.12	31.5	2.42											
14	5.65		3.06	4.47	4.42	35.6	0.545	4.63	35.6	2.54											
15	6.02		3.38	4.83	5.38	40.2	0.567	5.14	40.2	2.68											
16	6.40		3.71	5.21	6.47	45.4	0.590	5.62	45.4	2.84											
17	6.79		4.04	5.60	7.68	51.0	0.614	6.00	51.0	3.00											
18	7.19		4.32	5.99	8.79	57.0	0.633	6.66	57.0	3.17											
19	7.59		4.72	6.39	10.48	63.7	0.663	7.01	63.7	3.35											
20	8.00		5.06	6.79	12.05	70.7	0.689	7.47	70.7	3.53											
21	8.41		5.40	7.20	13.74	78.1	0.715	7.88	78.1	3.72											
22	8.82		5.74	7.60	15.53	86.0	0.741	8.32	86.0	3.91											
23	9.22		6.08	8.00	17.43	94.3	0.767	8.74	94.3	4.10											
24	9.63		6.42	8.40	19.44	103.1	0.793	9.15	103.1	4.30											
25	10.03		6.76	8.80	21.53	112.2	0.820	6.71	112.2	4.49	2918	4.46	4.56	30.1	0.268	0.486	30.1	3082	8.4	16.97	82.1
26	10.43	3082	8.72	9.20	18.39	88.8	0.618	6.95	118.9	4.57											
27	10.83		9.06	9.59	19.85	95.8	0.635	7.20	125.9	4.66											
28	11.23		9.39	9.98	21.35	103.0	0.652	7.44	133.1	4.75											
29	11.62		9.72	10.37	22.88	110.4	0.671	7.68	140.5	4.85											
30	12.01		10.05	10.76	24.46	118.1	0.688		148.2	4.94											

馬尾松人工林収穫予測表　地位指数 10　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量			間伐木							間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	4.84	6000	2.36	3.67	2 63	26.6	0.499	2.72	26.6	3.32											
9	5.10		2 59	3.93	3 16	29 3	0 513	3 73	29 3	3.26											
10	5 43		2 88	4.25	3 90	33 0	0.533	4 61	33.0	3.30											
11	5.81		3 21	4 63	4 84	37.7	0.555	5.42	37.7	3.42											
12	6 23		3 56	5 04	5 98	43 1	0.580	6.17	43 1	3.59											
13	6.67		3 94	5.48	7 30	49 2	0.607	6 91	49.2	3 79											
14	7 13		4 33	5 93	8.81	56 2	0.635	7.59	56 2	4.01											
15	7.60		4 72	6 40	10 50	63 7	0 664	8 27	63 7	4.25											
16	8 08		5 12	6 87	12.36	72 0	0 694	8 94	72 0	4.50											
17	8.56		5 52	7 34	14.38	81.0	0.724	9.57	81 0	4.76											
18	9.04		5 93	7 82	16.56	90.5	0.755	10 17	90 5	5 03											
19	9.52		6.33	8 29	18 89	100 7	0.786	10.80	100.7	5.30											
20	10 00		6 73	8.77	21 36	111 5	0 818	8 00	111 5	5.57	2903	4.43	4 47	29.7	0 266	0.483	67.3	3097	8.33	16 90	81 8
21	10 48	3097	8 74	9 24	18 59	89 8	0 621	8 37	119.5	5 69											
22	10.95		9 15	9.71	20.34	98 2	0.642	8 74	127 8	5.81											
23	11 43		9.55	10.18	22 16	106.9	0 663	9.07	136.6	5.94											
24	11.89		9.94	10 64	24.03	116 0	0.684	9.42	145 7	6.07											
25	12 36		10 33	11.10	25 95	125 4	0.706	9.75	155.1	6.20											
26	12.81		10.71	11.55	27.92	135.1	0.727	10.07	164.8	6.34											
27	13.27		11 09	12.00	29 93	145.2	0 748	10.37	174.9	6.48											
28	13 72		11.47	12.44	31 99	155.6	0 769	10 67	185.3	6.62											
29	14.16		11 84	12.88	34.08	166 3	0.791	10 96	195 9	6.76											
30	14 60		12 20	13.32	36 21	177.2	0.812		206.9	6.90											

馬尾松人工林収穫予測表　地位指数 12　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量			間伐木							間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	5 52	6000	2.95	4.34	4.10	34 0	0.538	5.26	34 0	4.26											
9	5.94		3.32	4.76	5.18	39 3	0.563	6 46	39 3	4.37											
10	6 43		3.73	5 24	6 55	45 8	0.592	7 56	45 8	4.58											
11	6 95		4.17	5 75	8 19	53 3	0.624	8 59	53 3	4.85											
12	7 49		4 63	6 29	10.09	61.9	0.657	9 59	61.9	5.16											
13	8 05		5 10	6 84	12.24	71 5	0 692	10 54	71 5	5 50											
14	8 61		5.57	7 40	14.63	82.0	0.728	11 44	82 0	5.86											
15	9 18		6.05	7.96	17 24	93 5	0.764	12.34	93.5	6.23											
16	9.75		6 53	8.52	20.07	105.8	0 801	9.49	105 8	6.62	2779	4.15	3 76	26.6	0 251	0.463	26 6	3221	8 03	16.30	79 2
17	10.32	3221	8.51	9.09	18.33	88.7	0 625	10.05	115 3	6.78											
18	10.89		8.99	9.64	20.46	98.8	0 651	10 57	125.4	6.97											
19	11 45		9.47	10.20	22.67	109.3	0 677	11 09	135.9	7.15											
20	12.00		9 94	10 75	24.97	120.4	0 703	11.58	147.0	7.35											
21	12.55		10.40	11 29	27 34	132 0	0 729	12 06	158.6	7 55											
22	13.09		10 85	11 83	29 78	144 0	0 755	12.49	170 7	7.76											
23	13.63		11.30	12.35	32.29	156.6	0.780	12 98	183.1	7.96											
24	14.16		11.74	12.88	34.86	169.5	0.806	9 57	196 1	8.17	1410	9.68	10.38	43 4	0.256	0 438	70.0	1810	13 12	24.47	126 1
25	14.68	1810	13.55	13.39	26.10	135.7	0.617	9.84	205 7	8.23											
26	15.19		13.97	13.90	27.76	145.6	0.635	10 11	215.5	8.29											
27	15.70		14.39	14.41	29.44	155.7	0.652	10.34	225 6	8.36											
28	16.20		14.80	14.90	31.13	166.0	0.669	10.59	236 0	8.43											
29	16.70		15.20	15.39	32.84	176,6	0.687	10.82	246.6	8.50											
30	17.19		15.59	15.87	34.56	187.4	0.704		257.4	8.58											

馬尾松人工林収穫予測表　地位指数 14　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量			間伐木							間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	6.19	6000	3.53	5 00	5 87	42.5	0.578	8.42	42.5	5.31											
9	6.79		4 03	5.59	7 67	50.9	0.614	9.89	50.9	5.66											
10	7.42		4 57	6.22	9 85	60.8	0.653	11.28	60.8	6.08											
11	8.08		5 13	6.87	12 38	72 1	0.693	12 61	72.1	6.55											
12	8 75		5.69	7.53	15.24	84.7	0.736	13.90	84.7	7.06											
13	9.42		6 25	8 20	18 41	98 6	0.780	15.11	98.6	7.58											
14	10 10		6 81	8 86	21 87	113.7	0.824	11 34	113.7	8.12	2949	4.53	4 76	30 9	0.272	0 491	30 9	3051	8 45	17.12	82.8
15	10 77	3051	9.02	9.53	19 51	94.1	0.629	12.08	125.1	8.34											
16	11.43		9.58	10 18	22 01	106.2	0.659	12.76	137.1	8.57											
17	12.09		10.14	10.83	24.63	119 0	0.688	13.41	149.9	8.82											
18	12.73		10 68	11.47	27 34	132 4	0.718	14.07	163.3	9 07											
19	13 37		11 22	12.10	30.14	146.4	0.747	14.66	177 4	9 34											
20	14 00		11.74	12 72	33.03	161 1	0.777	15 26	192.0	9.60											
21	14 62		12.25	13.34	35.99	176.4	0.806	11 31	207 3	9.87	1328	10 22	10.89	45.1	0.256	0.435	76 1	1724	13 62	25 10	131 2
22	15 23	1724	14.12	13.94	26 93	142 5	0.620	11.65	218.6	9.94											
23	15.83		14 61	14.53	28.88	154.2	0.640	11.99	230.3	10 01											
24	16.42		15.09	15 12	30 81	166 2	0.659	12 30	242.2	10.09											
25	17 00		15 55	15.69	32.75	178.5	0.679	12 60	254.5	10.18											
26	17 57		16 02	16.26	34 72	191.1	0.698	12.92	267.1	10.28											
27	18 14		16.47	16.81	36.71	204.0	0.718	13 18	280.1	10 37											
28	18.69		16 91	17.36	38 70	217 2	0.737	13 46	293.2	10.47											
29	19 24		17 34	17.90	40 72	230.6	0 756	13.70	306.7	10.58											
30	19.78		17 77	18 43	42 74	244 3	0.775		320 4	10.68											

馬尾松人工林収穫予測表　地位指数 16　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量			間伐木							間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	6 86	6000	4 10	5.67	7.41	52.0	0 618	12 20	52 0	6.50											
9	7.63		4.75	6 43	10.61	64.2	0 666	14.07	64 2	7.14											
10	8 42		5 41	7.21	13.78	78.3	0 715	15 84	78 3	7 83											
11	9.21		6 08	7.99	17.39	94 1	0.766	17 55	94.1	8.56											
12	10.01		6 74	8.78	21 41	111 7	0 818	13 43	111.7	9.31	2907	4.44	4 49	29 8	0 267	0.485	29.8	3093	8.35	16.92	81 9
13	10.80	3093	9 02	9 56	19.75	95 3	0.635	14.45	125 1	9.63											
14	11 58		9 68	10 33	22 75	109 8	0.670	15 38	139 6	9 97											
15	12.35		10 33	11.09	25.90	125 2	0 705	16 29	155 0	10.33											
16	13 11		10 96	11 84	29 18	141 4	0 740	17 15	171 3	10.70											
17	13 85		11.58	12 57	32.58	158 6	0 775	17 96	188 4	11.08											
18	14 58		12.19	13.30	36.08	176 6	0 810	13 34	206 4	11.47	1362	10.16	11.04	45 8	0 259	0.440	75 6	1731	13.57	25 04	130 8
19	15 30	1731	14.16	14.00	27 26	144 1	0 623	13 82	219.7	11.56											
20	16.00		14 73	14.70	29 51	157.9	0 647	14 26	233 5	11.68											
21	16 69		15 29	15 38	31 80	172.2	0 670	14.71	247.8	11.80											
22	17 37		15 84	16 05	34.11	186.9	0 693	15 11	262.5	11 93											
23	18 03		16.37	16.71	36.45	202.0	0 716	15 49	277.6	12.07											
24	18.69		16 89	17.35	38.80	217.5	0.738	15 89	293 1	12.21											
25	19.33		17 40	17.99	41 18	233 4	0.761	16 23	309 0	12.36											
26	19.96		17 90	18.61	43 57	249.6	0.784	16 58	325 2	12.51											
27	20.57		18 39	19.22	45 98	266.2	0 806	16 90	341.8	12.66											
28	21 18		18 87	19.82	48.40	283 1	0 828	17 20	358.7	12.81											
29	21 78		19.34	20.41	50.83	300 3	0.850	17 54	375.9	12.96											
30	22 36		19.80	20.99	53.27	317.8	0 872		393 4	13.11											

馬尾松人工林収穫予測表　地位指数 18　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量 連年成長量	成長量 総成長量	成長量 平均成長量	間伐木 ha当り本数	間伐木 平均胸径	間伐木 ha当り断面積	間伐木 ha当り幹材積	間伐木 材積間伐強度	間伐木 本数間伐強度	間伐木 累計間伐材積	間伐後 ha当り本数	間伐後 平均胸径	間伐後 ha当り断面積	間伐後 ha当り幹材積
8	7.53	6000	4.66	6.33	10.25	62.6	0.660	16.70	62.6	7.83											
9	8.47		5.45	7.26	14.01	79.3	0.718	19.04	79.3	8.81											
10	9.41		6.24	8.19	18.36	98.4	0.779	21.31	98.4	9.84											
11	10.35		7.02	9.11	23.24	119.7	0.841	15.93	119.7	10.88	3063	4.80	5.55	34.3	0.286	0.510	34.3	2937	8.76	17.69	85.4
12	11.27	2937	9.54	10.02	21.00	101.3	0.640	17.20	135.6	11.30											
13	12.17		10.31	10.92	24.50	118.5	0.679	18.38	152.8	11.75											
14	13.06		11.05	11.80	28.16	136.9	0.719	19.49	171.2	12.23											
15	13.93		11.77	12.65	31.98	156.4	0.759	20.57	190.7	12.71											
16	14.78		12.48	13.50	35.93	176.9	0.798	21.54	211.2	13.20											
17	15.61		13.17	14.32	40.00	198.5	0.837	15.91	232.8	13.69	1378	11.24	13.67	56.3	0.284	0.469	90.6	1559	14.66	26.3	142.2
18	16.43	1559	15.32	15.12	28.77	157.6	0.625	15.96	248.2	13.79											
19	17.22		15.96	15.91	31.20	173.6	0.650	16.48	264.2	13.90											
20	18.00		16.58	16.68	33.68	190.1	0.675	16.97	280.6	14.03											
21	18.76		17.19	17.43	36.18	207.0	0.699	17.44	297.6	14.17											
22	19.51		17.78	18.16	38.70	224.5	0.724	17.87	315.0	14.32											
23	20.24		18.35	18.89	41.24	242.3	0.748	18.28	332.9	14.48											
24	20.95		18.91	19.59	43.79	260.6	0.772	18.69	351.2	14.63											
25	21.65		19.46	20.28	46.36	279.3	0.796	19.07	369.9	14.80											
26	22.34		19.99	20.96	48.94	298.4	0.820	19.44	389.0	14.96											
27	23.01		20.51	21.63	51.53	317.8	0.843	19.74	408.4	15.13											
28	23.67		21.02	22.28	54.11	337.6	0.866	20.11	428.1	15.29											
29	24.32		21.52	22.92	56.71	357.7	0.889	20.39	448.2	15.46											
30	24.95		22.01	23.55	59.31	378.1	0.912		468.6	15.62											

出典

林傑・洪偉・陳平留・黃建几・穆信芳(1986). 林業調査規劃.

馬尾松人工林収穫予測表　地位指数 20　初植密度 6000

年齢	優勢木平均高	ha当り本数	平均胸径	平均樹高	ha当り断面積	ha当り幹材積	産量比数	成長量				間伐木						間伐後			
								連年成長量	総成長量	平均成長量	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積	材積間伐強度	本数間伐強度	累計間伐材積	ha当り本数	平均胸径	ha当り断面積	ha当り幹材積
8	8.20	6000	5.23	6 99	12.89	74.3	0.702	21.92	74.3	9.29											
9	9.31		6 16	8.09	17.88	96 3	0 773	24 87	96.3	10.70											
10	10.41		7 07	9.17	23 58	121.1	0.845	18.71	121.1	12.12	3090	4.87	5.75	35.1	0.290	0.515	35.1	2910	8.83	17.83	86 0
11	11.48	2910	9.74	10.23	21 69	104 7	0.646	20.35	139 9	12.71											
12	12 53		10.62	11.27	25 80	125.1	0.692	21.88	160.2	13.35											
13	13.55		11.48	12.28	30.12	147.0	0.738	23.30	182 1	14 01											
14	14.55		12.31	13 26	34.62	170 3	0 783	24.64	205.4	14 67											
15	15.51		13.11	14.22	39 27	194.9	0.829	17.96	230 0	15.34	1336	11.16	13.06	53 80	0 276	0.459	88.9	1574	14 56	26 21	141 1
16	16 46	1574	15.32	15 15	29 04	159.1	0.629	18.70	248.0	15 50											
17	17.38		16.06	16 06	31.91	177.8	0 659	19 38	266.7	15.69											
18	18.27		16 78	16.95	34.81	197.1	0 688	20.03	286.1	15 89											
19	19 15		17 47	17 81	37.75	217.2	0 716	20.63	306.1	16.11											
20	20 00		18.15	18.65	40 71	237.8	0.744	21 21	326 7	16 34											
21	20.83		18.80	19.48	43 70	259 0	0 773	21.74	347 9	16.57											
22	21 64		19.43	20 28	46.70	280.7	0 800	16.07	369.7	16 30	621	17 85	15 32	70.3	0.250	0.395	159.2	953	20.47	31.38	210 5
23	22.44	953	21 07	21.06	33 24	226.5	0.619	16.37	385.7	16.77											
24	23 21		21.65	21 83	35 10	242.9	0.638	16 63	402.1	16.76											
25	23 97		22 22	22.58	36.95	259.6	0.656	16.93	418.7	16.75											
26	24 72		22.77	23.31	38.81	276 5	0.674	17.17	435.7	16.76											
27	25.44		23 31	24.03	40 66	293 7	0 693	17.43	452 8	16 77											
28	26.16		23.83	24 74	42 50	311.1	0.710	17.64	470.3	16.80											
29	26 85		24.34	25 43	44 34	328 7	0.728	17.87	487.9	16.83											
30	27 54		24 54	26 10	46 18	346.6	0.746		505.8	16.86											

樹種：PINACEAE（マツ科）
Pinus markusii（メルクシマツ）
国：インドネシア

データ採取地の立地環境

Investigation into the growth yield of <u>P. merkusii</u> was started by means of sample plots established in the first plantation of the species in Java At the end of 1952 data were available from a sufficient number of plots to merit the construction of a provisional yield table (Ferguson, 1954) Since these tables were to be used as a basis of planning by the Forest Service they were extended by extrapolation to an age of 35 years. The data from age 30 years onwards must therefore be used with caution. Table 20 is an extract from the growth and yield table as published by Ferguson

(Notes on Table 20) In Indonesia, contrary to general use, the best site quality is indicated by the highest number. Site class 1 therefore indicates the lowest site quality. The quality class is estimated from the top height, i.e. the average of the hundred highest trees per hectare equally scattered over the stand This is about the same as the average height of the hundred most dominating trees per hectare. The volumes given in the table refer to the timber volume under bark to an over bark diameter of 7 cms. The volumes are valid for normal stands with sound boles. Deductions for lower stand density, for defects in the bole, and eventually also for a lower rate of merchantability, will be provided for later. The Forest Service has fixed the rotation provisionally at 30 years. This is somewhat more than the age at which the average annual increment culminates, being 25 years and lower at medium size classes and 20 years for better sites. It is to be expected that the produce of these forests will eventually be used as pulpwood. Since many of the forests have a function for the control of erosion and water supply in stream basins the rotation should not be too short and in this connection thirty years seems to be adequate.

成長・収穫に関する表，図，式など

Table 20

Site quality class	Upper height (m)			Number of trees per ha. main stand			Average diameter (cm)			Total basal area (m^2/ha) main stand		
	age			age			age			age		
	10	20	30	10	20	30	10	20	30	10	20	30
II	10.2	21.0	28.0	945	417	236	12.6	28.6	38.9	11.8	26.9	28.1
IV	14.7	27.0	34.6	857	253	154	19.3	37.5	48.7	25.1	27.9	28.7
VI	19.6	33.0	41.2	481	170	109	26.5	46.3	58.5	26.6	28.6	29.2

cont.

Site quality class	Volume main stand (m 3/ha)			Total production (m 3/ha)			Average annual increment (m 3/ha)		
	age			age			age		
	10	20	30	10	20	30	10	20	30
II	37	178	248	37	289	471	3.7	14.4	15.7
IV	115	238	322	125	445	643	12.5	22.2	21.4
VI	164	303	397	253	601	814	25.3	30 0	27.1

出典

Cooling, E.N.G. (1968). Fast growing timber trees of the lowland tropics. No. 4 : 116-119. Department of Forestry, Commonwealth Forestry Institute, University of Oxford.

樹種：PINACEAE（マツ科）
Pinus merkusii（メルクシマツ）
国　インドネシア

データ採取地の立地環境

4. Pinus merkusii Jungh. et de Vr.
(TUSAM)

Data,

Lokasi	Jumlah petak coba/ ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan la-- pangan/tanah
Bandung Utara	66	269	600 s/d 1500	
Bandung Selatan	8	8	1250	
Jumlah:	74	277		
Banyumas Barat	13	13	250	
Pekalongan Timur	21	21	600	
Purworejo	3	3	900	
Jumlah:	37	37		
Jember	5	17	400 s/d 500	
Banyuwangi Barat	11	41	400 s/d 450	
Jumlah:	16	58		
Jumlah semua:	127	372		

Umur (Age) (Tahun/ Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T. T.): Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T.P.) (Thinnings): V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (ΣVtw /ha) (m3)	Jumlah volume (Total volume) (Vol.T.T. + ΣT P.) (m3/ha)	Riap rata-rata tahunan (Mean annual) increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/ Year)
Pinus merkusii Jungh. et de Vr. (Tusam)													
BONITA II (SITE CLASS II)													
5	5,2	1305	57,1	4,0	5,2	2,8	15	5	5	20	4,0	-	5
10	11,3	675	36,1	10,2	17,4	16,1	57	22	27	84	8,4	12,8	10
15	16,9	460	29,6	15,8	27,4	21,5	117	38	65	182	12,1	19,6	15
20	22,1	355	25,8	20,9	29,3	24,2	177	50	115	292	14,6	22,0	20
25	26,4	290	23,9	25,2	33,8	26,0	216	51	166	382	15,3	18,0	25
30	29,4	245	23,4	28,5	37,8	27,5	238	43	209	447	14,9	13,0	30
35	31,5	220	23,0	30,6	40,6	28,5	254	37	246	500	14,3	10,6	35
BONITA III (SITE CLASS III)													
5	6,1	1170	51,5	4,9	6,6	4,0	20	6	6	26	5,2	-	5
10	13,0	605	33,6	12,0	19,8	18,7	74	25	31	105	10,5	25,8	10
15	19,6	410	27,1	18,5	26,6	22,9	147	41	72	219	14,6	22,8	15
20	25,0	310	24,4	23,9	32,4	25,5	203	53	125	328	16,4	21,8	20
25	29,4	240	23,6	28,4	38,1	27,4	237	43	168	405	16,2	15,4	25
30	32,6	200	23,3	31,8	42,7	28,7	260	33	201	461	15,4	10,6	30
35	34,8	180	23,0	33,8	45,7	29,6	276	28	229	505	14,4	8,8	35
BONITA IV (SITE CLASS IV)													
5	6,8	1070	48,2	5,6	7,7	5,0	24	7	7	31	6,2	-	5
10	15,6	540	29,6	14,4	22,1	20,7	100	29	36	136	13,6	21,0	10
15	22,5	350	25,5	21,4	30,0	24,8	180	51	87	267	17,8	26,2	15
20	28,1	260	23,7	27,1	36,4	27,0	228	47	134	362	18,1	19,0	20
25	32,6	200	23,3	31,8	42,7	28,6	261	35	169	430	17,2	13,6	25
30	36,0	165	23,3	35,2	48,0	29,9	283	25	194	477	15,9	9,4	30
35	38,3	140	23,7	37,5	52,9	30,8	298	20	214	512	14,6	7,0	35

BONITA V (SITE CLASS V)

5	8,5	890	42,5	7,3	10,9	8,4	40	9	9	49	9,2	-	5
10	17,3	470	28,6	16,5	24,3	21,8	122	31	40	162	16,2	22,6	10
15	25,1	305	24,5	22,3	32,9	25,9	201	52	92	293	19,5	26,2	15
20	31,0	220	23,2	20,3	40,4	28,2	251	39	131	382	19,1	17,8	20
25	35,7	170	23,1	34,9	47,3	29,9	282	26	157	439	17,6	11,4	25
30	39,0	140	23,3	38,4	53,3	31,2	302	18	175	477	15,9	7,6	30
35	41,6	115	24,0	40,9	59,5	32,0	317	12	187	504	14,4	5,4	35

BONITA VI (SITE CLASS VI)

5	10,4	740	38,0	9,2	15,2	13,4	59	12	12	71	14,2	-	5
10	20,2	400	26,6	18,9	27,2	23,3	158	43	55	213	21,3	28,4	10
15	27,7	250	24,5	26,8	37,1	27,0	227	48	103	330	22,0	23,4	15
20	34,3	175	23,7	32,9	46,2	29,3	272	32	135	407	20,3	15,4	20
25	38,8	130	24,3	38,0	55,1	31,0	301	18	153	454	18,2	9,4	25
30	42,6	100	24,2	42,0	64,1	32,3	322	10	163	485	16,2	6,2	30
35	45,4	85	25,8	44,8	70,5	33,2	338	4	167	505	14,4	4,0	35

出典

Suharlan, A., Sumerna, K, and Sudiono, Y (1975). Yield table of ten industrial wood specoes. Lembaga Penelitıan Hutan.

樹種：PINACEAE（マツ科）
Pinus merkusii （メルクシマツ）
国：インドネシア

データ採取地の立地環境

Locality:	Toba Lake (north Sumatra), Lembung (West Java)
Altitude:	1 100 m
Rainfall:	2 500 mm (dry months about 2)
Data source:	permanent sample plots
Number of plots:	50
Measurement specification:	Up to 7 cm top diameter under bark
Site quality:	'upper height' i.e. average height of 100 highest trees per hectare, used as indicator of site quality and site indices for the reference age 20 years have been determined.

MAI (m^3/ha) by site index and age

成長・収穫に関する表，図，式など

Age (years)	21	24	27	30	33
5	-	-	2.2	4.0	7.2
10	3.7	7.1	12.5	13.8	25.3
15	10.3	15.1	19.9	24.7	29.3
20	14.4	18.4	22.2	26.2	30.0
25	15.8	18.9	22.4	25.6	28.8
30	15.7	18.5	21.4	24.3	27.1
35	14.9	17.5	20.1	22.7	25.3

Remarks: Plant spacing 3 x 3 m and thinnings on relative spacing of 25 percent of 'upper height'. Thinning yield has been included in MAI.

出典

(2) Ferguson, J.H.A. Growth and yield of Pinus merkusii in Indonesia. 1954 Communication of the Forest Research Institute (Bogor) No. 43.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）

: *Pinus merkusii*　（メルクシマツ）

国　インドネシア

データ採取地の立地環境

Locality: Bundung, Banyumas Barat, Pakalongan Timur, etc.

Altitude: 250 - 1 500 m

Data source: permanent sample plots

Number of plots: 127

Measurement specification: 7 cm diameter under bark

Site quality: not defined, but 'upper heights' in metres at 20 years of age are 22.1, 25.0, 28.1, 31.0 and 34.3 for site classes V, IV, III, II, I respectively.

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site class

Age (years) \ Site class	V	IV	III	II	I
5	4.0	5.2	6.2	9.2	14.2
10	8.4	10.5	13.6	16.2	21.3
15	12.1	16.6	17.8	19.5	22.0
20	14.6	16.4	18.1	19.1	20.3
25	15.3	16.2	17.2	17.6	18.2
30	14.9	15.4	15.9	15.9	16.2
35	14.3	14.4	14.6	14.4	14.4

Remarks: Yield table is provisional and thinning has been included in MAI.

Comments

On average sites MAI figures in both tables are comparable and MAI culmination age seems to be ± 20 years. But since production aim is pulpwood and gum, which requires well-developed trees, a higher age, perhaps more than 35 years might be preferable.

出典

(3) Indonesian Department of Agriculture, Forest Research Institute
1975 Yield tables of ten industrial wood species.

ダイジェストデータ．Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
Pinus merkusii（メルクシマツ）
国：タイ

データ採取地の立地環境

Thailand
In 1968 the P.merkusii/P.kesiya forests of the northern region of Thailand, where all the natural Thai stands of P.kesiya occur, were reported

(F.A.O., 1968) to contain the following volumes of wood:-

Om Koi area (79,000 ha) 2.7 million m^3
(91% P.merkusii; 9% P.kesiva)
Baw Luang area 1.3 million m^3
Kun Yam area 0.7 million m^3

It was stated that on average there were 24 pine trees per ha with an average volume of 43 m^3 per ha. This represented 50% of the total for all species. The pines were up to 110 cm breast height diameter with heights of 20-30 m. Their overall average mean annual increment was estimated at 0.2-0.5% by diameter and 0.49% by volume. Maturity was reached in the Om Koi area at about 80 years and mature trees accounted for some 90% of the total volume. The majority of trees in this class were over-maure, with long, clean boles. It was ascertained from stem analysis that the typical pattern of development of individual naturally regenrated pines during the first 25 years in the Om Koi area was as shown in Table 6.10.

成長・収穫に関する表，図，式など

Table 6 10 Typical growth of individual natural trees, Om Koi area, Thailand (FAO, 1968)

Age (years)	Under bark diameter (cm)	Height (m)	Volume (m^3)	Mean annual volume increment %
10	4 0	4 3	0 02	
15	8 7	8 3	0 08	15 2
20	14 0	13 3	0 21	12 4
25	18 1	19 0	0 34	7 5

出典

Armitage, F.B. and Burley, J (1980). Tropical forestry papers No.9. Department of Forestry, Commonwealth Forestry Institute, University of Oxford.

樹種：PINACEAE（マツ科）
Pinus patula
国：ケニア

成長・収穫に関する表，図，式など

The final choice was an extension of the Schumacher equation, as follows:-

$$\ln H = b_0 + b_1/t + b_2S + b_3S/t \qquad (4.3.4)$$

where H, t, and S are as previously defined, and the b_i are regression coefficients fitted for each species. In this equation, both the asymptote and the slope are linear functions of site index, as can be seen by re-writing the model as shown:-

$$\ln H = (b_0 + b_2S) + (b_1 + b_3S)/t \qquad (4.3.5)$$

Table 2 : Site Index equation (4.3.4) coefficients for Kenya

	P.patula[1]	P.patula[2]	Cypress	P.radiata
b_0	2.5739	3.6068	3.4800	3.5438
b_1	-4.2269	-17.513	-11.716	-14.311
b_2	0.04793	0.008057	0.008467	0.01664
b_3	-0.1872	0.3308	0.1337	0.1474
N	1103	492	1096	1229
R^2	0.91	0.95	0.93	0.95
s_y	0.1201	0.0998	0.1069	0.0839
$\bar{S}$	22.3	23.6	18.2	27.4

Notes

(1) P.patula data from all permanent plots in Kenya.

(2) A subset of P.patula plots eliminating many young stands with anomalous early growth.

(3) N is the total number of observations.

(4) s_y is the standard error of the residuals from the regression.

(5) $\bar{S}$ is the mean site index for the data set used.

Figure 6 Site index curves for P.patula in Kenya

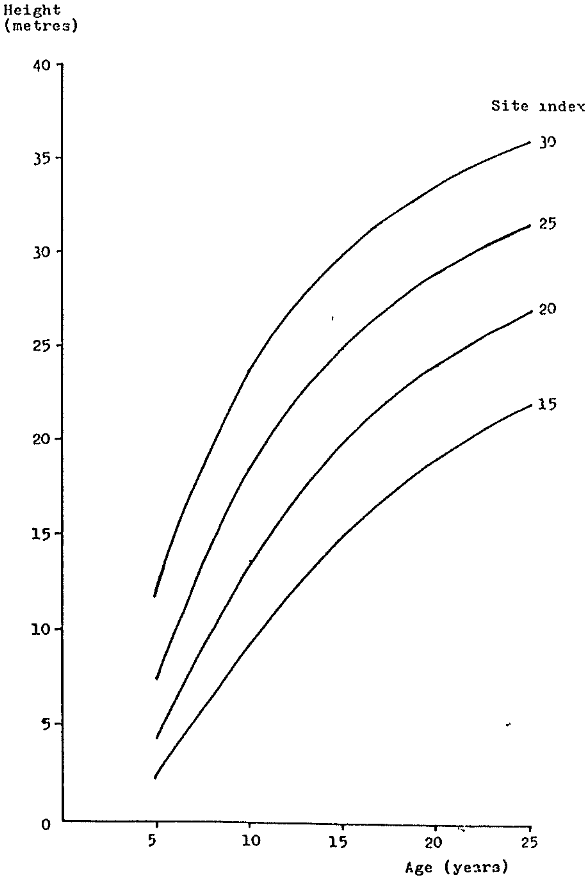


Figure 7 . Site index curves for P.radiata in Kenya

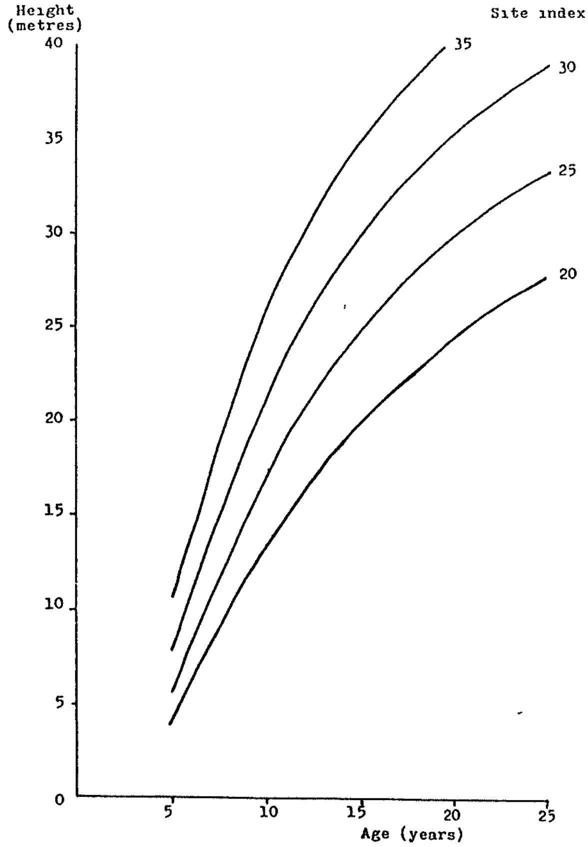
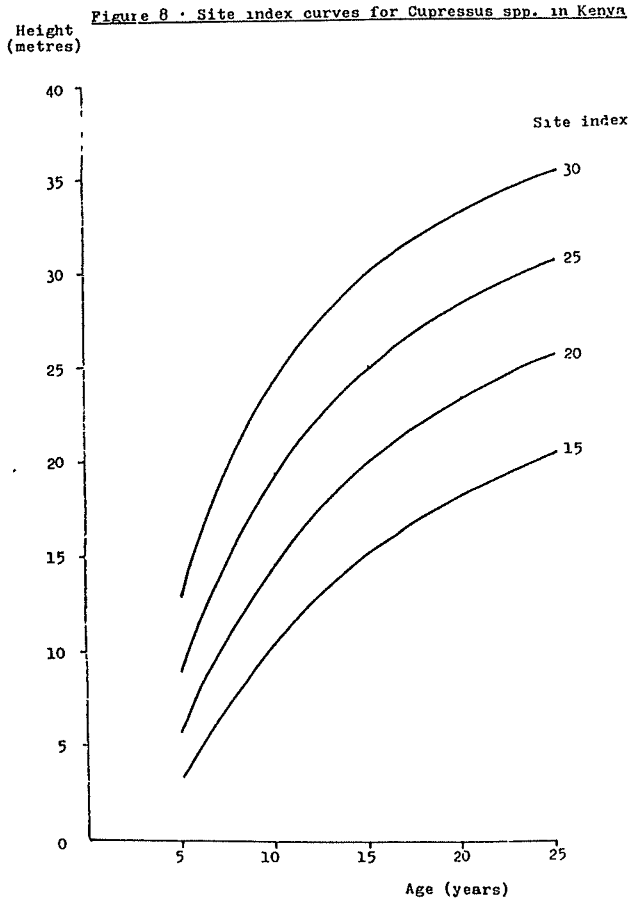


Figure 8 · Site index curves for Cupressus spp. in Kenya



出典

Alder, D (1977) A Growth and Management Model for Coniferous Platations in East Africa, Doctor of Philosophy at Oxford University, 32-37

樹種：PINACEAE（マツ科）
Pinus patula
国　：ケニア

データ採取地の立地環境

Locality:	distributed over entire plantation area
Rainfall:	750 - 2 500 mm (cover dry, medium and wet sites)
Data source:	permanent sample plots
Number of plots:	160
Plot size:	400 m^2
Measurement specification:	Up to 15.2 cm top diameter over bark
Stand density:	1 600 stems/ha (initial)

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site class and age

Age (years) \ Site class	I	II	III	Stems/ha
5	-	-	-	1 120
7	15.3	2.6	-	840
9	25.0	7.5	1.0	840
11	36.8	14.9	5.1	711
13	41.1	18.6	7.9	711
15	46.6	24.3	11.9	600
17	47.4	27.4	14.9	533
19	45.5	28.7	16.7	533
21	45.5	32.3	20.3	400
23	42.9	32.7	22.3	356
25	-	31.8	22.0	356

Remarks: Crop has been thinned at 5, 11, 15, 17, 21 and 23 years of age and thinning yield has been included in MAI. Based on dominant height measurement, three site classes have been defined at reference age 20 years:

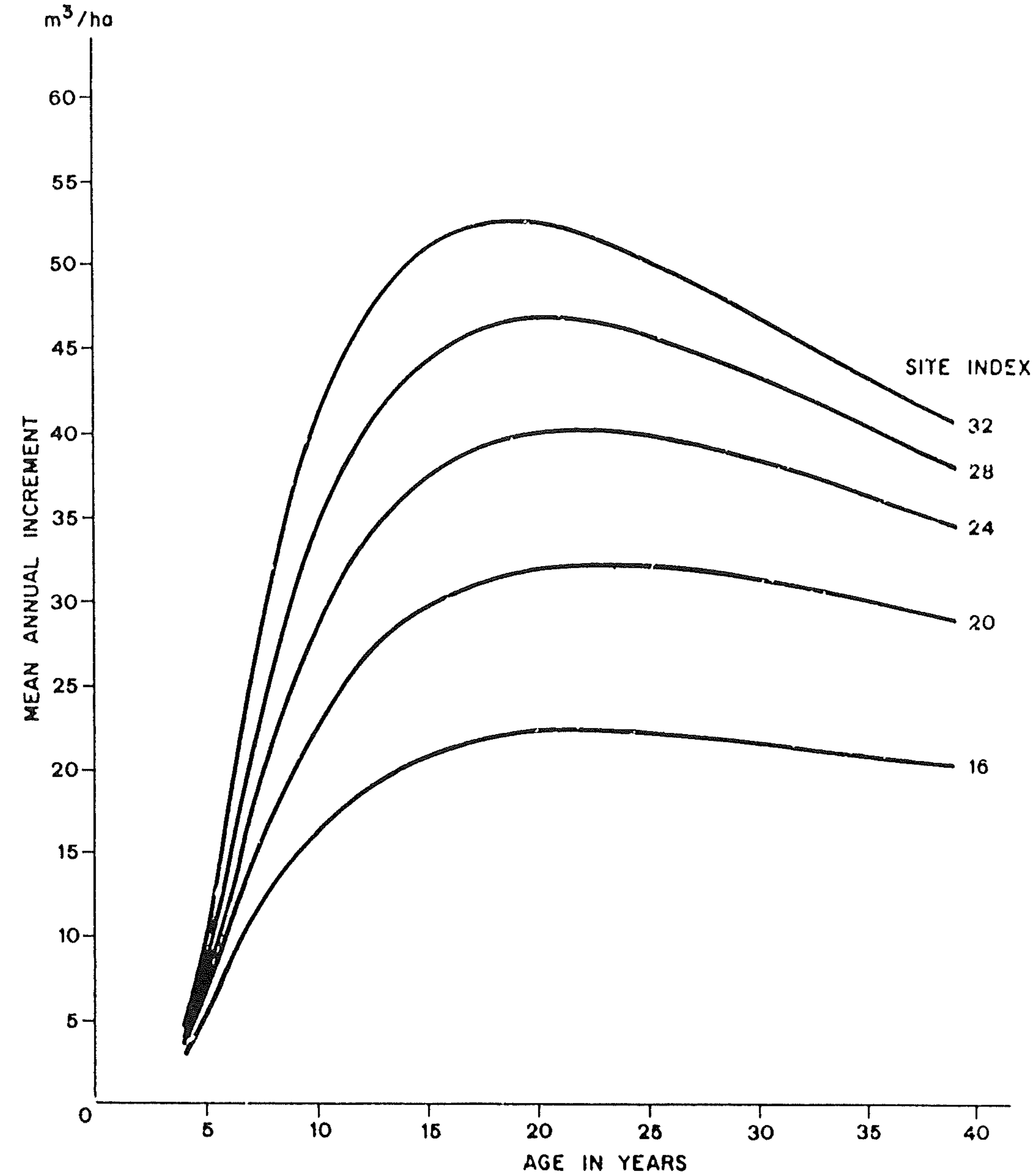
Site class	Height in m
I	32.4 - 37.4
II	27.2 - 32.4
III	21.5 - 27.2

Comments

Plantation site in Kenya seems to have very high production potential for this species; maximum MAI on best site is > 47 m^3/ha. MAI of about 20.0 m^3/ha for total volume production (pulpwood) can be expected on median site with average stand density between 17 to 22 years' age.

Pinus patula - Kenya (9)

MAI curves for different site index (unthinned stand)



出典

(8) Wanene, A.G. A provisional yield table for Pinus patula grown in
1975 Kenya. Forest Dept. Technical Note No. 143.

(9) C.F.I. Yield model for Pinus patula, P. radiata, and cypress
1975 in Kenya, Uganda, Tanzania and Malawi. Unit of Tropical Silviculture, C.F.I. University of Oxford.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
Pinus patula
国 ：マラウイ

データ採取地の立地環境

Locality:	Viphya plateau
Altitude:	1 200 – 1 900 m
Rainfall:	1 200 mm
No. of dry months:	3 – 6 months (less than 20 mm rainfall)
Soil:	silty clay loam, moderately deep
Data source:	permanent and temporary sample plots
Number of plots:	77 P.S.P. + 1% sampling of the whole plantation (20 383 ha)
Measurement specification:	Up to 5 cm top diameter under bark

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site index and age 1/

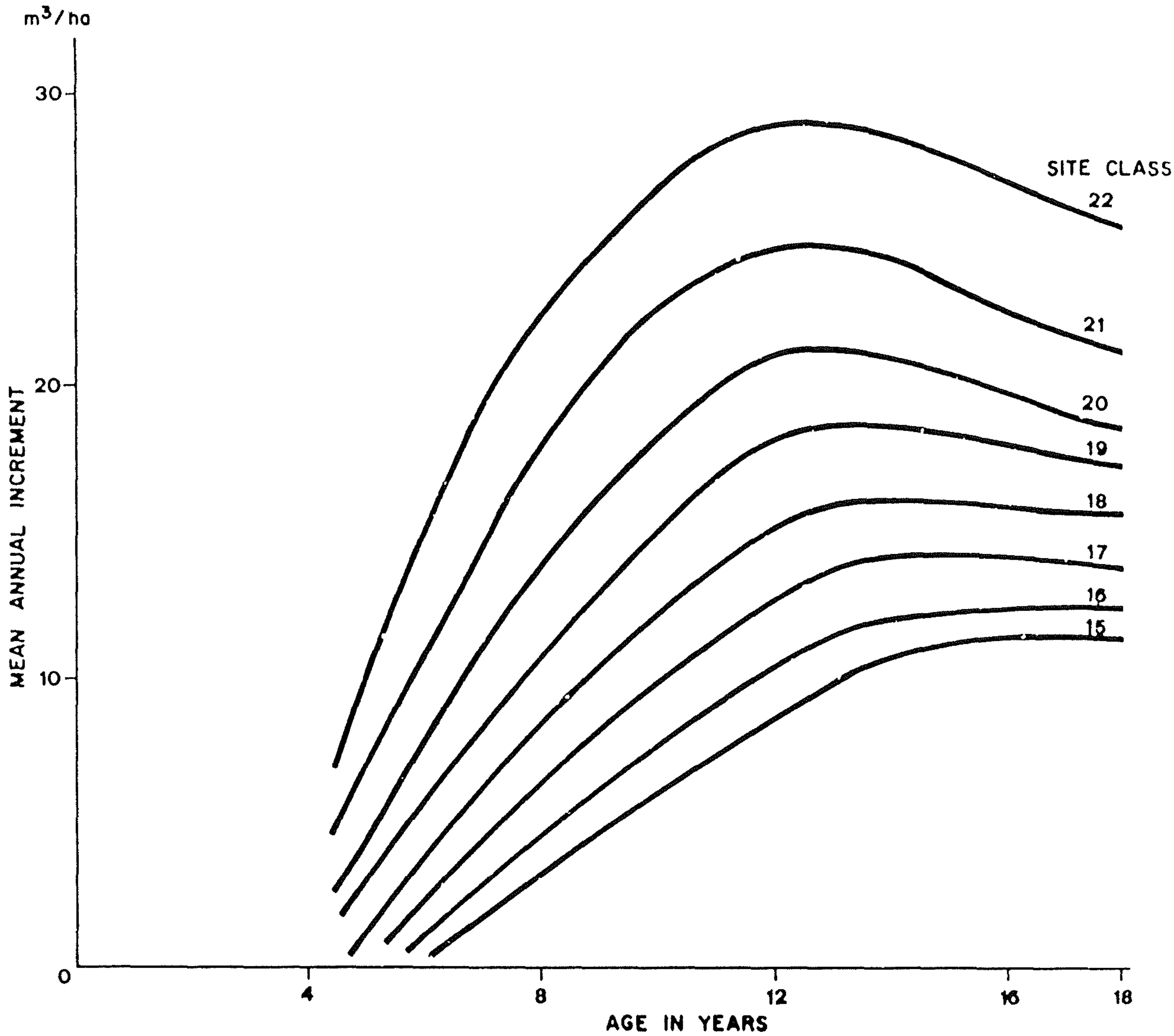
Age (years) \ Site class	16	18	20	22
4	-	-	2.0	7.0
6	1.2	4.0	8.1	15.5
8	4.7	8.7	14.3	22.8
10	7.8	12.2	18.5	26.5
12	10.5	15.0	21.4	29.2
14	12.1	16.3	21.1	28.1
16	12.6	16.1	19.8	27.1

1/ Site class has been determined by dominant height of the 100 largest diameter trees per ha at reference age 15 years.

Remark: Crop has not been thinned.

Pinus patula - Malawi (1)

MAI curves - site class-wise



出典

(1) Adlard, P.G. et al. Plantation inventory and site classification study for 1974 the Viphya Project. FAO/UNDP Report. Rome.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO. 1983 所収

樹種：PINACEAE（マツ科）
Pinus patula
国　：タンザニア

データ採取地の立地環境

TANZANIA (2)

Locality:	Sao Hill (8°26'S and 35°17'E)
Altitude:	1 750 – 1 950 m
Rainfall:	1 000 – 2 000 mm
Data source:	temporary and permanent sample plots
Number of plots	108 T.S.P. and 18 P.S.P.
Size of plots:	400 m^2 to 800 m^2
Stand density:	1 720 – 1 420 stems/ha (initial)

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site index and age[1/]

Age (years) \ Site index	30	27	24
6	12.3	5.8	–
8	19.1	12.9	6.9
10	24.5	18.0	12.1
12	28.2	22.0	16.3
14	30.7	24.8	19.6
16	32.6	26.9	21.6
18	33.9	28.3	22.9
20	34.6	29.1	23.8
22	34.5	29.5	24.6
24	34.4	29.5	24.8
26	33.8	29.0	24.5
28	32.8	28.1	23.8
30	31.7	27.2	23.1

[1/] Site index has been determined by average dominant height of the 100 largest diameter trees per ha at reference age of 20 years.

Remark: MAI is based on total volume production but lower limit and volume o.b./u.b. not specified.

Comments

Mean annual increment of volume production seems to culminate between 15 to 20 years on best sites and between 20 to 25 years on average or poor sites. Increased stand density results in increased total volume production (2).

出典

(2) Adlard, P.G. 1980 Growing stock levels and productivity conclusions from thinning and spacing trials in young *P. patula* stands in southern Tanzania. C.F.I. Occasional papers. University of Oxford.

(3) Adegbehin, J.O. *et al.* 1979 Studies of dominant heights development and yield of *Pinus patula* at Sao Hill forest project. Southern Tanzania Record No. 6, Division of Forestry, University of Dar-es-Salaam, Tanzania.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO 1983　所収

樹種：PINACEAE（マツ科）
Pinus patula
国 ：タンザニア

データ採取地の立地環境

1. INTRODUCTION

Sao Hill Forest Project is in the Southern Highlands of Tanzania at approximately 8°6'S and 35°17'E. Softwood afforestation in the area began in the 1960's mainly with *Pinus patula*, *Pinus elliottii*, and *Pinus radiata*. The emphasis has swung to favour *Pinus patula* due to better performance. Todate 30,000 ha of the species have been planted at Sao Hill with an annual target of 3000-5000 ha.

成長・収穫に関する表，図，式など

3.2 Site index curves

Two site index curve equations were fitted using data from both the permanent sample plots and the stem analysis data. For 391 observations the equations were;

1. The 3 parameter Chapman-Richards equation

$$Hdom = 1.31.\ Site.\ (1-\exp(-0.13\ Age))^{1.83} \quad \ldots\ldots\ldots \quad 6$$
$$RSS = 907.22$$

2. The Schumacher equation:

$$Hdom = 2.06.\ Site.\ (\exp(-6.25/Age^{0.79})) \quad \ldots\ldots \quad 7$$
$$RSS = 939.32$$

Generally the curves from the two equations were more or less similar in shape and their superimposition on the raw data were satisfactory. The Chapman-Richards, equation however produced a better fit on the basis of the residual sum of squares (RSS). In addition the lower rate of growth in the raw data beyond the age of 24 is best demonstrated by the Chapman-Richards equation. The general superiority of this models prompted its adoption in this study and the resulting site index curves are shown in Fig 1.

3.3 The height - diameter equation

Since the psps data did not cover the younger ages, a total of 233 of ages 1-5 years trees were added to these data to bring the total number of observations to 1298.

After a considerable experimentation with various models describing the height and diameter relationship the following equation was selected.

$$\log H = 1.43 + \underset{(0.0106)}{1.25(1/A)} + \underset{(0.026)}{0.721\log(Hdom)} + \underset{(0.011)}{0.045(\log(N)} +$$
$$\underset{(0.62)}{15.92(1/OD)} - \underset{(0.098)}{4.26\ (1/D)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$
$$R^2 = 0.96;\ STD\ ERROR\ of\ est.\ 0.047;$$

where H = total tree height (m)
H = Age of the tree (years)
Hdom = Dominant height (m)
N = Stocking (number of steas/ha)
D = DBH (cm)

This equation is a modification of a similar one used by Burkhart of Strub (1974).

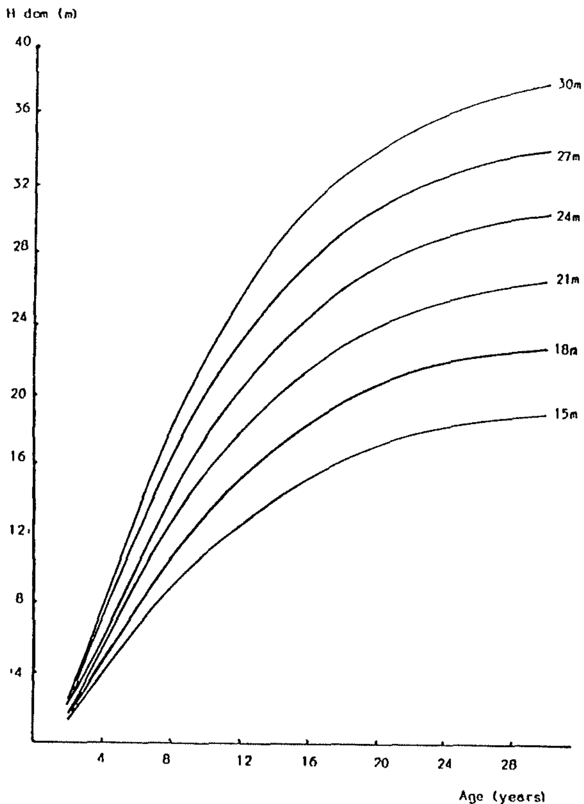


Fig 1 Site index curves for P. patula at Sao Hill

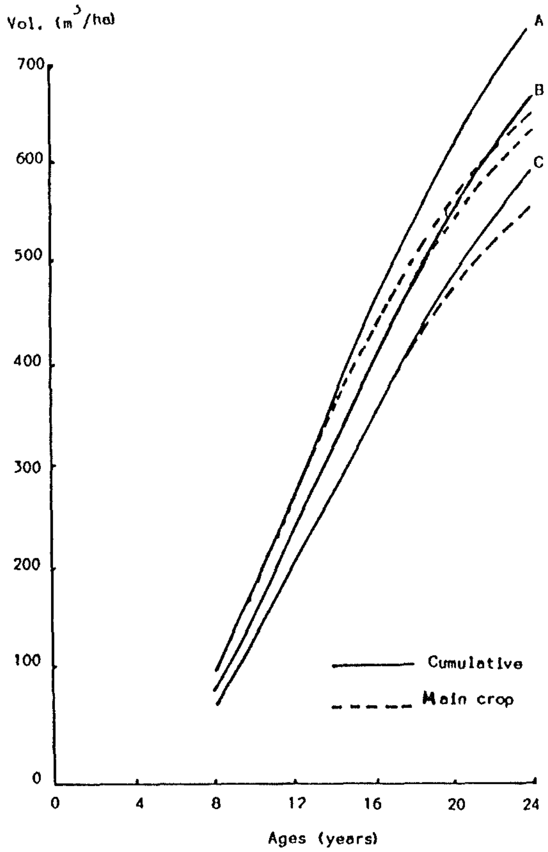


Fig. 8 Simulated cumulative and maincrop volume development at different spacings

Table 5 Total and assotment out turn volumes (m3/ha) for selected combinations of spacing & thinning.

Spacing (m)		Thinning age	Stems left/ha	Volumes m^3 Total	Mean tree	Sawlog /ha	pulplog /ha
1	2.7x2.7	-	1390	653	0.6	562	70
2	2.7x2.7	11	1110	674	0.6	562	86
3	3.0x3.0	-	1111	654	0.6	552	63
4	3.0x3.0	15	740	599	0.7	514	66
5	3.5x3.5	-	816	556	0.8	504	40

Table 5 indicates that high utilizable volumes are obtained with schedules 1,2, and 3. The largest mean tree volume is obtained with schedule 5, but the timber from this schedule may be characterized with large knots due to long period of tree growth.

出典

Malimbwi, R E , Philip, M S (1989) A Growth and Yield Model for *Pinus patula* at Sao Hill Southrn Tanzania, Artificial Intelligence and Growth Models for Forest Management Decisions

樹種：PINACEAE（マツ科）
Pinus patula
国 ：多国籍〔ウガンダ、タンザニア、ブラジル、インド〕

データ採取地の立地環境
成長・収穫に関する表，図，式など

Countries / Details	Uganda		Tanzania	Brazil	India
Reference	(7)	(6)	(2)	(4)	(5)
Locality	Mwenge, Mafuea, Lendu	Mafuga	Kiwira, Sao Hill	Serra Mantiguera	Ramam (W.B.)
Altitude (m)	-	2070-2250	2000-2400	-	2270
Rainfall (mm)	-	1158	2000-3100	-	2500
Temperature in °C	-	10 - 22	-	-	Cool
Soil	-	-	deep sandy clay	latosol	deep clayey loam
Data source	P.S.P.	P.S.P.	P.S.P.	-	trial plots
No. of plots	29	2	6	-	-
Area of plots	-	1200-2800 m^2	-	-	-
Stems/ha (initial)	-	1700	750	-	-
Measurement specification	7.5 cm u.b.	-	Total vol^h o.b.	-	-
MAI (m^3/ha)	23.8 (14) 1/	22.0 (12.5)	14.2 (6)	21.0	25.0 (19) 1/
(A1)	17.1 (17)	21.0 (17.8)	26.0 (9)	-	22.2 (33)
(A2)	9.8 (18)	19.5 (22.7) 1/	28.3 (12) 1/	-	17.1 (38)
(A3)	-	20.8 (11.1)	27.9 (15)	-	-
(A4)	-	24.3 (17.3)	-	-	-
(A5)	-	24.5 (19.8)	-	-	-
Remarks:	Maximum MAI for site class I, II and III at different ages	MAI for two different plots and thinning included	Crop unthinned. Stocking constant. MAI for different stocking also mentioned	No other details	No other details

1/ Figures in brackets indicate age in years

出典

(4) Golfari, L. Quoted in Wormald, J.J. Pinus patula Tropical Forestry
1975 Paper No. 7, University of Oxford.

(5) Ghosh, R.C. et al. Pinus patula, its problems and prospects in West
1973 Bengal. Indian Forester Vol. 99 No. 6.

(6) Kayumi, S.Y.S. The growth of Pinus patula at three different sites
1976 at Mafuga, Uganda. Forest Dept. Technical Paper No. 214/76.

(7) Kingston, B. A provisional yield table for Pinus patula growing in
1970 Uganda and an estimate of the financial rotation. Technical No. 166/70.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
Pinus oocarpa（オーカルパマツ）
国：ブラジル

データ採取地の立地環境　　成長・収穫に関する表，図，式など

Locality:	Agudos (São Paulo) 22°19'S, 49°4'W	
Altitude:	550 m	
Rainfall:	1 500 mm	
Yield data:	Age	MAI (m^3/ha)
	14	20.14
	8	24.50
Remarks:	Seed origin from Honduras. No other details indicated.	

出典

(2) Ferreira, M. *et al.* Programme for genetic improvement of *Pinus oocarpa*
1978 Schiede in Brazil by the IPEF. Progress and problems of genetic improvement of tropical forest trees. Vol. 2 C.F.I., University of Oxford.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科）
　　　Pinus oocarpa　（オーカルパマツ）
国　：プエルトリコ

データ採取地の立地環境

International provenance trials for this species have been initiated in a number of tropical and sub-tropical countries since 1971.

成長・収穫に関する表，図，式など

Growth rate of some provenances at 5.7 years of age in Puerto Rico is reported as follows (4):

Provenance	MAI (m^3/ha) o.b.
30/71 Mountain Pine Ridge (Belize)	37.0
6/71 Yucul (Nicaragua)	32.6
22/70 Alamicauba (Nicaragua)	32.4
1/70 Camelias (Nicaragua)	30.8
7/71 Singuatepeque (Honduras)	10.8

出典

(4) Lieger et al. 1982 Growth and selected assessment traits of Pinus caribaea and Pinus oocarpa provenance trials in Puerto Rico (unpublished).

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：PINACEAE（マツ科）
Pinus roxburghii　（ヒマラヤマツ）
国　：インド

データ採取地の立地環境

成長・収穫に関する表，図，式など

The height-age-site index relationship is basic to uniform forest growth prediction. The relationship is usually referred to simply as the ***site index curves*** for a particular species in a given environment. Here site index curves for chir pine (***Pinus roxburghii***) has been found out using the data from permanent sample plots maintained in this branch by following nested regression method.

Data pertaining ***Pinus roxburghii*** are collected from 22 permanent sample plots laid out in East Almora, West Almora and Nainital Divisions. These sample plots have been maintained for last 72 years, the oldest of them was laid down during 1912.

The 'Top height' (mean height of the 100 thickest stems per hectare) and age relationship has only been considered upto an age where after the 'Top height' has either become stationary or has declined. The examples are SP Nos 66, 61, 59 of West Almora which has the ages as 117, 117, and 120 years respectively.

In this paper, the nested regression method is used which is statistically the most appropriate and is also amenable to manual calculation. The method is related to a single model of height growth.

$$Ho = H_{max}\, e\,(b/A^k) \qquad \text{.........(1)}$$

(Which is known as Schumacher Equation)

Where Ho is dominant height,
H_{max} is a parameter to be fitted and represents the maximum height the species could reach,
e=2.71828

b is a parameter to be fitted
k is a parameter to be fitted
A is the age of the stand.

By taking logarithms to the base 'e' of both sides of equation (1), we get,

$$\log_e H_o = \log_e H_{max} + b/A^k \qquad \text{.........(2)}$$

If we let

$Y = \log_e H_o$

$X = 1/A^k$

$a = \log_e H_{max}$

Equation 2 becomes

$$Y = a + bX \qquad \text{.........(3)}$$

then 'a' and 'b' can be fitted by linear regression.

Nested regression method was first described by Bailey and Clutter. It involves the use of common slope and common intercept estimators from convariance analysis.

The common slope regression model is given by the equation

$$Y = a_i + bX \quad \ldots\ldots(4)$$

Where 'a_i' is different for each plot, but 'b' (the slope) is same for all plots

The common intercept model is given by the equation :

$$Y = a + b_i X \quad \ldots\ldots(5)$$

Where the intercept 'a' is the same for all plots, but the slope 'b_i' is different for each plot.

In terms of the Schumacher equation, common intercept model is used in this paper with Y as $\log_e H_o$ and X as $1/A^k$.

The statistical estimators for the common slopes and common intercept models are as given hereunder :

The common slope

$$b = \frac{\sum_i^{mi} \left(\sum_j^{ni} X_{ij} \cdot Y_{ij} - \sum_j^{ni} X_{ij} \cdot \sum_j^{ni} Y_{ij} \Big/ ni \right)}{\sum_i^{m} \left[\sum_j^{ni} X_{ij}^2 - \left(\sum_j^{ni} X_{ij} \right)^2 \Big/ ni \right]} \quad \ldots\ldots\ldots\ldots (6)$$

The common intercept

$$a = \frac{\sum_i^{m} \sum_j^{ni} Y_{ij} - \sum_i^{m} \left(\sum_j^{ni} X_{ij} \cdot \sum_j^{ni} X_{ij} Y_{ij} \Big/ \sum_j^{ni} X_{ij}^2 \right)}{\sum_i^{m} ni - \sum_j^{m} \left[\left(\sum_j^{ni} X_{ij} \right)^2 \Big/ \sum_j^{ni} X_{ij}^2 \right]} \quad \ldots\ldots\ldots\ldots (7)$$

The non-linear 'k' coefficient is directly calculated using a regression model containing this coefficient in linear form

Method.

1 Within each plot, a set of transformed 'Y' values are calculated for 2nd, 3rd......nth observations from the formula.

$$Y_{ij} = \log_e \left\{ \left[\frac{H_{ij} - H_{ij-1}}{A_{ij} - A_{ij-1}} \right] \div \tfrac{1}{2} (H_{ij} + H_{ij-1}) \right\} \quad \ldots\ldots (8)$$

(There being no Y value corresponding to the first height observation)

2. A corresponding set of transformed X values are calculated from the formula.

$$X_{ij} = \log_e \left(2/(A_{ij} + A_{ij-1}) \right) \quad \ldots(9)$$

3. Using these transformed values of X and Y, a common slope estimator is calculated by the help of Equation (6).

4. On subtracting 1 from common slope estimator obtained as above, we get the estimate of k.

thus $k = b - 1$

Results : $k = .545867$

For further calculations, it is rounded to 2nd decimal place.

$k = .55$
$b = -9.849$
$a = 4.200$

Using common intercept model we have

$$\log_e H_o = 4.200 + b_i/A^{0.55} \quad ...(10)$$

The top height/Age data of each sample plot was plotted on a graph and points for successive remeasurements joined with straight lines (Fig. 1)

(The points of remeasurements, when height increment is zero or negative, have been ignored in the entire calculations).

Next following the trend of (i) the plots on the lower edge of the mass of data and (ii) the upper edge of the data two curves were drawn by hand.

The two curves read values of height as 21 m (lower curve) and 33 m (upper curve) at a reference age of 80 years.

The range of 12 m (33 m−21 m) is then divided into 6 equal parts Thus we get values of site indices as 21, 23, 25, 27, 29, 31, 33 m at a reference age of 80 years.

The parameter b_i depends upon site index S (Eqn 10)

$$\log_e S_o = 4.200 + b_i/A^{0.55}$$

For a selected site index, b_i is calculated by the formula :

$b_i = (\log_e S - a) \cdot A^{0.55}$

Where $a = 4.200$

$A = 80$

The values of b_i for different site indices are tabulated below .

a = 4.200, Age = 80 yrs	S		b_i
	21	—	-12.8665
	23	—	-11.8535
	25	—	-10.9250
	27	—	-10.0681
	29	—	- 9 2724
	31	—	- 8 5297
	33	—	- 7 8335

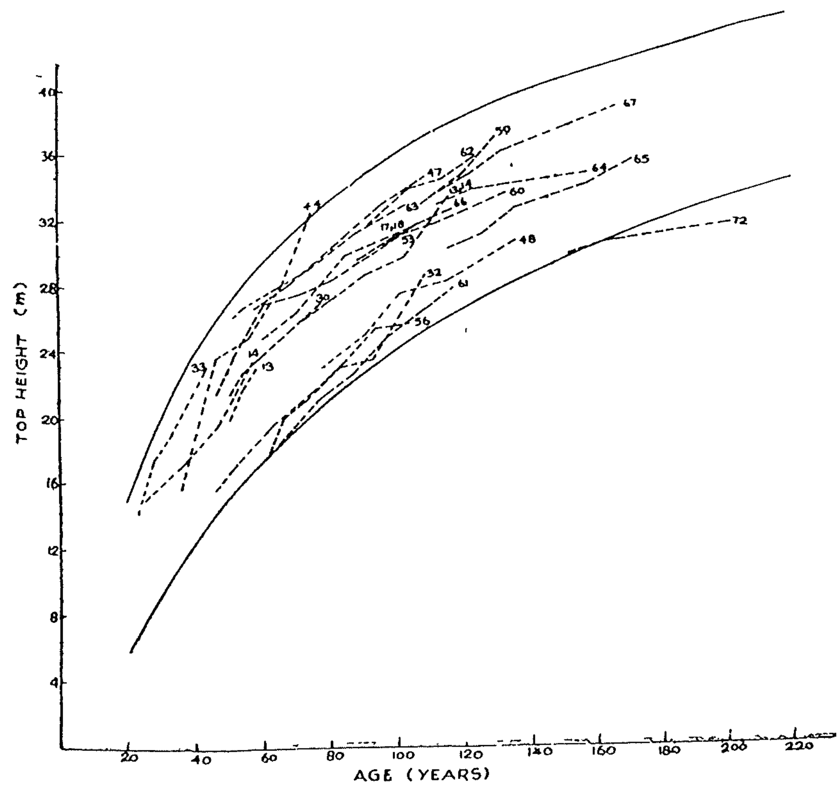
Now $H_{max} = e^a = 66\ 686$ (a = 4 200

Finally from equation (1) substituting the values of H_{max} & k and b_i for each site index curve, values of H_o are calculated for selected values of A, the age

The values of S, b_i A and H_o are tabulated by running a suitable computer programme in National Forest Computer Centre, F R I This is given in Table 1.

The curves that result from the above parameter values are given in Fig 2 on the same scale as is used for the data in Fig 1.

Fig 1



Initial Site Index Curves Drawn from Permanent Sample Plots

Fig 2

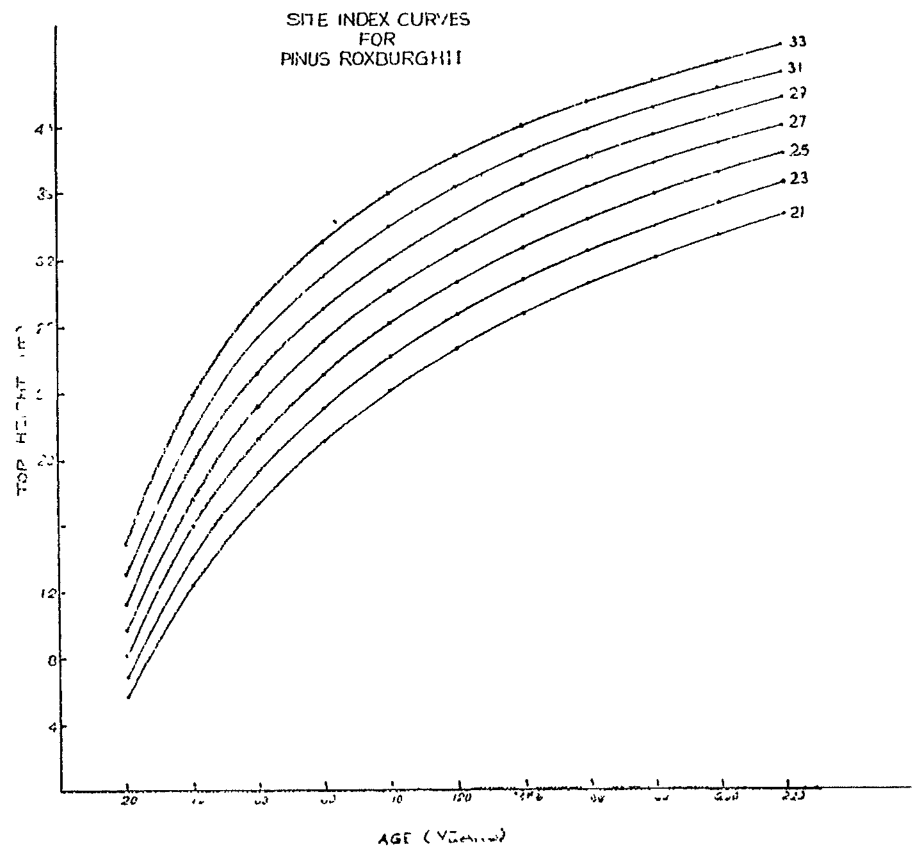


Table 1

K	Common Intercept	H Max
55	4 200	66 686

Species : *Pinus roxburghii*

Data : Sample plot data from West Almora, East Almora and Nainital

The site index curves are drawn based on Schumacher Equation given by
H (o) = H (Max) *E** (B/AGE**K)

Reference Age taken to be 80 years

Site quality slope	21 −12 8665	23 −11.8535	25 −10.9250	27 −10.0681	29 −9 2724	31 −8 5297	33 − 7.8335
1	2	3	4	5	6	7	8
Age			*Estimated height*				
†20	5 602	6 809	8 141	9 601	11 190	12 910	14 762
30	9 191	10 743	12.395	14 144	15.988	17.926	19 955
†40	12.284	14 034	15 856	17.747	19 705	21.726	23.808
50	14 934	16 802	18.717	20.679	22.684	24 730	26 816
†60	17 226	19.163	21.130	23.123	25 142	27.185	29.251
70	19 230	21.208	23.199	25.202	27 217	29 242	31.277
†80	21 000	23.000	25.000	27 000	29.000	31.000	33 000
90	22 579	24.588	26.587	28 576	30.555	32 526	34 489
†100	23 998	26.009	28.000	29 972	31 928	33 868	35.793
110	25.284	27.290	29 269	31.222	33.151	35 060	36.949

(Contd)

1	2	3	4	5	6	7	8
†120	26.456	28.458	30.417	32.344	34 252	36.129	37.983
130	27.631	29.517	31.463	33.372	35.249	37 096	38 915
†140	28.521	30.493	32.421	34.308	36.158	37 975	39.761
150	29.437	31.395	33.303	35.168	36.992	38.783	40.534
†160	30.289	32.231	34.120	35.961	37.760	39.520	41 244
170	31.083	33.008	34.878	36.697	38.471	44.204	41 899
†180	31 826	33.735	35.584	37.382	39.131	40 838	42.506
190	32.524	34 415	36 245	38.021	39.747	41.429	43.070
†200	33.180	35.054	36.865	36.620	40 324	41.981	43.597
210	33.799	35.656	37.448	39 182	40.864	42.499	44.091
†220	34.384	36.225	37.998	39.712	41.373	42 985	44 554

Programme by P.L. Dhawan

Note : 1. Values of height are rounded to 1st place of decimal while plotting the data on the graph.
2. Values marked with (†) are plotted on the graph.

出典

Reference

Misra, N.M. nad Lal, P. (1984). An approach to fit site index curves for *Pinus roxburghii* by nested regression method. Indian For., 110 : 989 -996.

樹種：PINACEAE（マツ科）
Pinus roxburghii （ヒマラヤマツ）
国 ：パキスタン，

データ採取地の立地環境

1 **Basic Data.** This yield table has been prepared for chir pine (*Pinus roxburghii*) of the Guzara forests of Hazara civil division The table is based on data from 74 temporary sample plots laid out in Guzara forests Location of the plots is shown in Figure 1 The size of the plots ranged from 0 1 acres (0 04 hectares) to 0 6 acres (0 24 hectares) and the age of the plots ranged from 12 years to 72 years

2 **Sample size.** In order to determine the number of plots required, an initial sample of 20 plots was taken out in evenaged chir pine crops on private lands on the Abbottabad—Mansehra and Abbottabad-Sherwan roads. The basal area per unit area was considered the criterion for determining the number of plots required. Allowing a permissible error of 10% with t(.05,19)=2 093, the number of plots required worked out to 58. Since the initial sample did not cover all the chir pine area it was decided to take 70-80 plots, about 10-15 in each 10 year age class upto 60 years. Thus 74 plots were finally selected for this study

3 **Selection of plots.** The plots were laid out in crops taht appeared to be fully stocked and even aged Since 10-15 sample plots were to be selected for each decade throughout the tract, a record was kept of the number of plots as the field work progressed

4 **Plot measurements.** The diameters at breast height of all the trees on the lopt were measured About 10 sample trees covering all diameter classes were chosen and subjected to the following measurements·

(*i*) height

(*ii*) age

(*iii*) the 5 year diameter increment under bark at breast heigt

(*iv*) bark thickness

5 **Individual plot calculations.** For each plot the basal area, number of trees, total volume to 2 inches diameter outside bark and volume increment were calculated on acre basis. Also the mean diameter and mean height were calculated. The standard volume tables for Guzara chir pine (2) and the method described by Kuusela (3) were used.

Due to the absence of data on past thinning and mortality, the influence of stand density on volume increment could not be ascertained. The volume increment calculations were therefore not used in making the yield table.

成長・収穫に関する表，図，式など

6. **Preparing the yield table.** Because of the limited number of plots, no division into different site qualities was made The plots were divided into age groups as shown in Table 1.

There was a big variation in the number of trees on unit area basis within each group upto the age of 42 years Three plots were rejected because they contained more than three times the average number for their age group.

The variation in basal area, volume, mean diameter and mean height was less, perhaps because the basal area and volume growth is limited by the amount of light, water and nutrients available

Within each group, the average value of each quantity was found. Smooth curves were drawn to fit these values as closely as possible. Adjustments were then made to satisfy the following conditions.

(*i*) Basal area = 0 005454 × number of trees × mean diameter squared. This is the standard formula linking basal area, number of trees and mean diameter.

(*ii*) The following regression equation was obtained linking total volume, basal area and mean height. Total volume = 0 4662 × basal area × mean height. Correlation coefficient = 0 991.

(*iii*) The mean height and mean diameter approximately follows the height—diameter relationship given by Hussain and Ghauri (2)

Age at breast height was determined in the field To get age of a tree at ground level, five years were added to age at breast height since it was estimated from seedling data that a chir plant took five years to attain breast height in good soil

The mean annual increment and current annual increment were calculated from the following formulae:

$$\text{Mean annual increment} = \frac{\text{Total volume}}{\text{Age at ground level}}$$

$$\text{Current annual increment} = \frac{\text{Volume increment in 5 years}}{5}$$

Table 2 below shows the estimated values of all the quantities in British units, and Table 3 in metric units. Figures 2 to 5 show graphs of the mean diameter, mean height, basal area and volume growth respectively.

6. **Comments.** The diameter and height growth and the total voume increments are almost the same as for interim yield table of chir pine of reserved forests in NWFP (1). But there is difference in number of trees and basal area since the present tables are based on plots where no previous thinnings were carried out, whereas in reserved forests thinnings are carried out under management plans. However volume growth in the guzara forests seems not to be adversely influenced by the higher density.

These forests, therefore, may be thinned when the trees are big enough to be saleable but non-commercial thinning should be avoided as far as possible.

TABLE 2

Yield Table for Guzara Forests of Chir pine in British units.

Age (years)	Mean diameter (inches)	Mean height (ft)	Per acre: Number of trees	Basal area (ft^2)	Total volume (ft^3)	Mean annual increment (ft^3)	Current annual increment (ft^3)
15	2.3	14	2218	64	500	33	64
20	3.8	22	1003	79	820	41	
25	5.3	29	614	94	1230	49	84
30	6.9	36	420	109	1830	61	120
35	8.4	44	320	123	2520	72	138
40	9.9	52	256	134	3250	81	146
45	11.3	59	205	142	3920	87	134
50	12.7	65	165	148	4510	90	118
55	13.9	70	145	152	5000	91	98
(60*	14.6	75	135	156	5480	91	96)
(65	15.1	80	127	160	5950	92	94)
(70	15.6	84	123	164	6400	91	90)

*Values at ages 60, 65 and 70 are not reliable because of lack of data

TABLE 3

Yield Table for Guzara Forests of Chir pine in metric units

Age (years)	Mean diameter (cm)	Mean height (m)	Per hectare: Number of trees	Basal area (m^2)	Total volume (m^3)	Mean annual increment (m^3)	Current annual increment (m^3)
15	5.8	4.3	5481	14.7	35	2.3	4.4
20	9.7	6.6	2478	18.1	57	2.9	
25	13.6	8.8	1517	21.6	86	3.4	5.6
30	17.5	11.1	1038	25.0	128	4.3	8.4
35	21.3	13.4	791	28.2	176	5.0	9.6
40	25.1	15.7	633	30.8	227	5.7	10.2
45	28.7	18.0	507	32.6	274	6.1	9.4
50	32.3	19.8	408	34.0	316	6.3	8.4
55	35.3	21.3	358	34.9	350	6.4	6.8
(60*	37.1	22.8	334	35.8	383	6.4	6.6)
(65	38.4	24.3	314	36.7	416	6.4	6.6)
(70	39.6	25.6	304	37.6	448	6.4	6.4)

*Values at ages 60, 65 and 70 are not reliable because of lack of data.

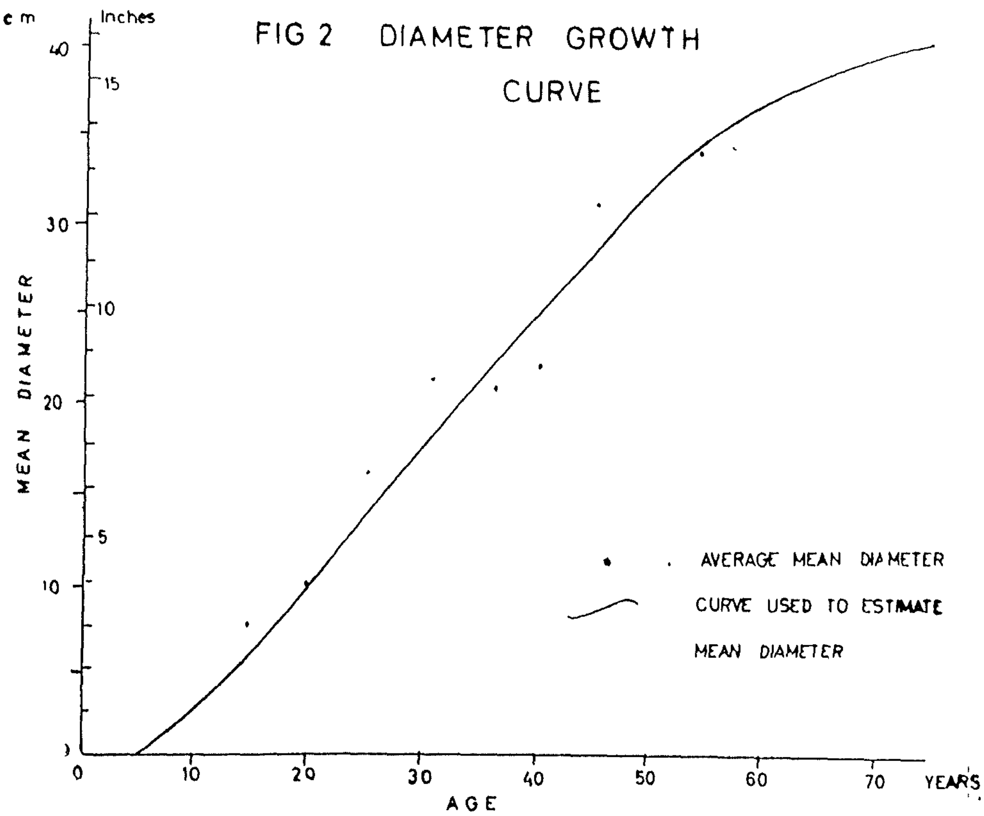
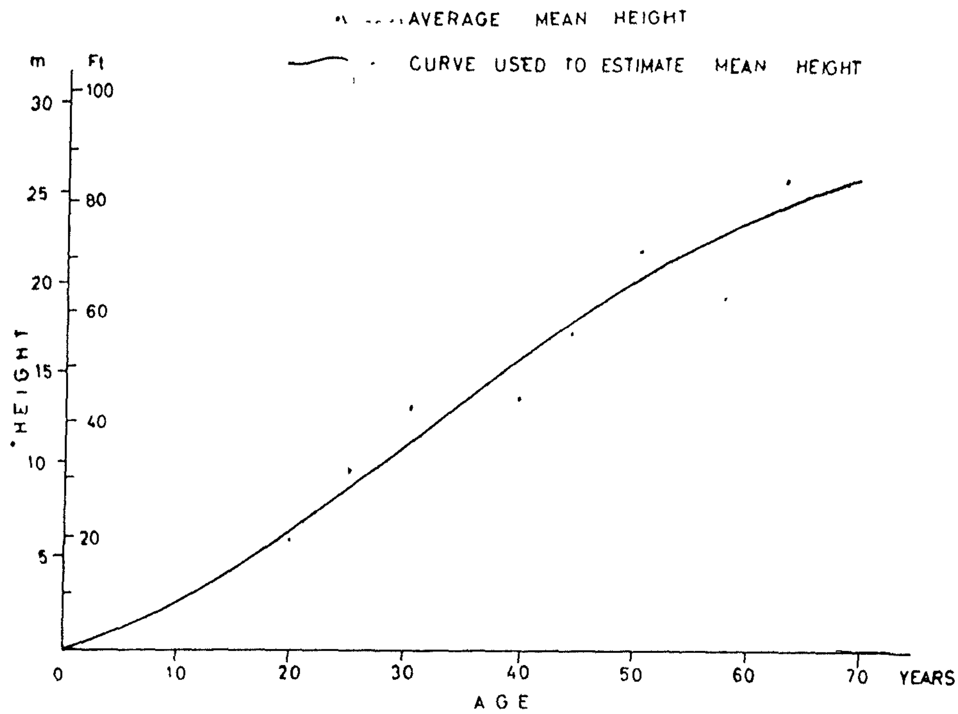


FIG 2 DIAMETER GROWTH CURVE

FIG 3 HEIGHT GROWTH CURVE



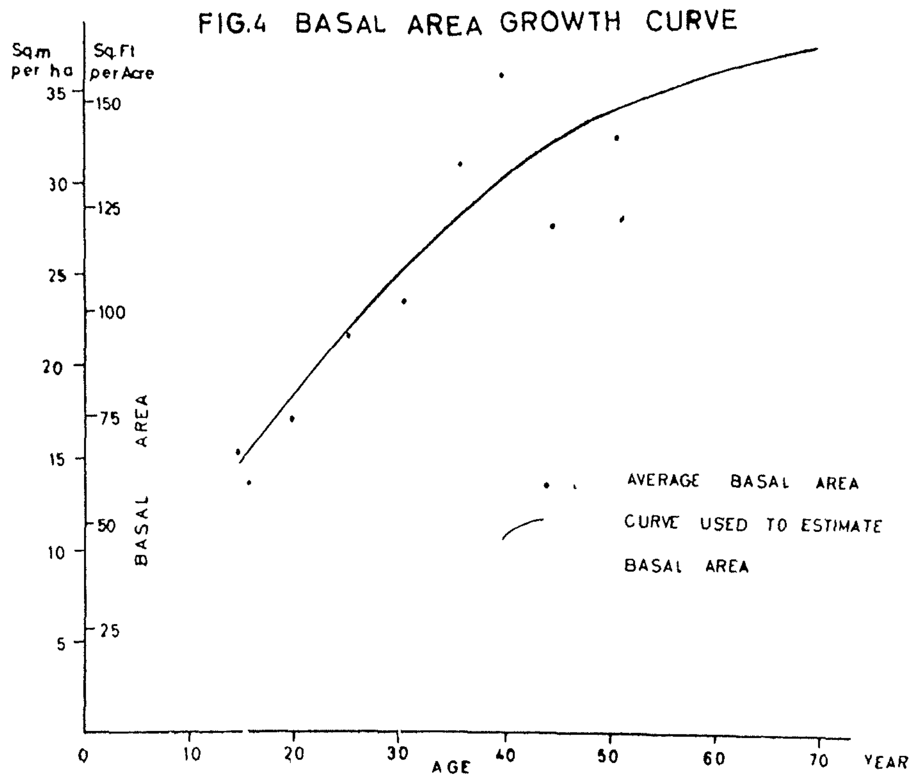


FIG.4 BASAL AREA GROWTH CURVE

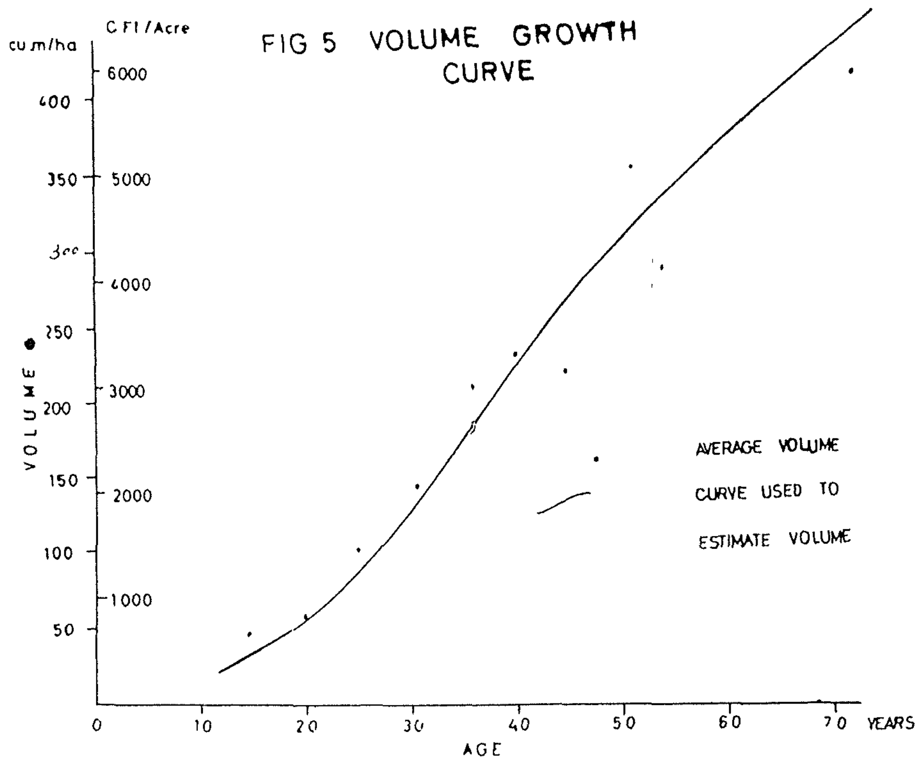


FIG 5 VOLUME GROWTH CURVE

出典

Glennie, E B , Hussain, R W (1978) Empirical Yield for Chii Pine (*Pinus rotburghii*) of Guzara Forests of Hazara, The Pakistan of Forestry, October 1978, 221-229

樹種：PINACEAE（マツ科）
Pinus spp.
国：ブラジル

データ採取地の立地環境

An essential factor for this study is the correlation between species and site. Investigation of the growth of pines in São Paulo is the first approach, since most of the plantations are no older than fifteen years, which means that only a part of the rotation has been analyzed. Of the pines under observation, trustworthy results for Pinus elliottii var. elliottii are available, and to a lesser extent for P. taeda, P. patula, P. khesya, P. caribaea var. caribaea, P. caribaea var. hondurensis, P. oocarpa, and P. caribaea var. bahamensis.

Earlier studies (Van Goor 1965; Golfari 1967) established remarkable correlations between the growth of P. elliottii var. elliottii and some components of the site, such as climate, soil (at the level of great group, as an indicator of natural fertility), and former vegetation. Its yield table, however, is a provisional one.

成長・収穫に関する表，図，式など

Permanent Sample Plots

To obtain exact data on the relation between productivity and site, a number of permanent sample plots were established, representing the most diverse edapho-climatic conditions in the state. For P. elliottii var. elliottii there are 684 plots, selected in accordance with preestablished criteria (Van Goor 1975). Each plot at the end of rotation must contain at least twenty useful trees, and, whenever possible, uncontrollable "external" influences, such as unfamiliarity with the origin of the basic genetic material, must be avoided. A seed of unknown origin can affect productivity to such an extent that the factors of the site may become "disguised."

Table 6. Yields for temperate Pinus (rotation 20 years, spacing 2 x 2 m).*

	Age (yrs)	Outside Bark Thinned (m^3)	Inside Bark Thinned (m^3)	Inside Bark Thinned, as Pulp (m^3)	Stacked Volume Inside Bark, as Pulp (m^3)	Inside Bark for Sawmill (m^3)
P1	7	46	34	34	44	--
	9	56	42	32	41	10
	12	72	54	24	31	30
	16	91	68	10	13	58
	20	325	244	25	33	219
	Total	590	442	125	162	317
P2	7	35	26	26	34	--
	9	43	32	28	35	4
	12	54	40	22	28	18
	16	69	52	11	15	41
	20	232	174	18	25	156
	Total	433	324	105	137	219
P3	7	25	19	19	24	--
	9	32	24	24	31	--
	12	40	30	20	26	10
	16	51	38	10	13	28
	20	170	128	13	17	115
	Total	318	239	86	111	153

*See note for Table 5.

Table 5. Yields for temperate *Pinus* (rotation 35 years, spacing 2 x 2 m).*

	Age (yrs)	Outside Bark Thinned (m^3)	Inside Bark Thinned (m^3)	Inside Bark Thinned, as Pulp (m^3)	Stacked Volume Inside Bark, as Pulp (m^3)	Inside Bark for Sawmill (m^3)
P1	7	46	34	34	44	--
	9	56	42	32	41	10
	12	72	54	24	31	30
	16	91	68	10	13	58
	23	105	79	8	10	71
	35	470	353	35	45	318
	Total	840	630	143	184	487
P2	7	35	26	26	34	--
	9	43	32	28	35	4
	12	54	40	22	28	18
	16	69	52	11	15	41
	23	80	60	6	8	54
	35	341	256	26	34	230
	Total	622	466	119	154	347
P3	7	25	19	19	24	--
	9	32	24	24	31	--
	12	40	30	20	26	10
	16	51	38	10	13	28
	23	60	45	5	7	40
	35	256	192	20	26	172
	Total	464	348	98	127	250

*Percentage of bark = 25%. Bark factor = 0.866. Form factor = 0.50. Coefficient of stacking = 1.30. Square bark factor = 0.75 (% of wood).

or

$$T_r = P - E - \frac{\Sigma c}{\Sigma q}$$

dividing T_r by the cost of transportation for $m3/km$ of wood, one determines the maximum possible radius for transportation.

It becomes evident that when the effective rentability is equal to the potential rentability, the sum available for transportation will be equal to zero and the transportation of wood will not be economical.

出典

Victor, M A M , Kronka, F J M et al Land Classification for Industrial Afforestation in the State of Sao Paulo, Brazil, Forest Site and Productivity, 69-92

福建闽北杉木人工林收获预测表

立地指数：19

初植密度：4500株/公顷 300株/亩

表1

林龄	林分状况							主林木				付林木				备注
	上层树高 (m)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	林分平均树高 (m)	产量比数	每公顷株数/数株亩每 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	
4	5.9	4500/300			42.7/2.85		0.65									
6	8.0	4500/300	7.6	20.43	82.9/5.53	6.4	0.74	3000/200	8.6	17 43	70.6/4.71	1500/100	5.1	3.00	12.3/0.82	第一次间伐强度 材积14.8% 株数33.3%
8	10.9	3000/200	10.8	27.48	139.4/9.29	9 0	0.73									
10	13.1	3000/200	12.2	35 07	206.5/13.77	11.0	0 80	1600/107	14 5	26 42	160.6/17.71	1400/93	8.8	8.65	45.9/3.06	第二次间伐强度 材积22.2% 株数46.7%
12	14.9	1600/107	16.0	32 18	214.6/14.31	12.6	0.66									
14	16.2	1600/107	17.0	36.32	258.6/17.24	13 7	0.71									
16	17.3	1600/107	18.0	40.72	298.9/19.93	14.7	0.72									
18	18.3	1600/107	18.7	43.94	338.0/22.53	15.6	0.74									
20	19 0	1600/107	19 2	46.32	366.8/24.45	16.3	0 75									
22	19.7	1600/107	19.7	48.77	396.8/26.45	16.9	0 77									
24	20.3	1600/107	20.1	50.77	423.3/28.22	17.4	0 78									
26	20.8	1600/107	20 5	52.82	446.1/29.74	17.9	0.79									
28	21.2	1600/107	20.8	54.37	464.7/30.98	18.3	0 79									
30	21.6	1600/107	21 1	55 95	483.7/32.25	18.6	0.80									

立地指数：19

初植密度：3750株/公顷 250株/亩

表2

林龄	林分状况							主林木				付林木				备注
	上层河高 (m)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	林分平均树高 (m)	产量比数	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	
6	8.0	3750/250	8.1	19.31	77.5/5.2	6.4	0.70									
8	10.9	3750/250	10.0	29.44	150.5/10.0	9.0	0.80	2000/133	12.0	22.63	117.6/7.8	1750/117	7.0	6.82	32.9/2.2	第一次间伐强度 材积21.9% 株数46 7%
10	13.1	2000/133	13.7	29.48	177.5/11.8	11.0	0.69									
12	14.9	2000/133	15.1	35.82	235.5/15.7	12.6	0.73									
14	16.2	2000/133	16.1	40.72	282.4/18.8	13.7	0.76	1600/107	17.0	36.32	258.6/17.2	400/27	11.9	4.4	23.8/1.6	第二次间伐强度 材积8 4% 株数20%
16	17.3	1600/107	18.0	40.72	298.9/19.9	14.7	0.72									
18	18.3	1600/107	18.7	43.94	338.0/22.5	15.6	0.74									
20	19.0	1600/107	19.2	46.32	366.8/24.5	16.3	0.75									
22	19.7	1600/107	19.7	48.77	396.8/26.5	16.9	0.77									
24	20.3	1600/107	20.1	50.77	423.3/28.2	17.4	0.78									
26	20.8	1600/107	20.5	52.82	446.1/29.7	17.9	0.79									
28	21.2	1600/107	20.8	54.37	461.7/31.0	18.3	0.79									
30	21.6	1600/107	21.1	55.95	483.7/32.2	18.6	0.80									

立地指数：19

初植密度：3000株/公顷 200株/亩

表3

林龄	林分状况 上层树高 (m)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	林分平均树高 (m)	产量比数	主林木 每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	付林木 每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	备注
6	8.0	3000/200	8.6	17.43	70.6/4.7	6.4	0.63									
8	10.9	3000/200	10.8	27.48	139.4/9.3	9.0	0 73									
10	13.1	3000/200	12.2	25.07	206.5/13.8	11.0	0 80	1600/107	14.5	26.42	160.6/10.7	1400/93	8.8	8.65	45.9/3.1	第一次间伐强度 材积22.2% 株数46.7%
12	14.9	1600/107	16.0	32.18	214.6/14.3	12.6	0.66									
14	16.2	1600/107	17.0	36.32	258.6/17.2	13.7	0 71									
16	17.3	1600/107	18.0	40.72	298.9/19.3	14.7	0.72									
18	18.3	1600/107	18.7	43.94	338.0/22.5	15.6	0.74									
20	19.0	1600/107	19.2	46.32	366.8/24.5	16.3	0.75									
22	19.7	1600/107	19.7	48.77	396.8/26.5	16.9	0.63									
24	20.3	1600/107	20.1	50.77	423.3/28.2	17.4	0.64									
26	20.8	1600/107	20.5	52.82	446.1/29.7	17.9	0.65									
28	21.2	1600/107	20.8	54.37	464.7/30.98	18.3	0.65									
30	21.6	1600/107	21.1	55.95	483.7/32.2	18 6	0.66									

立地指数：19

初植密度：2250株/公顷 150株/亩

表4

林龄	林分状况							主林木				付林木				备注
	上层树高（m）	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷胸高断面积（m²）	每公顷干材积/每亩干材积（m³）	林分平均树高（m）	产量比数	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷胸高断面积（m²）	每公顷干材积/每亩干材积（m³）	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷胸高断面积（m²）	每公顷干材积/每亩干材积（m³）	
6	8.0	2250/150	9.0	14.31	61.4/4.09	6.4	0.55									
8	10.9	2250/150	11.6	23.78	129.8/8.65	9.0	0.69									
10	13.1	2250/150	13.3	31.25	186.2/12.41	11.0	0.72									
12	14.9	2250/150	14.6	37.67	246.2/16.41	12.6	0.76	1600/107	16.0	32.16	214.7/14.31	650/43	10.4	5.51	31.5/2.10	第一次间伐强度 材积14.7% 株数28.9%
14	16.2	1600/107	17.0	36.32	258.6/17.24	13.7	0.71									
16	17.3	1600/107	18.0	40.72	298.9/19.93	14.7	0.72									
18	18.3	1600/107	18.7	43.94	338.0/22.53	15.6	0.74									
20	19.0	1600/107	19.2	46.32	366.8/24.45	16.3										
22	19.7	1600/107	19.7	48.77	396.8/26.45	16.9										
24	20.3	1600/107	20.1	50.77	423.3/28.22	17.4										
26	20.8	1600/107	20.5	52.82	446.1/29.74	17.9										
28	21.2	1600/107	20.8	54.37	464.7/30.98	18.3										
30	21.6	1600/107	21.1	55.95	483.7/32.25	18.6										

立地指数： 15

初植密度：5250株/公顷 350株/亩

表 5

林龄	林分状况							主林木				付林木				备注
	上层树高（m）	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷胸高断面积（m²）	每公顷干材积/每亩干材积（m³）	林分平均树高（m）	产量比数	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷胸高断面积（m²）	每公顷干材积/每亩干材积（m³）	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷胸高断面积（m²）	每公顷干材积/每亩干材积（m³）	
6	5 8	5250/350	5.8	13.86	43.8/2.92	4.4	0.68									
8	8.2	5250/350	7.4	22.58	92.0/6.13	6.6	0.79	3250/217	8.6	18 88	77.1/5 14	2000/133	4.8	3.70	14.8/0.99	第一次间伐强度 材积16.1% 株数38.1%
10	10.0	3250/217	9.9	25.03	119.2/7.95	8.2	0.71									
12	11.5	3250/217	10.9	30 32	160.8/10.72	9.5	0 77	2250/150	12 1	25 88	139.8/9.32	1000/67	7 5	4.44	21.0/1.40	第二次间伐强度 材积13.1% 株数44.4%
14	12 6	2250/150	13.0	29.86	171.0/11.4	10.5	0.70									
16	13.6	2250/150	13.7	33.17	202.1/13.47	11.4	0.71									
18	14.4	2250/150	14.3	36.14	228.7/15.25	12.1	0.74									
20	15.0	2250/150	14.7	38.18	249.7/16.47	12.7	0.76									
22	15 6	2250/150	15.1	40.30	271.7/18.11	13.2	0 77									
24	16.1	2250/150	15.5	4[illegible].46	290.6/19.37	13.7	0 78									
26	16.5	2250/150	15.7	43.56	306.2/20.41	14.0	0.78									
28	16.9	2250/150	16 0	45.25	322.1/21.47	14.4	0.79									
30	17.2	2250/150	16.2	46.37	334.5/22.30	14.6	0.80									

立地指数：15

初植密度：4500株/公顷 300株/亩

表6

林龄	林分状况：上层树高 (m)	林分状况：每公顷株数/每亩株数 (株)	林分状况：平均胸径 (cm)	林分状况：每公顷胸高断面积 (m²)	林分状况：每公顷干材积/每亩干材积 (m³)	林分状况：林分平均树高 (m)	林分状况：产量比数	主林木：每公顷株数/每亩株数 (株)	主林木：平均胸径 (cm)	主林木：每公顷胸高断面积 (m²)	主林木：每公顷干材积/每亩干材积 (m³)	付林木：每公顷株数/每亩株数 (株)	付林木：平均胸径 (cm)	付林木：每公顷胸高断面积 (m²)	付林木：每公顷干材积/每亩干材积 (m³)	备注
6	5.8	4500/300	6.1	13.14	41.1/2.74	4.4	0.64									
8	8.2	4500/300	7.8	21.51	87.4/5.83	6.6	0.75	2900/193	8.8	17.63	73.5/4.90	1600/107	5.6	3.88	13.9/0.98	第一次间伐强度 材积15.9% 株数35 6%
10	10.0	2900/193	10.2	23.70	114.0/7.60	8.2	0.70									
12	11.5	2900/193	11.3	29.09	154.5/10.30	9.5	0.75	2250/150	12.1	25.88	139.8/9.32	650/43	7.9	3.22	14.7/0.98	第二次间伐强度 材积9 5% 株数18 9%
14	12.6	2250/150	13.0	29.86	171.0/11.40	10.5	0.70									
16	13.5	2250/150	13 7	33.17	202.1/13.47	11.4	0.71									
18	14.4	2250/150	14 3	36.14	228.7/15.25	12.1	0.74									
20	15.0	2250/150	14.7	38.16	249.7/16.65	12.7	0.76									
22	15.6	2250/150	15.1	40.30	271.7/18.11	13.2	0.77									
24	16.1	2250/150	15.5	42.46	290.6/19.37	13.7	0.78									
26	16.5	2250/150	15.7	43.56	306.2/20.41	14.0	0.78									
28	16.9	2250/150	16.0	45 25	322.1/27.47	14.4	0.79									
30	17.2	2250/150	16.2	46.37	334.5/22.30	14.6	0.80									

立地指数：15

初植密度：3750株/公顷 250株/亩

表7

林龄	林分状况 上层树高 (m)	林分状况 每公顷株数/每亩株数 (株)	林分状况 平均胸径 (cm)	林分状况 每公顷胸高断面积 (m^2)	林分状况 每公顷干材积/每亩干材积 (m^3)	林分状况 林分平均树高 (m)	林分状况 产量比数	主林木 每公顷株数/每亩株数 (株)	主林木 平均胸径 (cm)	主林木 每公顷胸高断面积 (m^2)	主林木 每公顷干材积/每亩干材积 (m^3)	付林木 每公顷株数/每亩株数 (株)	付林木 平均胸径 (cm)	付林木 每公顷胸高断面积 (m^2)	付林木 每公顷干材积/每亩干材积 (m^3)	备注
6	5.8	3750/250	6.4	12.08	37.9/2.53	4.4	0.59									
8	8.2	3750/250	8.2	19.80	81.8/5.45	6.6	0.71	2750/183	8.9	17.10	71.7/4.78	1000/67	5.8	2.70	10.1/0.67	第一次间伐强度 材积12.3% 株数26.7%
10	10.0	2750/183	10.1	23.35	111.6/7.44	8.2	0.68									
12	11.5	2750/183	11.5	28.57	151.5/10.10	9.5	0.73									
14	12.6	2750/183	12.3	32.67	184.5/12.30	10.5	0.76	2250/150	13.0	29.86	171.0/11.40	500/33	8.5	2.81	13.5/0.90	第二次间伐强度 材积7.3% 株数18.2%
16	13.6	2250/150	13.7	33.17	202.1/13.47	11.4	0.73									
18	14.4	2250/150	14.2	35.64	228.7/15.25	12.1	0.75									
20	15.0	2250/150	14.7	38.18	249.7/16.65	12.7	0.77									
22	15.6	2250/150	15.1	40.28	271.7/18.11	13.2	0.78									
24	16.1	2250/150	15.5	42.53	290.6/19.37	13.7	0.79									
26	16.5	2250/150	15.7	43.65	306.2/20.41	14.0	0.79									
28	16.9	2250/150	16.0	45.23	322.1/21.47	14.4	0.80									
30	17.2	2250/150	16.2	46.35	334.5/22.30	14.6	0.81									

立地指数：　1 5

表8　　　　　　　　　　　　　　　　　　　　　　　　　　初植密度：3000株/公顷 200株/亩

林龄	林分状况							主林木				付林木				备注
	上层树高 (m)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	林分平均树高 (m)	产量比数	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	
6	5 8	3000/200	6.7	10.59	33.9/2.26	4.4	0.52									
8	8.2	3000/200	8.8	18.24	74.6/4.97	6 6	0.64									
10	10.0	3000/200	10.1	24 03	115.6/7.71	8.2	0.68									
12	11.5	3000/200	11.2	29 55	156.4/10.43	9.5	0 75	2250/150	12.1	25 68	139.8/9.32	750/50	8 1	3.87	16.6/1.11	间伐强度 材积10.6% 株数25.0%
14	12 6	2250/150	13.0	29.86	171.0/11.40	10 5	0.66									
16	13.6	2250/150	13.7	33.17	202.1/13.47	11.4	0.68									
18	14.4	2250/150	14.3	36.14	228.7/15.25	12.1	0.70									
20	15.0	2250/150	14.7	38.18	249.7/16.65	12.7	0.72									
22	15 6	2250/150	15.1	40.30	271.7/18.11	13.2	0 73									
24	16 1	2250/150	15.5	42.46	290.6/19.37	13.7	0 74									
26	16.5	2250/150	15.7	43.56	306.2/20.41	14.0	0 75									
28	16.9	2250/150	16 0	45.25	322.1/21.47	14.4	0.76									
30	17.2	2250/150	16.2	46.37	334.5/22.30	14.6	0.77									

立地指数：11

初植密度：6000/公顷 400/亩

表9

林龄	林分状况：上层树高 (m)	林分状况：每公顷株数/每亩株数 (株)	林分状况：平均胸径 (cm)	林分状况：每公顷胸高断面积 (m²)	林分状况：每公顷干材积/每亩干材积 (m³)	林分状况：林分平均树高 (m)	林分状况：产量比数	主林木：每公顷株数/每亩株数 (株)	主林木：平均胸径 (cm)	主林木：每公顷胸高断面积 (m²)	主林木：每公顷干材积/每亩干材积 (m³)	付林木：每公顷株数/每亩株数 (株)	付林木：平均胸径 (cm)	付林木：每公顷胸高断面积 (m²)	付林木：每公顷干材积/每亩干材积 (m³)	备注
6	3.6	6000/400	4.0	7.56	16.0/1.07	2.4										
8	5.4	6000/400	5.3	13.26	39.5/2.63	4.1	0.70	4800/320	5.7	12.24	36.1/2.40	1200/80	3 3	1.02	3.4/0.23	第一次间伐强度 材积8.7% 株数25%
10	6.9	4800/320	6.8	17.42	61.8/4.12	5.4	0.71									
12	8.0	4800/320	7.5	21.22	84.8/5.65	6.4	0.76	3000/200	8.6	17.43	70.6/4.70	1800/120	5.4	3.79	14.2/0.95	第二次间伐强度 材积16 8% 株数45.2%
14	9.2	3000/200	9.5	21.27	96.3/6.42	7.5	0.68									
16	9.8	3000/200	10.0	23.55	110.5/7.37	8.0	0.70									
18	10.4	3000/200	10.4	25.47	125.9/8.39	8.7	0.72									
20	11.0	3000/200	10.8	27.48	142.2/9.48	9.1	0.74									
22	11.5	3000/200	11.2	29.55	156.5/10.43	9.5	0.76									
24	11.9	3000/200	11.5	31.17	168.3/11.22	9.9	0.77									
26	12.3	3000/200	11.7	32.25	180.6/12.04	10.3	0.78									
28	12.6	3000/200	11.9	33.36	190.2/12.68	10.6	0.78									
30	12.9	3000/200	12.1	34.5	200.0/13 33	10.8	0.79									

立地指数：1 1

初植密度：5250株/公顷 350株/亩

表10

林龄	林分状况：上层树高(m)	林分状况：每公顷株数/每亩株数(株)	林分状况：平均胸径(cm)	林分状况：每公顷胸高断面积(m²)	林分状况：每公顷干材积/每亩干材积(m³)	林分状况：林分平均树高(m)	林分状况：产量比数	主林木：每公顷株数/数株亩每(株)	主林木：平均胸径(cm)	主林木：每公顷胸高断面积(m²)	主林木：每公顷干材积/每亩干材积(m³)	付林木：每公顷株数/每亩株数(株)	付林木：平均胸径(cm)	付林木：每公顷胸高断面积(m²)	付林木：每公顷干材积/每亩干材积(m³)	备注
6	3.6	5250/350	4.1	6.93	15.0/1.00	2.4										
8	5.4	5250/350	5.5	12.50	37.5/2.50	4.1	0.66									
10	6.9	5250/350	6.6	17.96	63.8/4.25	5.4	0.74	3800/253	7.2	15.47	56.3/3.75	1450/97	4.7	2.49	7.5/0.50	第一次间伐强度 材积11.8% 株数27.8%
12	8.0	3800/253	8.1	19 57	77.9/5.19	6.4	0 70									
14	9 2	3800/253	8.9	23.64	105.4/7.03	7.5	0.74									
16	9.8	3800/253	9.3	25.80	120.7/8.05	8.0	0.75	3000/200	10 0	23 55	110.6/7.37	800/53	6.0	2.25	10.1/0.67	第二次间伐强度 材积8.4% 株数21.1%
18	10.4	3000/200	10.4	25.47	125.9/8.39	8.7	0.72									
20	11.0	3000/200	10.8	27.48	142.2/9.48	9.1	0.74									
22	11 5	3000/200	11.2	29.55	156.5/10.43	9.5	0.76									
24	11.9	3000/200	11.5	31.17	168.3/11.22	9.9	0 77									
26	12.3	3000/200	11.7	32.25	180.6/12.04	10.3	0 77									
28	12.6	3000/200	11 9	33.36	190.2/12.68	10.6	0.78									
30	12.9	3000/200	12.1	34.50	200.0/13.33	10.8	0.80									

立地指数：　　1 1

表11　　　　　　　　　　　　　　　　　初植密度：4500株/公顷 300株/亩

林龄	林分状况							主林木				付林木				备注
	上层树高（m）	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷高断面胸积（m²）	每公顷干材积/每亩干材积（m³）	林分平均树高（m）	产量比数	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷高断面胸积（m²）	每公顷干材积/每亩干材积（m³）	每公顷株数/每亩株数（株）	平均胸径（cm）	每公顷高断面胸积（m²）	每公顷干材积/每亩干材积（m³）	
6	3.6	4500/300	4.3	6.53	13.8/0.92	2.4										
8	5.4	4500/300	5.8	11.88	35.07/2.34	4.1	0 61									
10	6.9	4500/300	6.9	16.83	60.3/4.02	5.4	0.70	3600/240	7.3	15.06	55.0/3.67	900/60	4.9	1.76	5.3/0.35	第一次间伐强度 材积8.9% 床数20%
12	8.0	3600/240	8.2	19.01	76.3/5.09	6.4	0 68									
14	9.2	3600/240	9.0	22.90	103.4/6.89	7.5	0.73									
16	9 8	3600/240	9.4	24.98	118.4/7.89	8.0	0.75	3000/200	10.0	23.55	110.6/7.37	600/40	5.5	1.43	7.8/0.52	第二次间伐强度 材积6.6% 株数16.7%
18	10.4	3000/200	10.4	25.47	125.9/8.39	8.7	0.72									
20	11.0	3000/200	10.8	27.48	142.2/9.48	9.1	0.74									
22	11.5	3000/200	11.2	29.55	156.5/10.43	9.5	0.76									
24	11.9	3000/200	11.5	31.17	168.3/11.22	9.9	0.77									
26	12.3	3000/200	11.7	32.25	180.6/12 04	10.3	0 77									
28	12.6	3000/200	11 9	33.36	190.2/12.68	10.6	0.78									
30	12.9	3000/200	12 1	34.50	200/13.33	10.8	0.80									

出典 呉敬·王篤治·凸仁喜(1981). 林業調査規劃.

立地指数: 11

初植密度: 3750/公顷 250/亩

表12

林龄	林分状况							主林木				付林木				备注
	上层树高 (m)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	林分平均树高 (m)	产量比数	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	每公顷株数/每亩株数 (株)	平均胸径 (cm)	每公顷胸高断面积 (m²)	每公顷干材积/每亩干材积 (m³)	
6	3.6	3750/250	4.4	5.70	12.4/0.83	2.4										
8	5.4	3750/250	6.1	10.95	32.2/2.15	4.1	0.56									
10	6.9	3750/250	7.3	15.70	55.9/3.73	5.4	0.65									
12	8.0	3750/250	8.1	19.31	77.5/5.17	6.4	0.70	3000/200	8.6	17.43	70.6/4.71	750/50	5.7	1.88	6.9/0.46	间伐强度 材积8 9% 株数20%
14	9.2	3000/200	9.5	21.27	96.3/6.42	7.5	0.68									
16	9.8	3000/200	10.0	23.55	110.5/7.37	8.0	0.70									
18	10.4	3000/200	10.4	25.47	125.9/8.39	8.7	0.72									
20	11.0	3000/200	10.8	27.48	142.2/9.48	9.1	0.74									
22	11.5	3000/200	11.2	29.55	156.5/10.43	9.5	0.76									
24	11 9	3000/200	11.5	31.17	168.3/11.22	9.9	0.77									
26	12.3	3000/200	11.7	32.25	180.6/12.04	10.3	0.77									
28	12.6	3000/200	11.9	33 36	190.2/12.68	10.6	0.78									
30	12.9	3000/200	12.1	34.50	200.0/13.33	10.8	0.80									

樹種：TAXODIACEAE（スギ科）
Cryptomeria japonica （スギ）
国　：インド

データ採取地の立地環境

Study sites

The study sites are located in Darjeeling (26°37′ to 27°30 N and 87°59′ to 88°56′ E) of West Bengal which receive 3300 mm mean annual rainfall and experience 16°C and 10°C mean annual maximum and minimum temperatures respectively. Nine sites with wide range of elevations, slopes etc. (3 from Kalimpong, 2 from Kurseong and 4 from Darjeeling Forest Divisions) of transplantation areas of this district were selected in the present investigation Important parameters of the study sites are tabulated in Tables 1 and 2. The soils of nine sites have already been classified (Nath *et al* 1983, 1986; Pal *et al.* 1984) according to the Taxonomic System of classification (Soil Survey Staff 1975).

The greater portion of the district is covered by the Darjeeling gneisses and consists of garnetiferous mica schist, quartzites and biotite-kyanite and sillimanite gneiss.

The ground flora in the study sites are thin and mainly composed of Ferns, Kamli (*Boehemia* spp.), Bilauni (*Maesa chisia*) etc.

Materials and methods

Vegetational parameters and growth attributes were recorded following the method suggested by Dombois and Ellenberg (1974). In each stand, 12 tree quadrats (10 m × 10 m) were laid out and vegetational parameters listed in Table 1 were recorded. Soil pedons were exposed in each site and profile morphology was recorded as per the Soil Survey Manual (Soil Survey Staff 1975) Soil samples collected from each horizon were analysed in the laboratory for their physicochemical attributes following standard methods (Piper 1950; Black 1965; Jackson 1973) The weighted average values for the physicochemical attributes upto 60 cm depth were presented for the present investigation.

G B H. (Girth at breast height) of *C japonica* at different ages recorded in Silvicultural Experimental plots of Kalimpong and Darjeeling Forest Divisons was considered as base to compare the growth performance of the transplantations in the field. From the G B.H. data collected from Experimental plots, a curve was drawn against age of trees. Taking this as reference, average G.B.H. of each transplanted crops of the study sites were plotted in the same curve against the respective age (Fig 1) and performance was noted in terms of percent deviation from the base (Table 1). The volume of *C japonica* was calculated using the average G B H. and farm factor applicable for the area.

Table 1

Site characteristics and vegetational parameters

Site	Division	Elevation (m)	Slope (%)	Age of plants (year)	No of plants per ha	Average height (m)	Av Girth (GBH) (cm)	Volume* of timber	Basal area (m²/ha)	Standard** G B H.	Per cent increase in G B H. over standard
I	Kalimpong	1710	10 0	12	1329	12 6	76 6	398 7	62.1	45 0	70.2
II	Kalimpong	2000	30 0	17	1406	14 4	90.3	632.7	91 3	61 5	46 8
III	Darjeeling	2150	15 0	46	915	31 5	132 3	915 0	127 5	137 5	−3.8
IV	Darjeeling	1902	30 0	49	875	32.5	155 5	1268.7	168 4	144 0	8 0
V	Darjeeling	2250	15 0	51	883	33 4	135.2	949 2	128.5	147 0	− 8.0
VI	Kurseong	1650	20 0	52	739	34.9	202 5	1995 3	241 3	149 0	35 9
VII	Kalimpong	1975	40.0	53	778	31.7	128 3	719 6	102 0	151 0	− 15 0
VIII	Kurseong	1890	29.0	55	696	35.0	162.0	1113.6	145 4	154 0	5 2
IX	Darjeeling	2275	8 0	61	712	37 2	185 3	1566 2	194 6	162 0	14 4

*Calculated from G B.H and No. of trees

**Computerised from Table values collected from experimental plots of Kalimpong, Darjeeling and Kurseong Divisions.

出典

Balvinder Singh, S.,Nath, P.K. Das, S.B. Singh and S.K. Banerjee (1987). Soil Characteristics under introduced Cryptomeria japonica (Dhupi) in Darjeeling Himalayan Region. Indian For., 113 : 191-201.

樹種：TAXODIACEAE(スギ科)
Cryptomeria japonica (スギ)
国 ：インド

データ採取地の立地環境

Locality: hill slopes in West Bengal
Altitude: 1 500 to 2 400 m
Rainfall: 3 000 mm
Data source: permanent sample plots
Number of plots: 27

Site quality function:

$$\log H = 4.38294 - 6.79859 \frac{1}{\sqrt{A}} \qquad (r^2 = 0.826)$$

where: H = top height in metres
A = stand age in years

Three site qualities have been identified for reference age of 30 years.

Site quality	Top height in m
I	27.1
II	23.1
III	19.1

成長・収穫に関する表，図，式など

MAI and basal area by site quality

Age (years) \ Site quality	I		II		III	
	Basal area m^2/ha	MAI (m^3/ha)	Basal area m^2/ha	MAI (m^3/ha)	Basal area m^2/ha	MAI (m^3/ha)
5	10.2	12.6	7.8	11.4	5.8	10.5
10	38.5	20.1	29.7	14.5	21.7	10.5
15	63.4	29.0	57.0	20.4	37.9	13.6
20	78.9	34.1 (15.6)	67.0	24.7 (6.7)	53.1	16.6 (0.2)
30	94.9	38.0 (25.7)	85.7	28.8 (17.5)	73.2	20.4 (9.7)
40	102.3	38.4 (28.7)	95.3	30.2 (21.6)	84.9	22.0 (14.4)
50	106.2	37.7 (29.8)	100.7	30.3 (23.5)	92.0	22.8 (16.8)

Remarks: Thinning yield has been included and measurement specification for volume production is 5 cm diameter over bark. Figures in brackets give MAI of standard timber (measured up to 20 cm diameter under bark). Basal area seems to be on higher side.

出典

(3) Singh, S.P. *et al.* 1982 Growth performance of *Cryptomeria japonica* in hills of West Bengal. Indian Forester. May issue.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：TAXODIACEAE(スギ科)
Cryptomeria japonica (スギ)
国　：日本

データ採取地の立地環境

成長・収穫に関する表，図，式など

<u>JAPAN</u> (1)

Locality:　Kumamoto

<u>Yield data for best site</u>

Age (years)	MAI (m^3/ha)
10	8.8
20	15.0
30	14.6
40	14.0
50	13.3
60	12.6

<u>Remarks</u>: No other detail mentioned.

出典

(1) Goor, 1965　Reflorestamento com coniferas no Brazil. Boletim No. 9 Ministerio da Agricultura, Serviço Florestal Rio de Janeiro.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO 1983　所収

樹種：TAXODIACEAE(スギ科)
Cryptomeria japonica (スギ)

國：台灣

データ採取地の立地環境

第一章　生育環境概況

作爲實驗對象之柳杉人工林，係分佈於台灣大學實驗林之各營林區內，地近北緯 24°與北廻歸線之間及東經 121° 之西。海拔高約爲 860 公尺至 2,100 公尺。生育地之地質主要屬於第三紀層及少許之第四紀層。基岩多爲由第三紀層之砂岩及頁岩相互交疊而成，風化容易，故所形成之土壤多混有碎屑，結合度及濕度適中，比較肥沃。柳杉人工林在造林之前，多爲腦寮跡地，墾地及竹林地，表土深厚而富腐植質。地表狀態由於林木已經鬱閉地床植物之發生不茂，僅有稀疏之羊齒類、蕁麻類、姑婆芋以及其他雜草類等。

氣候帶有熱帶性之特徵，即雨水多及濕度高，一年中之寒暑差異不顯著。氣溫因受海拔高度及地形之影響，殊難概言。大體言之，一、二月間最低，七、八月間最高。海拔 400 ～ 500 公尺之地區，氣溫通常不降到零度以下，僅每隔若干年偶而發現結霜現象，海拔高 1,000 ～ 1,100 公尺之地區，普通每年結霜 2 ～ 3 次或偶而發生 5 ～ 6 次。至於 2,000 公尺以上之地區，結霜之次數增多及常見有結冰現象。雨量豐沛，以對高岳一帶最高，每年雨量達 3,000 ～ 4,000 公厘，溪頭次之，亦達 2,000 ～ 3,000 公厘。全年可依乾燥與降雨之情形，而劃分爲乾燥期與雨期。自十月以至次年四月末爲乾燥期，自五月以至九月末爲雨期，接近雨期時，其降雨日數及降雨量逐漸增加，至五、六月而達最高峰，七月又漸減退，八月以迄九月中旬又復上升達最高點，十月以後驟然減退。降雨量與次數以十一、十二月及一月等爲最少，及至二月下旬時則有少量降雨，其後則漸增，至五月即完全進入雨期。雨期中之降雨量約佔年降雨量 77%，降雨日數約佔該期 60%。現在將實驗林各主要地方氣象觀測站之長期觀測結果的平均值[54]，列如表 1—1 以供參考。

表 1—1　台大實驗林之氣候觀測平均值

測候站	海拔高度 (公尺)	氣溫 平均	氣溫 最高	氣溫 最低	平均濕度 (%)	降水量 總量	降水量 日數
溪頭	1,150	16.4	20.2	11.4	90.5	2,888	123
清水溝	520	21.2	25.2	14.8	88.3	2,732	126
水里	250	22.5	26.3	17.0	82.7	2,438	128
內茅埔	485	21.2	25.4	15.6	81.3	1,881	122
和社	785	21.6	25.4	16.1	72.2	2,054	134
對高岳	2,270	11.8	15.4	6.7	88.4	3,756	161

樣區之形狀，以周圍界短及容易測定之圓形或正方形爲最適宜；或因受地形及林分面積之限制，採用長方形也可。

本章所用之樣區，即爲根據上述原則而選定，但因受現有林分之限制，仍難免發生上述之偏差。全部共選定222個樣區（永久樣區每測定一次，即當做一個樣區計算），樣區之面積爲0.04～0.30公頃。樣區按營林區及齡級之分類，列如表5—1。

表5—1　測定樣區按產地及齡級之分佈

產地＼齡級	10以下	11～20	21～30	31～40	41～50	51～60	61以下	合計
溪頭		55	41	6	3	12	2	119
清水溝		20	14	3	2	2		41
水里		3	7					10
內茅埔	1	1	1	8				11
和社		4		3				7
對高岳	3	6	6	5	8	6		34
合計	4	89	69	25	13	20	2	222

全部222個測定樣區使用前述五項基準研判結果，共有34個落於信賴帶外，如表5—2所列，決定棄却不用。

表5—2所載之樣區棄却條件，有兩個以上者，但無測定或計算所產生之矛盾現象，皆因施業方法不同或調查人員之個人偏差，致使樣區之測定值遠離一般趨勢，不適供作編製法正收穫表之用。測定樣區經過棄却之後，尙存188個適當樣區，如表5—3所列。

表5—3　選用樣區按產地及齡級之分佈

產地＼齡級	10以下	11～20	21～30	31～40	41～50	51～60	61以上	合計
溪頭		50	40	6	3	12	2	113
清水溝		17	13	1	2	2		35
水里		2	7					9
內茅埔			1	8				9
和社			4	1				5
對高岳	3	4		2	5	3		17
合計	3	73	65	18	10	17	2	188

表5—9　林分收穫表　　地位上等（地位指數級31）

林齢	主林木							副林木							主副林木合計								林齢
	平均		毎公頃					平均胸高直徑	毎公頃						毎公頃								
	胸高直徑	樹高	株數	胸高斷面積	材積	材積生長連年量	材積生長平均量		株數	佔總株數之比率	材積	佔總材積之比率	材積累計	與主林木材積之比數	株數	材積	材積生長連年量	材積平均生長量 A	材積平均生長量 B	總收穫量	副林木材積累計量與總收穫量之比數	生長率	
年	cm	m	株	m^2	m^3	m^3	m^3	cm	株	%	m^3	%	m^3	%	株	m^3	m^3	m^3	m^3	m^3	%	%	年
10	11 07	11.47	1757	17.04	102.449		10.245	10.47								102.449		10.245	10.245	102.449			10
						26.399											36.223						
15	16.61	16.58	1326	28.86	234.446		15.630	13.95	431	24.53	49.119	17.32	49.119	20.95	1757	283.565		18.904	18.904	283.565	17.32	22.58	15
						23.932											31.887						
20	20.75	19.98	1111	37.75	354.355		17.718	16.55	215	16.21	39.528	10.04	88.647	25.02	1326	393.883		22.150	19.694	443.002	20.01	10.93	20
						21.065											27.625						
25	24.13	22.61	975	44.85	459.678		18.387	18.68	136	12.24	32.802	6.66	121.449	26.45	1111	492.480		23.245	19.699	581.127	20.90	6.80	25
						18.480											24.340						
30	26.99	24.84	382	50.79	552.076		18.403	20.48	93	9.54	29.300	5.04	150.749	27.31	975	581.376		23.248	19.379	702.825	21.45	4.81	30
						16.445											21.880						
35	29.51	26.76	812	55.98	634.300		18.123	22.06	70	7.94	27.175	4.11	177.924	28.05	882	661.475		23.206	18.899	812.224	21.91	3.68	35
						15.014											20.131						
40	31.87	28.41	751	60.37	709.369		17.734	23.55	61	7.51	25.587	3.48	203.511	28.69	812	734.956		22.822	18.374	912.880	22.29	2.99	40
						13.861											18.696						
45	34.05	29.92	702	64.41	778.672		17.304	24.92	49	6.52	24.176	3.01	227.687	29.27	751	802.848		22.364	17.841	1006.359	22.62	2.51	45
						12.926											17.484						
50	36.10	31.28	662	68.15	843.303		16.866	26.20	40	5.70	22.788	2.63	250.475	29.70	702	866.091		21.876	17.322	1093.778	22.90	2.15	50
						12.044											16.360						
55	38.01	32.48	629	71.72	903.525		16.428	27.41	33	4.98	21.577	2.33	272.052	30.11	662	925.102		21.374	16.820	1175.577	23.14	1.87	55
						11.441											15.543						
60	39.85	33.58	600	75.24	960.730		16.012	28.56	29	4.61	20.509	2.09	292.561	30.45	629	981.239		20.888	16.354	1253.291	23.34	1.66	60

地位中等（地位指數級26）

林齢	主林木							副林木							主副林木合計								林齢
	平均		毎公頃					平均胸高直徑	毎公頃						毎公頃								
	胸高直徑	樹高	株數	胸高斷面積	材積	材積生長連年量	材積生長平均量		株數	佔總株數之比率	材積	佔總材積之比率	材積累計	與主林木材積之比數	株數	材積	材積生長連年量	材積平均生長量 A	材積平均生長量 B	總收穫量	副林木材積累計量與總收穫量之比數	生長率	
年	cm	m	株	m^2	m^3	m^3	m^3	cm	株	%	m^3	%	m^3	%	株	m^3	m^3	m^3	m^3	m^3	%	%	年
10	9.86	8.49	1894	14.48	73.209		7.321	9.66								73.209		7.321	7.321	73.209			10
						20.792											28.919						
15	15.06	12.68	1408	25.08	177.167		11.811	12.98	486	25.66	40.636	18.66	40.636	22.94	1894	217.803		14.520	14.520	217.803	18.66	24.37	15
						20.221											26.876						
20	18.90	15.98	1173	32.88	278.271		13.914	15.39	235	16.69	33.278	10.68	73.914	26.56	1408	311.549		17.609	15.577	352.185	20.99	11.95	20
						17.535											23.019						
25	21.99	18.52	1031	39.12	365.944		14.638	17.33	142	12.11	27.421	6.97	101.335	27.69	1173	393.365		18.691	15.735	467.279	21.69	7.17	25
						15.332											20.235						
30	24.63	20.68	931	44.34	442.602		14.753	18.99	100	9.65	24.516	5.25	125.851	28.43	1031	467.118		18.948	15.571	568.453	22.14	5.00	30
						13.546											18.133						
35	26.97	22.50	853	48.80	510.330		14.581	20.47	78	8.38	22.936	4.30	148.787	29.16	931	533.266		18.832	15.236	659.117	22.57	3.80	35
						12.287											16.670						
40	29.16	24.09	787	52.69	571.766		14.294	21.84	66	7.74	21.912	3.69	170.699	29.85	853	593.678		18.562	14.842	742.465	22.99	3.07	40
						11.178											15.400						
45	31.22	25.53	732	56.18	627.656		13.948	23.14	55	6.99	21.110	3.25	191.809	30.56	787	648.766		18.210	14.417	819.465	23.41	2.56	45
						10.396											14.458						
50	33.15	26.83	687	59.39	679.636		13.593	24.35	45	6.15	20.308	2.90	212.117	31.21	732	699.944		17.835	13.999	891.753	23.79	2.20	50
						9.661											13.565						
55	35.01	27.96	648	62.44	727.946		13.235	25.52	39	5.68	19.516	2.61	231.633	31.82	687	747.462		17.447	13.590	959.579	24.14	1.92	55
						8.821											12.574						
60	36.78	28.97	615	65.44	772.046		12.867	26.63	33	5.09	18.772	2.37	250.405	32.43	648	790.818		17.041	13.180	1022.451	24.49	1.67	60

地位下等（地位指數級 21）

林齡	主林木 平均 胸高直徑	主林木 平均 樹高	主林木 每公頃 株數	主林木 每公頃 胸高斷面積	主林木 每公頃 材積	主林木 每公頃 材積生長連年量	主林木 每公頃 材積生長平均量	副林木 平均胸高直徑	副林木 每公頃 株數	副林木 每公頃 佔總株數之比率	副林木 每公頃 材積	副林木 每公頃 佔總材積之比率	副林木 每公頃 材積累計	副林木 每公頃 與主林木材積之比數	主副林木合計 每公頃 株數	主副林木合計 每公頃 材積	主副林木合計 每公頃 材積生長連年量	材積平均生長量 A	材積平均生長量 B	總收穫量	副林木累計量與總收穫量之比數	生長率	林齡
年	cm	m	株	m^2	m^3	m^3	m^3	cm	株	%	m^3	%	m^3	%	株	m^3	m^3	m^3	m^3	m^3	%	%	年
10	7.61	5.11	2191	9.95	33.937		3.394	7.51								33.937		3.394	3.394	33.937			10
						14.188											19.792						
15	12.17	8.84	1643	18.85	104.878		6.992	11.16	548	25.01	28.017	21.08	28.017	26.71	2191	132.895		8.860	8.860	132.895	21.08	31.39	15
						15.164											19.921						
20	15.46	11.98	1364	25.45	180.696		9.035	13.23	279	16.98	23.788	11.63	51.805	28.67	1643	204.484		11.625	10.224	232.501	22.28	14.29	20
						13.637											17.610						
25	17.99	14.42	1210	30.80	248.882		9.955	14.82	154	11.29	19.862	7.39	71.667	28.80	1364	268.744		12.822	10.750	320.549	22.36	8.26	25
						11.900											15.634						
30	20.22	16.51	1096	35.20	308.383		10.279	16.22	114	9.42	18.669	5.71	90.336	29.29	1210	327.052		13.291	10.902	398.719	22.66	5.61	30
						10.300											13.918						
35	22.22	18.21	1004	38.95	359.881		10.282	17.48	92	8.39	18.090	4.79	108.426	30.13	1096	377.971		13.380	10.800	468.307	23.15	4.15	35
						9.101											12.636						
40	24.12	19.75	923	42.19	405.384		10.135	18.67	81	8.07	17.678	4.18	126.104	31.11	1004	423.062		13.287	10.577	531.488	23.73	3.29	40
						8.099											11.580						
45	25.93	21.14	854	45.11	445.880		9.908	19.81	69	7.48	17.406	3.76	143.510	32.19	923	463.286		13.098	10.295	589.390	24.35	2.71	45
						7.301											10.737						
50	27.69	22.39	795	47.84	482.385		9.648	20.92	59	6.91	17.178	3.44	160.688	33.31	854	499.563		12.861	9.991	643.073	24.99	2.30	50
						6.599											9.979						
55	29.41	23.47	742	50.41	515.379		9.371	22.00	53	6.67	16.903	3.18	177.591	34.46	795	532.282		12.599	9.678	692.970	25.63	1.99	55
						6.003											9.326						
60	31.06	24.45	697	52.86	545.394		9.090	23.04	45	6.06	16.613	2.96	194.204	35.61	742	562.007		12.327	9.367	739.598	26.26	1.75	60

表5—10 計算主林木林分表之實驗式

平均胸高直徑級	實驗式	相關係數	F 值	殘差之標準差
12 以下	$Y = 11.834381 + 3.047468X - 0.049890X^2 + 0.000372X^3$	0.964950	901.3243678	15.799685
12 ～ 16	$Y = 42.287565 + 2.641074X - 0.052561X^2 + 0.000376X^3$	0.971847	1134.23621836	9.169518
16 ～ 20	$Y = 47.055853 + 2.345906X - 0.046095X^2 + 0.000336X^3$	0.969712	2595.45513457	8.841139
20 ～ 24	$Y = 51.94786 + 2.055730X - 0.040750X^2 + 0.000307X^3$	0.961178	2265.03105843	9.759590
24 ～ 28	$Y = 50.829216 + 2.141789X - 0.041799X^2 + 0.000311X^3$	0.971559	1452.24569225	8.226634
28 ～ 32	$Y = 52.185827 + 2.131856X - 0.043097X^2 + 0.000329X^3$	0.961943	727.05020259	10.103363
32 ～ 36	$Y = 49.729965 + 1.837953X - 0.030522X^2 + 0.000228X^3$	0.987555	2313.06764728	5.449056
36 ～ 40	$Y = 54.155694 + 1.721222X - 0.027973X^2 + 0.000200X^3$	0.978544	1187.96707609	6.135859
40 以上	$Y = 66.474258 + 1.323857X - 0.023017X^2 + 0.000167X^3$	0.976356	544.00077723	4.734740

表５－11　主林木之林分表

平均胸徑 株數百分率 胸徑	6	10	14	18	22	26	30	34	38	42	46	50
2	8.1	2.8										
4	20.3	8.3										
6	35.6	11.9	0.2									
8	18.8	19.8	6.2									
10	11 3	21.2	8.7	3.9								
12	5.9	12.8	17.9	6.4	1.3							
14		8.6	38.6	9.2	5.2	1.4						
16		6.7	11.3	21.4	6.7	4.2	0.6					
18		5.5	7.2	28.3	10.4	5.0	3.4	1.8				
20		2.4	5.5	10.3	25.2	6.7	4.0	3.6				
22			4.4	6.9	19.4	10.3	5.0	4.2	2.2			
24				5.2	9.0	22.4	6.7	4.8	3.5			
26				4.3	6.3	16.7	11.3	6.0	4.0			
28				3.7	4.9	8.4	22.7	7.7	4.6	0.2		
30				0.4	4.1	5.9	12.7	10.4	5.7	3.8		
32					3.6	4.6	7.1	12.1	7.1	4.5	2.4	
34					3.1	4.0	5.1	10.4	9.5	5.5	3.9	1.2
36					0.8	3.3	4.2	7.7	12.1	7.1	4.5	3.3
38						3.1	3.5	6.0	11.4	10.2	5.4	3.8
40						2.6	3.1	4.9	8.6	15.9	7.2	4.5
42						1.4	2.7	4.2	6.6	15.1	10.2	5.5
44							2.5	3.6	5.2	9.6	15.2	7.1
46							2.3	3.2	4.4	6.8	13.5	10.3
48							2.1	2.9	3.8	5.3	8.9	14.3
50							1.0	2.7	3.3	4.4	6.5	12.3
52								2.7	3.1	3.8	5.1	8.3
54								1.1	2.7	3.4	4.2	6.2
56									2.2	3.0	3.6	4.8
58										1.4	3.3	4.1
60											2.9	3.5
62											2.7	3.2
64											0.5	2.8
66												2.6
68												2.2

出典

Yong-Chi Yang(1975). Studies on the growth and yield of Cryptomeria in the experimental forest of Taiwan University. Research Bulletin of the Taiwan University Forests, 116.

樹種：TAXODIACEAE(スギ科)
Cryptomeria japonica (スギ)
国：ブラジル

データ採取地の立地環境

Locality:	São Paulo
Altitude:	700 - 900 m
Rainfall:	2 000 mm
Data source:	temporary sample plots
Number of plots:	125
Size of plots:	100 m^2

MAI (m^3/ha) by site[1/] class

成長・収穫に関する表，図，式など

Age (years) \ Site class	I	II	III	IV
5	12.0	8.4	5.6	3.2
10	27.9	19.6	12.9	7.4
15	31.0	21.8	14.3	8.3
20	30.0	21.1	13.9	8.0
30	26.0	18.2	12.0	6.9
35	24.0	16.8	11.0	6.4

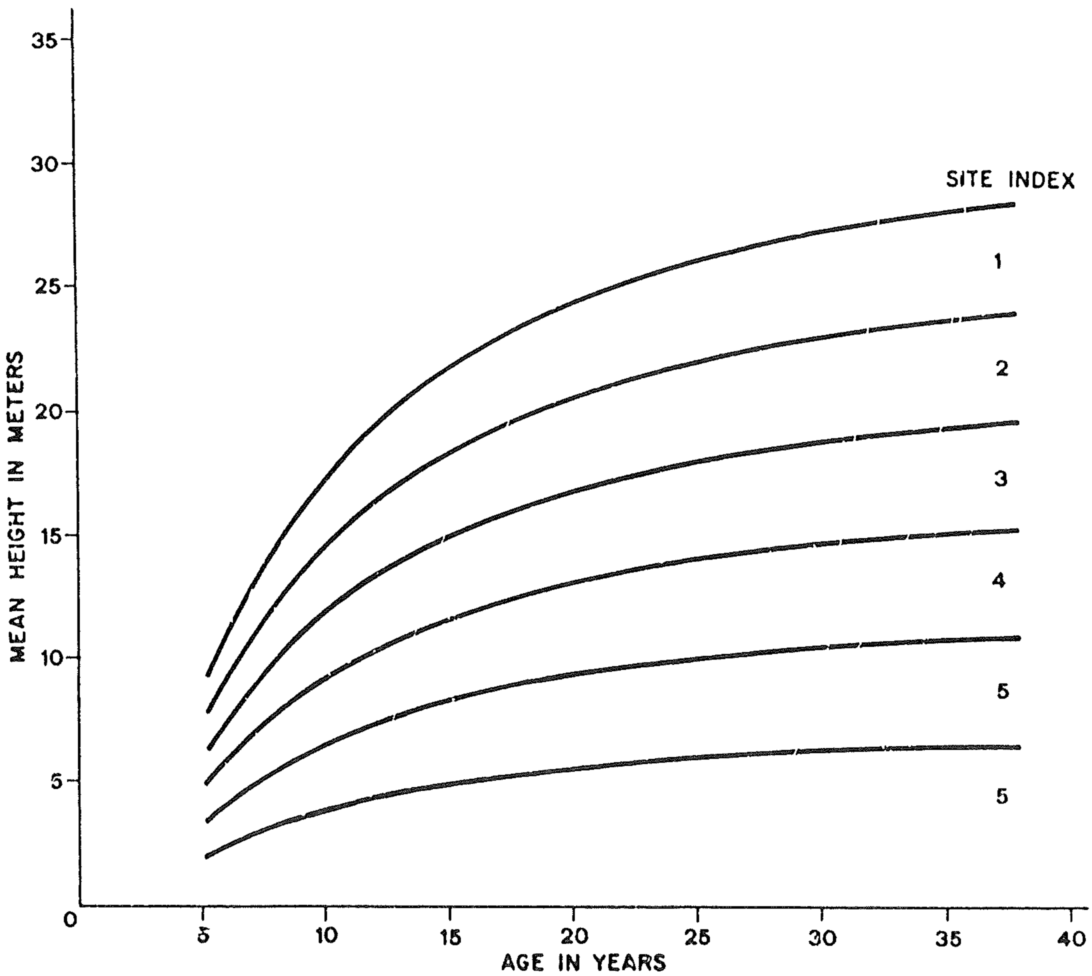
1/ In the present study this is production class.

Remarks: MAI is based on stand density of 2 250 stems/ha. No measurement specification has been indicated but MAI is volume of standard (limpa) timber without bark. Maximum heights corresponding to production classes at reference age 30 years are:

	Height in m
I	27.2
II	23.0
III	18.8
IV	14.6

Cryptomeria japonica - Brazil (2)

Site index curves



出典

(2) Heinsdijk, D. Conifer plantation in Brazil. Preliminary study of volume 1962 and yield of *A. angustifolia*, *Cryptomeria japonica*, *C. lanceolata* and *P. elliottii*. Boletim No. 5.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：CUPRESSACEAE（ヒノキ科）

Cupressus lusitanica （メキシカンサイプレス）

国　ケニア

Synonyms: C. benthami Endl.
C. coulteri Forbes
C. glauca Lamarck
C. knightiana Knight and Perry ex Gordon
C. lindleyi Klotzich ex Endl.

Family: Cupressaceae

データ採取地の立地環境

KENYA (3)

Locality: east and west of Rift
Other character: planted by taungya system
Data source: permanent sample plots
Number of plots: 133
Size of plots: 405 m^2
Stand density: 1 600 stems/ha (initial)

成長・収穫に関する表，図，式など

General site index equation

$$hd = 19.00 + 0.4568\,A - 88.27\left(\frac{1}{A}\right) \qquad (r^2 = 0.92)$$

where: hd = dominant height taken as mean height of the 100 trees per hectare with the largest diameter at breast height
A = stand age in years.

Yield table for an average site

	Total production		Merchantable volume 15.2 cm top d. o.b.	
Age (years)	MAI (m^3/ha)	Thinning yield (m^3/ha)	Volume (m^3/ha)	Thinning yield (m^3/ha)
6	11.8		-	
7	14.0	20.4	3.0	
8	15.9		39.0	
12	21.4	70.0	171.2	38.5
13	22.0		201.9	
17	23.8	79.8	326.2	67.7
18	23.9		352.2	
22	24.4	70.2	459.4	65.9
23	24.4		485.3	
26	24.3		554.3	
30	24.2		648.3	
35	23.9		760.0	

Remarks: Sample plots were distributed in three sites - good, average and poor.
Thinning yields have been included in MAI.

出典

(3) Mathu, W.J.; Philip, M.S. Growth and yield studies of Cupressus lusitanica
1979 in Kenya. Division of Forestry, Faculty of Agriculture. Dar-es-Salaam University, Tanzania. Record No. 5.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：CUPRESSACEAE(ヒノキ科)
Cupressus lusitanica (メキシカンサイプレス)
国　：ウガンダ

Synonyms: C benthami Endl.
C coulteri Forbes
C glauca Lamarck
C knightiana Knight and Perry ex Gordon
C lindleyi Klotzich ex Endl

データ採取地の立地環境

Data source: permanent sample plots
Number of plots: in 7 plantations

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site index

Age (years) \ Site index	12	14	16	18	20	22
5	3.6	7.6	11.8	16.2	21.0	26.2
7	8.4	12.6	16.9	21.7	26.8	32.7
10	11.8	16.2	20.7	26.1	32.0	39.0
12	12.8	17.4	22.0	27.5	33.7	40.9
15	13.2	17.9	22.4	28.0	34.5	41.3
16	13.1	17.8	22.3	27.7	34.1	40.9
20	12.4	16.6	20.6	25.4	31.2	37.3
25	11.2	14.8	18.1	22.2	27.0	32.1

Remarks: Site index has been calculated at 10 years reference age and thinning yield has been included in MAI.

出典

(2) Kingston, B.; Kayumi, S.Y. A Preliminary yield table for Cupressus lusitanica grown in plantations in Uganda. Uganda Forest Department Technical No. 195.
1972

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：CUPRESSACEAE（ヒノキ科）
Cupressus lusitanica（メキシカンサイプレス）
国：コロンビア

Synonyms: C. benthami Endl.
C. coulteri Forbes
C. glauca Lamarck
C. knightiana Knight and Perry ex Gordon
C. lindleyi Klotzich ex Endl.

データ採取地の立地環境

Locality:	Province of Antioquia
Altitude:	2 200 - 2 500 m
Rainfall:	1 600 mm
Soil:	volcanic ash soil
Data source:	temporary sample plots
Number of plots:	57
Size of plots:	240 to 1 000 m^2

(a) Site index equation at reference age 15 years

$$\log S = \log H - 1.80436\left(\frac{1}{15} - \frac{1}{A}\right)$$

成長・収穫に関する表，図，式など

where: S = site index
H = dominant height in m
A = stand age

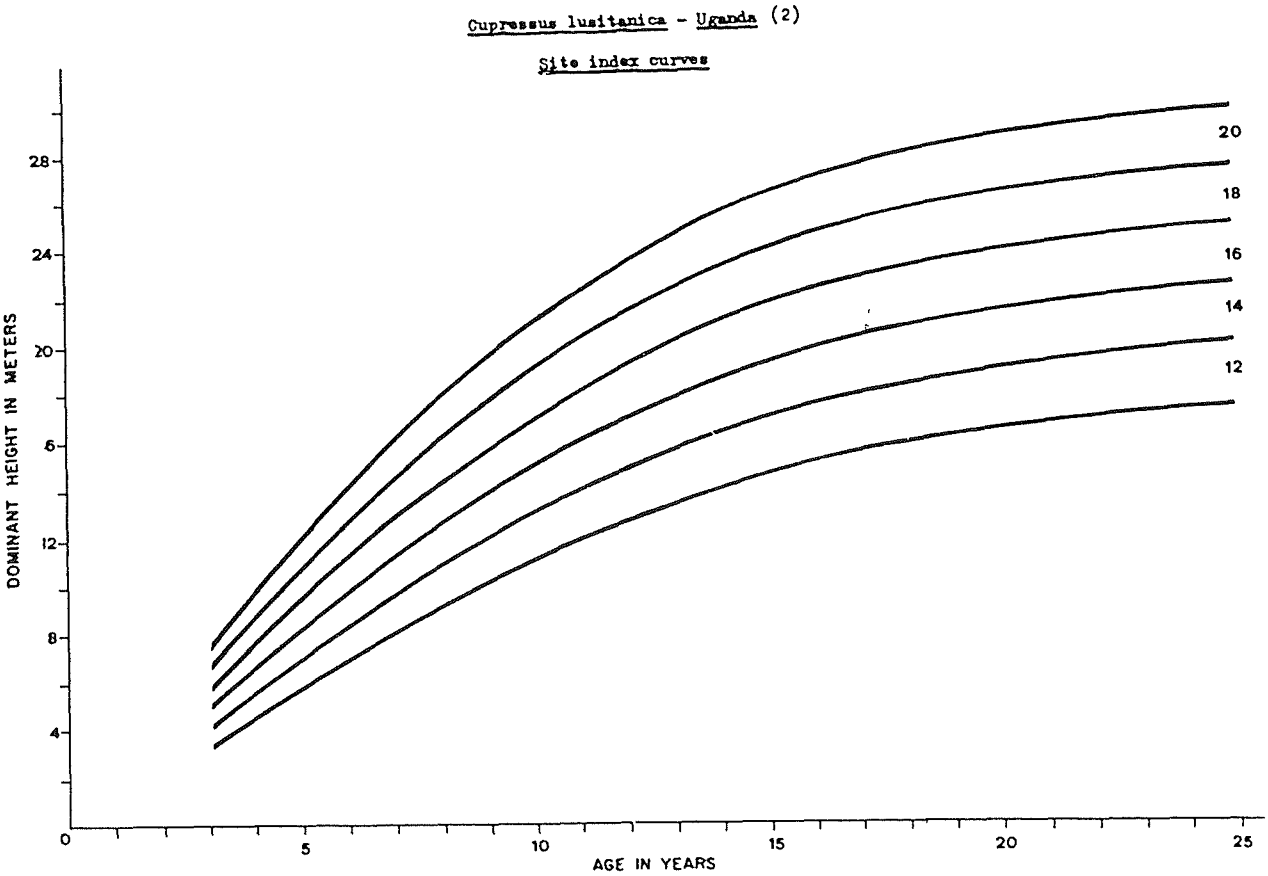
(b) Yield equation for total volume per ha

$$\log V = 0.9788 + 0.8397\frac{1}{A} + 0.0840\,S - 0.2131\frac{S}{A} \qquad r^2 = 0.88$$

where: V = total volume in m^3 per hectare and other symbols have same meaning as in (a)

(c) Yield data at 20 years' age

Site index	MAI (m^3/ha)
9	2.4
12	4.0
15	6.6
18	11.0
21	18.10



出典

(5) Tschinkel, H. 1972 Site classification and increment of Cupressus lusitanica in Antioquia, Colombia. Revista Facultad Nacional de Agronomía. Medellín. 27(1).

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：CUPRESSACEAE（ヒノキ科）
　　・*Cupressus lusitanica*　（メキシカンサイプレス）
国　：多国籍［ブラジル、ベネズエラ、ナイジェリア］

データ採取地の立地環境

成長・収穫に関する表，図，式など

Countries / Details	Brazil	Venezuela	Nigeria
Reference	(1)	(4)	(7)
Locality	São Paulo	Mérida	Gamba
Altitude	-	2200–2400 m	1520 m
Rainfall	-	2000 mm	1800 mm
Soil	-	-	humid ferrisol
Data source	-	-	-
No. of plots	-	2	one
Plot size	-	-	-
Measurement specification	-	-	7.5 cm d. o.b.
MAI: (A1) 1/ (A2) (A3) (A4)	20.0 (20–30)	10.0–75.0 (6)	13.9 (24)

1/ (A1), etc. are age in years

出典

(1) Carvalho, J.S. Cupressus lusitanica in São Paulo. An. Bras. Econ. Flor.
1957 Inst. Nac. Pinho No. 7.

(4) Schulz, J.P.; Rodrigues, P. Establishment of yield plots in experimental
1967 plantations in C. lusitanica and P. radiata in Venezuela Andes.
Revista Florestal Venezolana No. 15.

(7) Savanna Forestry Research Station, Nigeria. FO:SF/NIR 16, Technical Report
No. 7. 1974.

ダイジェストデータ．Pandrey, D　Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：ARAUCARIACEAE(ナンヨウスギ科)、
Agathis loranthifolia (アガチィス、マニラコパールノキ)
国：インドネシア

データ採取地の立地環境

3. Agathis loranthifolia Salisb.

(DAMAR)

Data.

Lokasi	Jumlah petak coba/ ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan la-- pangan/tanah
Sukabumi	15	56	800 s/d 1100	sedikit me- ring.
Banyumas Barat	12	54	700 s/d 800	rata dan se- dikit miring
Pekalongan	1	2		
Purworejo	9	15		
Banyumas Timur	7	13		
Jumlah:	29	84		
Banyuwangi Utara	4	9	500 s/d 800	agak miring/ rata
Malang Selatan	1	3		
Malang Utara	3	6		
Jumlah:	8	18		
Jumlah semua:	52	158		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/ Year)	Peninggi (Upper-height)	TEGAKAN TETAP (MAIN STAND) (T. T.)						Tegakan penjarangan (T P) (Thinnings)		jumlah volume	Riap rata-rata tahunan	Riap tahunan berjalan	Umur (Age) (Tahun/ Year)
		Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height)	Rata-rata diameter (Average diameter)	Bidang dasar/ha (Basal area/ha)	V.kayu tebal/ha (Thick-wood/ha	V.kayu tebal/ha (Thick-wood/ha	Vkt kumu-latip/ha (ΣVtw /ha)	(Total volume) (Vol.T.T. + ΣT.P.)	(Mean annual) increment)	(Current annual increment)	
	(m)			(m)	(cm)	(m^2)	(m3)	(m3)	(m3)	(m3/ha)	(m3/ha)	(m3/ha)	
Agathis loranthifolia Salisb (Damar) BONITA I (SITE CLASS I)													
5	4,6	3320	40,6	2,2	3,0	7,0	9	2	2	11	2,2	2,2	5
10	11,2	1715	23,1	8,8	8,9	10,7	24	11	13	37	3,7	5,2	10
15	15,6	1100	20,8	13,6	14,4	17,9	105	12	25	130	8,7	18,6	15
20	19,0	775	20,3	17,2	19,6	23,5	171	31	56	227	13,8	19,4	20
25	22,0	564	20,6	20,3	25,3	28,3	234	44	100	334	15,2	21,4	25
30	24,6	456	20,4	23,0	30,2	32,6	292	53	153	445	14,8	22,2	30
35	27,0	396	20,0	25,3	34,2	36,4	346	56	209	555	15,9	22,0	35
40	28,9	360	19,6	27,4	37,4	39,6	393	54	263	656	16,4	20,2	40
45	30,4	330	19,4	29,1	40,3	42,0	431	50	313	744	16,5	17,6	45
50	31,6	320	19,0	30,2	41,8	43,9	460	48	361	821	16,4	15,4	50

BONITA II (SITE CLASS II)

5	5,6	2900	35,5	3,2	4,0	7,0	13	3	3	16	3,2	3,2	5
10	13,0	1435	21,8	11,0	11,0	13,6	76	15	18	94	9,4	15,6	10
15	18,0	855	20,4	16,1	18,0	21,6	152	18	36	188	12,5	18,8	15
20	22,0	570	20,4	20,2	25,0	28,0	230	42	78	308	15,4	24,0	20
25	25,0	445	20,4	23,6	30,8	32,2	300	44	122	422	16,9	22,8	25
30	27,8	380	19,8	26,4	35,6	37,8	366	55	177	543	19,5	24,2	30
35	30,2	330	19,6	28,8	40,2	41,9	427	51	228	655	18,7	22,4	35
40	32,1	300	19,1	31,0	43,9	45,4	482	45	273	755	18,9	20,0	40
45	34,2	200	18,8	32,8	46,8	48,1	529	40	313	842	18,7	17,4	45
50	35,3	270	18,5	34,0	48,5	50,0	556	37	350	906	18,1	12,8	50

BONITA III (SITE CLASS III)

5	6,6	2580	32,1	4,2	5,4	9,6	17	4	4	21	4,2	4,2	5
10	15,3	1140	20,8	13,4	13,9	17,4	104	19	23	127	12,7	21,2	10
15	20,6	655	20,4	18,8	22,6	26,2	201	37	60	261	17,4	26,8	15
20	25,0	450	20,2	23,3	30,6	33,0	297	54	114	411	20,5	30,0	20
25	28,2	360	20,1	26,9	36,9	38,4	377	55	169	546	21,8	27,0	25
30	31,1	320	19,3	29,8	41,3	43,0	448	49	218	666	22,2	24,0	30
35	33,6	292	18,7	32,2	45,4	47,3	511	42	260	771	22,0	21,0	35
40	35,8	270	18,3	34,5	49,1	51,0	570	36	296	866	21,6	19,0	40
45	37,7	250	18,0	36,3	52,4	54,0	620	30	326	946	21,0	16,0	45
50	39,0	240	17,8	37,8	54,6	56,2	660	27	353	1013	20,3	13,4	50

BONITA IV (SITE CLASS IV)

5	7,4	2450	29,3	5,2	6,6	10,6	32	6	6	38	7,6	7,6	5
10	17,6	900	20,3	15,5	17,3	21,1	142	25	31	173	17,3	27,0	10
15	23,4	505	20,4	21,7	27,8	30,7	262	48	79	341	22,7	33,0	15
20	28,0	370	20,0	26,5	36,2	38,0	368	55	134	502	25,1	32,2	20
25	31,3	317	19,3	30,1	42,0	43,9	461	48	182	643	25,7	28,2	25
30	34,6	280	18,6	33,2	47,1	48,8	541	39	221	762	25,4	23,8	30
35	37,3	254	18,1	36,0	51,7	53,3	609	31	252	861	24,6	19,8	35
40	39,4	235	17,8	38,2	55,5	56,8	679	25	277	956	23,9	19,0	40
45	41,2	220	17,6	40,2	58,9	59,9	720	21	298	1018	22,6	12,4	45
50	42,6	210	17,4	41,6	61,3	62,0	766	17	315	1081	21,6	12,6	50

BONITA V (SITE CLASS V)

5	8,4	2220	27,1	6,2	7,6	10,0	29	7	7	36	7,2	7,2	5
10	20,0	700	20,3	18,2	21,3	25,0	191	34	41	232	23,2	39,2	10
15	26,4	405	20,2	24,7	33,4	35,5	333	56	97	430	28,7	39,6	15
20	31,0	320	19,4	29,7	41,3	42,8	448	50	147	595	29,8	33,0	20
25	34,6	280	18,6	33,5	47,1	48,9	548	39	186	734	29,4	27,8	25
30	37,9	245	18,1	36,9	53,1	54,3	633	30	216	849	28,3	23,0	30
35	40,8	220	17,7	39,7	58,5	59,1	710	22	238	948	27,1	19,8	35
40	43,0	200	17,7	42;0	63,3	62,9	779	16	254	1033	25,8	17,0	40
45	44,9	190	17,4	43,9	66,4	65,8	835	12	266	1101	24,5	13,6	45
50	46,1	175	17,6	45,2	71,1	67,7	878	9	275	1153	23,1	10,4	50

出典

Suharlan, A., Sumerna, K, and Sudiono, Y. (1975). Yield table of ten industrial wood specoes Lembaga Penelıtian Hutan.

樹種：ARAUCARIACEAE（ナンヨウスギ科），
Agathis spp.（アガサイス）
国　：多国籍〔マレーシア（マラヤ），インドネシア，セレベス，ザイール，パプアニューギニア，ソロモン，フィージー，ニューカレドニア，オーストラリア，ブルネイ，インド，南アフリカ，ニューヘブリジーズ島（バヌアツ共和国），ケニア，プエルトリコ〕

データ採取地の立地環境

Plantations in Java

Trial plots of *Agathis* were established at various places through Java in the 1930s These were described by de Jong (1938) who gave the following locations

West Java Garoet (nr Bandung), Midden Preanger (Bandung), Tasikmalaja, West Preanger (Sukabumi), Zuid Cheribon

Central Java Banjumas (Baturaden), Kedoe, Pekalongan, Probolinggo

East Java Banjuwangi, Bondowoso, Djember, Oost Brantai (or Malang) Passorean

In the late 1940s and subsequently planting was concentrated at a few places only, partly because the trials revealed greatest success in the wetter climates and complete failure or poor growth in the dry lowlands of eastern Java

Plantations in Irian Jaya

The taxon planted is the indigenous *Agathis*, described here as *A dammara Irian Jaya provenance*, which has hitherto usually been called *A labillardieri* The total area planted is about 2300 ha, divided between Sorong (km 14 on the road to Klamono) 750 ha, Teminabuan (1000 ha or more) and Biak (over 500 ha), the localities are shown on Fig 3 2 It is not known if the Sorong and Teminabuan plantations still stand

Plantations in southern Queensland

Most of the plantations were in the Mary valley around Imbil, some 50 km inland, separated from the sea by a range of hills. This is 32 km beyond the western margin of the natural range (see sect 3 2) (though a solitary wild tree was known) and the climate is drier with more marked dry seasons

The species has precise site requirements It had to be planted on fertile, well-drained soils above the frost line (young stock can be killed by harsh frost though by 2 5 years age only tender young tips get killed (Petrie 1922))

Plantations in New Zealand

Only limited success was achieved in open-planting about 200 ha (Morrison & Lloyd 1972) but recently, following success at Raetea Forest, further planting has commenced This is costly but is justified by public interest in kauri and hence the official policy to promote its silviculture (Beveridge 1977)

Selangor of logged lowland mixed dipterocarp rain forest, on sites formerly without *Agathis* though within its area (Ismail 1966)

There has been little or no attention paid after planting so most of the seedlings soon become overshadowed Survival is good but growth is slow except of the minority of seedlings situated under a canopy gap. The Malayan provenance of *A dammara* is one of the slowest growing, and grows very slowly in shade.

Brunei

It was planned to plant up 4,000 ha of heath forest at Badas with nursery raised stock of *A dammara Badas provenance* over five years from 1975 Failure of the seed crop in 1975 delayed the start by one year By September 1976 only about 22 ha had been planted. This is a forest in which this taxon naturally occurs, at high density, as described in sect. 3 2. It was logged in 1958-60. In 1974 (*author obs*) there were a few small stands of sapling *Agathis* of healthy but spindly appearance, and all within 20 m of a relict mother tree Small seedlings were rare. *Agathis* regeneration has grown slowly under dense shade of regrowth primary forest hardwoods which by 1974 had formed a 9 m high canopy of poles, many as coppicing clumps, including conspicuous *Dipterocarpus borneensis, Eugeissona minor, Podocarpus neriifolius* and *Whiteodendron moultonianum*.

Solomon Islands, Santa Cruz Islands

The main *A macrophylla* stand on Ndendo island has been logged since 1974 (sect. 3 2) It is planned to regenerate a dense stand by replanting naturally occurring seedlings (survivors or new ones) after logging, at 2-3 m spacing in lines 9-10 m apart. This will facilitate periodic removal of overhead regrowth shade. The *Agathis* should grow up together to form continuous lines about 3 m tall in 3 years and 6 m tall in 5 years. If there are not enough wildings supplementary nursery-raised seedlings will be used too This proposal is based on experience on Vanikolo where natural regeneration was repeatedly released *in situ* (sect 4 5) which proved very costly and time consuming because the *Agathis* seedlings are scattered irregularly. There would be no market for thinnings on Santa Cruz. The possibility is being considered of interplanting the lines of *Agathis* with mahogany (*Swietenia*) to give a sawn timber crop in 16-20 years. The timber industry is at present, and potentially in the longer term too, the main source of income and

Malaya

Agathis dammara seedlings as wildings, or raised in nurseries from seed obtained locally from natural stands in hilly lowland rain forest, have been planted as part of a big scheme of enrichment planting in

成長・収穫に関する表，図，式など

Table 5 1 Summary of growth in small open-planted trial plots (age—yrs height and diameter—m diameter increment—mm)

			Height		Diameter		
	Trial number	Age	Mean	m a i	Mean	m a i	Provenance
Agathis australis							
New Zealand	0	28	8 9	0 3	0 22	8	
Agathis dammara							
Malaya	2	14 3			0 07	5	Ulu Selangor
	5	10 5			0 07	7	Badas
	7	11 3			0 12	11	Javan
Java	10	36	23 6	0 65	0 51	4	W Borneo
	11	31	22 8	0 73	0 44	14	W Borneo
	12	26	22 2	0 85	0 39	15	Minahassa
	13	36	22 5	0 63	0 41	11	Minahassa
	14	29			0 31	11	S Celebes
	15	34	26 4	0 78	0 50	15	Malili
Celebes	16	35	30	0 86	0 40	11	Malili
Java	18	32 5	36 2	1 11	0 67	21	Lokke
Zaire		20	26	0 77			? Javan
Agathis lanceolata							
New Caledonia	19	10	2 92	0 24			
Agathis macrophylla							Vanikolo
Malaya	20	2 7	2 34- 3 02	0 87- 1 12			
	22	10 5			0 19	18	
Sarawak	23	2	1 2	0 45			
Sabah	25	8	7 5-12	0 6- 1 5			
Papua New Guinea	26	18	10-15	0 5- 0 7	0·14- 0 38	8-21	
Solomons	27	11	12	1 1	0 24	22	
	28	14	17	1 2	0 31	22	
	29	7	9 4	1 3	0 13	19	
	30	7	7 4	1 1	0 15	21	
Fiji	31	10	9 8	0 98	0 16	16	
	32	6 5	7 0	1 1	0 1	15	
	33	7	2 2	0 3	0 08	12	
Agathis moorei							
New Caledonia	35	15	5 25	0 2			
	36	14	3 87	0 15			
	38	9			0 17	19	
Agathis obtusa							
New Hebrides	42	6	5				
	43	4	3 75	0 93	0 04	11	
	44	4	6 07	1 55	0 07	18	
Agathis robusta							
Papua New Guinea	46	24	21 3	0 89	0 30	7	N Queensland
Queensland	49	15	9	0 6			N Queensland
	50	20	20 3	1 0	0 18	9	N Queensland
	51	13 4	12 8	0 95	0 09	7	N Queensland
Solomons	52	13	13	1	0 18	14	N Queensland
	53	15	19	1 27	0 31	21	S Queensland
	54	13	16	1 23	0 23	17	S Queensland
	55	7 6	7 3	0 96	0 09	12	S Queensland
Fiji	56	9	2 77	0 33			S Queensland
	57	13	5 3	0 41	0 09	7	S Queensland
South Africa		25	17	0 68	0 37	1	N Queensland
India Dehra Dun		4	1 8	0 45			S Queensland
		8	4 85	0 6			S Queensland
India Kerala		5	4 5	0 9			S Queensland
		14		0 66		12	S Queensland
Kenya		13		0 79		12	S Queensland
Puerto Rico		23			0 26	11	S Queensland
Agathis vitiensis							
Fiji	58	12	9	0 75	0 14	11	S Queensland

Table 5 2 Summary of growth in small under-planted trial plots (age—yrs, height and diameter—m, diameter increment—mm)

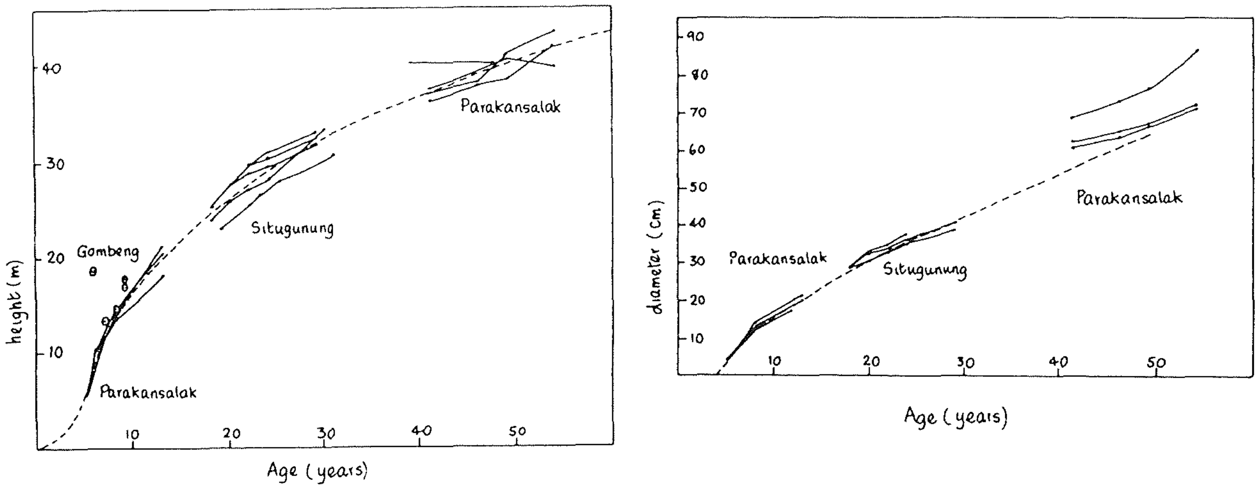
	Trial number	Age	Height Mean	Height m a i	Diameter Mean	Diameter m a i	Provenance
Agathis dammara							
Brunei	59	5	0 96	0 19			Badas
	60	5	0 63	0 13			
Celebes	62	24			0 1	4	Malili
	63	23			0 1	4	
	64	19			0 13	7	
	66	12	3	0 25			
Agathis macrophylla							Vanikolo
Sarawak	71	1	1 2	0 5			
Fiji	73	6 4	1 42	0 22	0 01	2	
	74	6 4	2 23	0 35	0 03	4	
	75	6 4	1 3	0 2	0 01	1 6	
	76	6 4	1 42	0 2	0 01	1 6	
	77	6 4	2 92	0 46	0 03	5	
	78	8	7 3	0 91	0 08	10	
	79	5 6	6 3	1 1	0 08	14	
	80	8	2 9	0 36	0 04	5	
	81	6 5	3 6	0 55	0 07	10	
	83	9	8 1	0 9	0 14	16	
	84	6 5	8 1	1 25	0 15	23	
	85	5 7	5 5	1 0	0 1	17	
	86	6	8 2	1 37	0 04	7	
	87	5	2 5	0 5	0 04	8	
Agathis moorei							
New Hebrides	89	6	3-6	0 5-1	0 03-0 05	5-8	
New Caledonia	90	16/17			0 11	6	
	91	10			0 14	14	
Agathis obtusa							
New Hebrides	95	6	8-9	1 3-1 5			Erromango
	96	3 3	2-3	0 6-0 9			
	97	3 3	1	0 3			
Agathis robusta							
Queensland	101	10	3 6	0 36			N Queensland
	103	11	8 2	0 75	0 09	8	
	105	11	3 56	0 32			S Queensland

Table 5.3 Summary of growth in plantations (Most of these plantations have been thinned at least once, (age-yrs· height and diameter—m, diameter increment—mm)

	Trial number	Age	Height Mean	Height m a i	Diameter Mean	Diameter m a i
Agathis dammara Javan provenance						
Java, Situgunung	a	56	39	0 7	0 19 0 8	11 14
Java Pekalongan	b	9	7 5-9	0 8-1		
	c	15	15-18	1-1 2	0 16-0 29	11 19
	d	21	18	0 9	0 22-0 44	11 21
	e	35	36	1	0 38-0 73	11 21
Java Banjumas Timur	f	15	12	0 8	0 19-0 29	13-19
	g	29	39	1 3	0 29-0 48	10 16
	h	30	—	—	0 19	6
	j	30	40	1 3	0 29	10
	k	37	36 40	1 1 1	0 22 0 48	6 13
	l	37	39	1 1	0 67	18
Agathis robusta, south Queensland provenance*						
	m	25	20 4	0 8	—	—

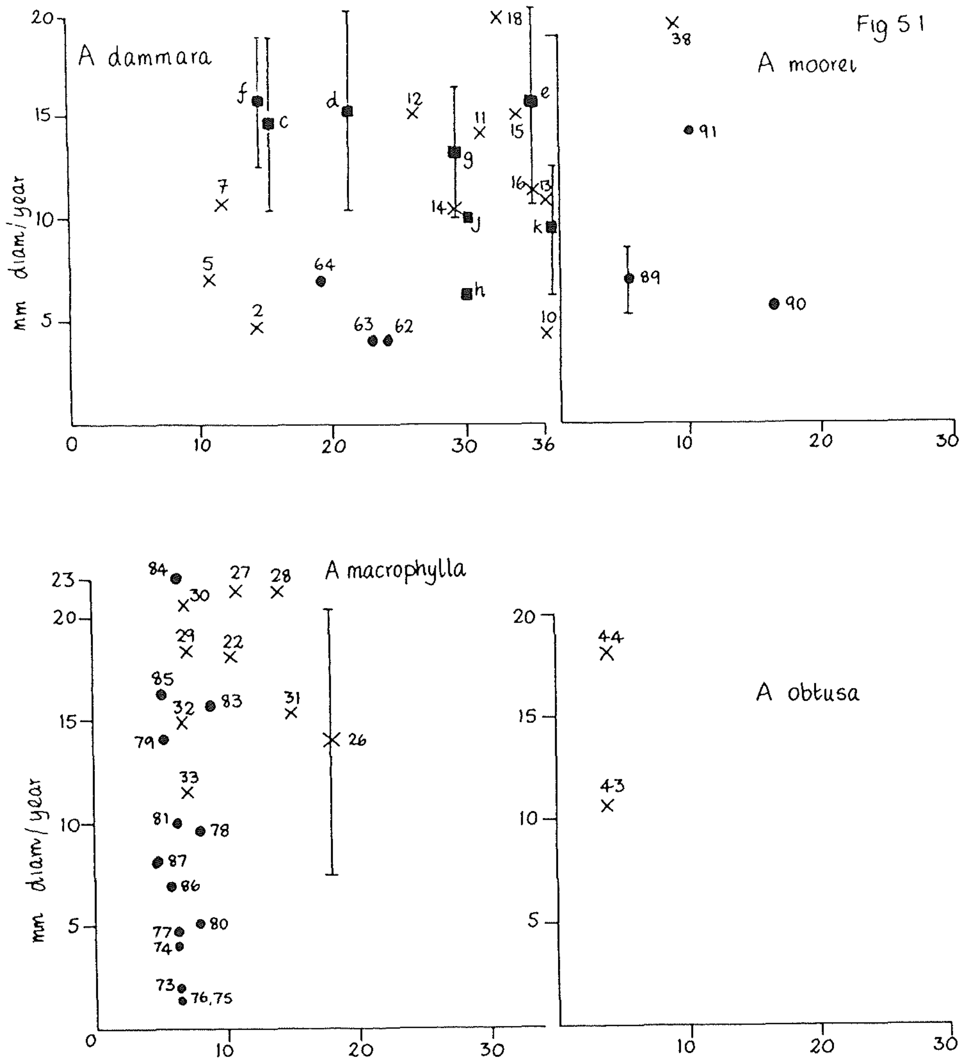
*The figures in Table 4 3 are similar

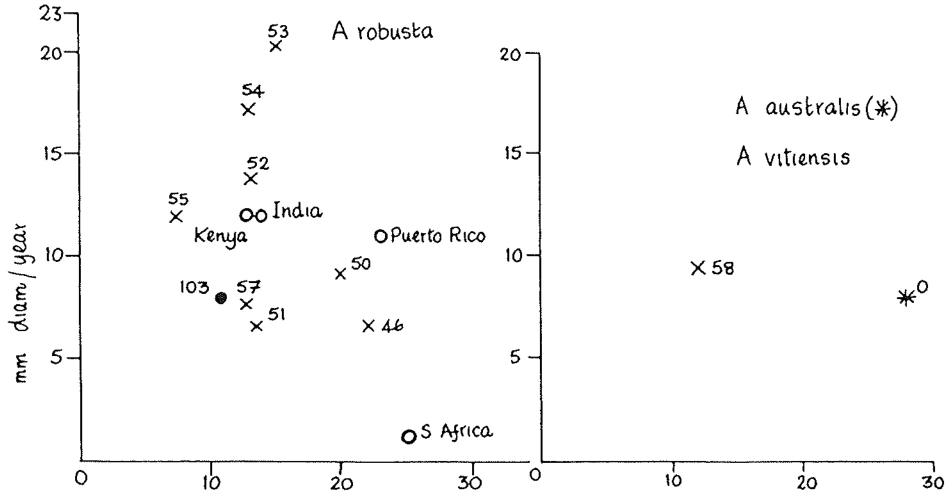
Fig 5 3



5.3 Height and diameter growth in the Javan plantations. (From Ferguson 1949b).

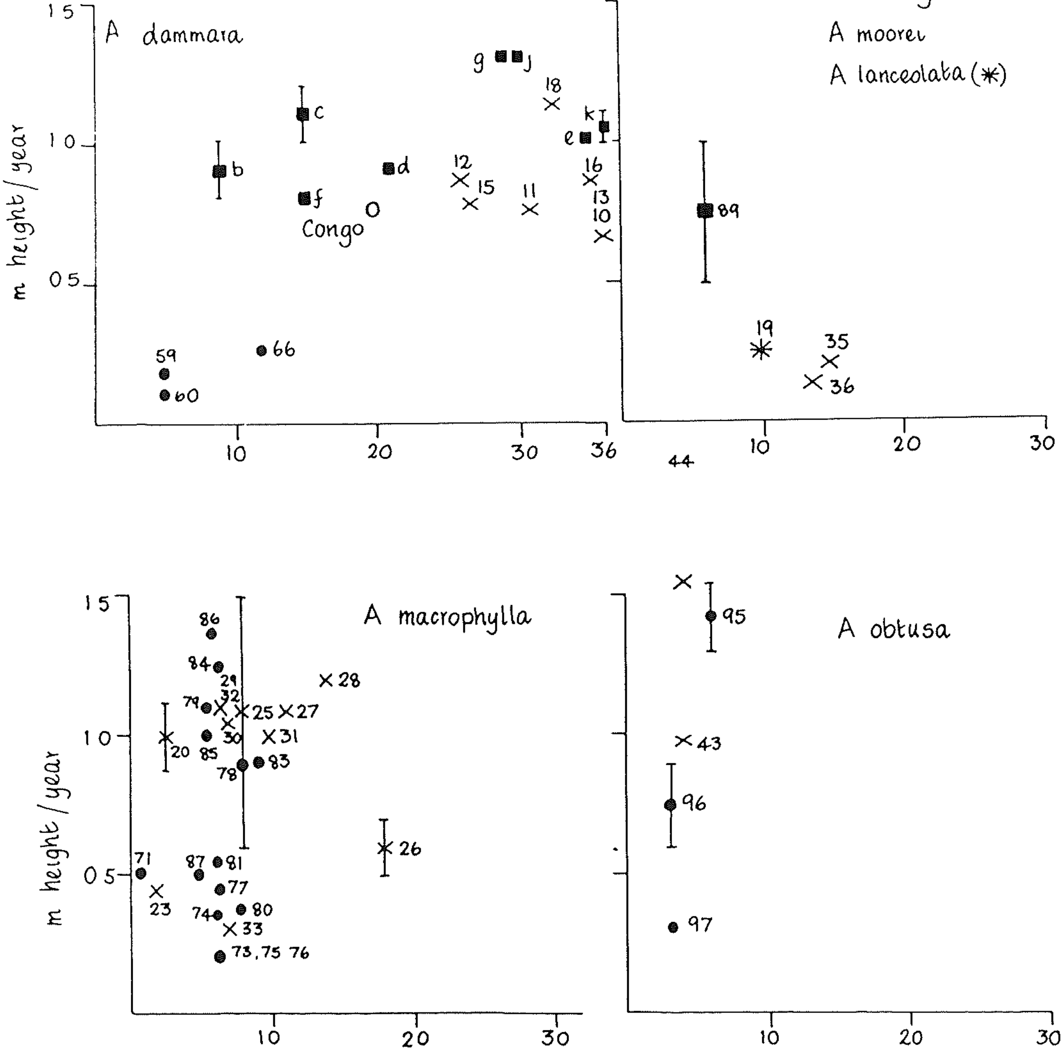
Fig 5 1

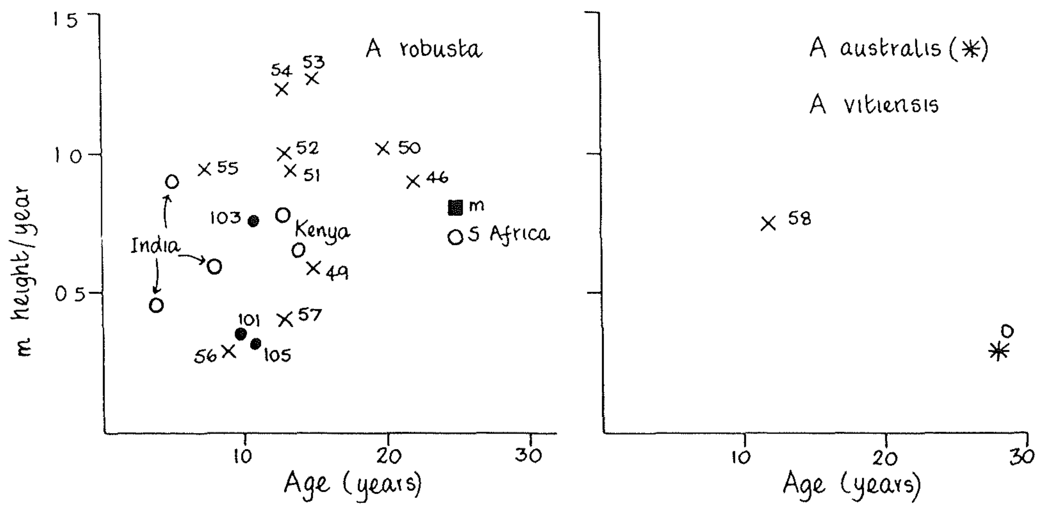




5 1 Diameter growth against age (Small plots—open x, underplanted •, exotic o Plantations ■.)

Fig 5 2





5 2 Height growth against age. (Small plots—open x, underplanted•; exotic o. Plantations ■.)

Table 5 4 Diameter growth in broad classes
(letters refer to plantations, numbers to small plots open-planted, roman, under-planted, *italic*)

Annual diameter increment	*A dammara*	*A macrophylla*	*A robusta*	*A australis*	*A moorei*	*A obtusa*	*A vitiensis*
over 20 mm	18 Java d e Java	26 Papua New Guinea 27 28 30 Solomons *84 Fiji*	53 Solomons				
15-20 mm	d e f Java	22 Malaya 26 Papua New Guinea 29 Solomons 31 32 Fiji *83 Fiji*	54 Solomons	0 New Zealand	38 New Caledonia	44 New Hebrides	
10-15 mm	7 Malaya 11 12 13 14 15 Java 16 Celebes c d e f g Java	26 Papua New Guinea 33 Fiji *79 81 85 Fiji*	52 55 Solomons Kenya (2) Puerto Rico		*91 New Caledonia*	43 New Hebrides	58 Fiji
under 10 mm	5 Malaya 10 Java *62, 63 64 Celebes* g h j k Java	*73 74 75 76 77 78 80 86 87 Fiji*	46 Papua New Guinea 50 51, Queensland 57 Fiji *103 Queensland* South Africa		*89 New Hebrides* *90 New Caledonia*		
Total no trials	23	23	13	1	4	2	1

Table 5.5 Height growth in broad classes
(letters refer to plantations, numbers to small plots open-planted roman, under-planted, *italic*)

Annual height increment	*A dammara*	*A macrophylla*	*A obtusa*	*A robusta*	*A moorei*	*A vitiensis*	*A lanceolata*
1 0-1 5 m	18 Java c e g h k Java	20 Malaya 25 Sabah 27 28 30 Solomons 31 32 Fiji *79 84 85 86 Fiji*	44 New Hebrides *95 New Hebrides*	50 Queensland 52 53 54 Solomons			
0 5 1 m	10 11 12 13 15 Java 16 Celebes b f d Java Zaire	20 Malaya 26 Papua New Guinea *71 Sarawak* *78 81 83 87 Fiji*	43 New Hebrides *96 New Hebrides*	46 Papua New Guinea 49 51 Queensland 55 Solomons *103 Queensland* m Queensland India (2) Kenya (2) South Africa	*89 New Hebrides*	58 Fiji	
under 0 5 m	*59 60 Brunei* *66 Celebes*	23 Sarawak 33 Fiji *73 74 75 76 77 80 Fiji*	*97 New Hebrides*	56 Fiji *101 105 Queensland* India (1)	35 36 New Caledonia		19 New Caledonia
Total no trials	19	25	5	19	3	1	1

出典 Whitmore, T C (1977) A First Look at Agathis, Tropical Forestry Paper, No 11, 20-30

樹種：ARAUCARIACEAE(ナンヨウスギ科)
Araucarias cunninghamii　(フープパイン)
国　：多国籍［パプアニューギニア，モーリシャス］

Colonial Pine, Hoop Pine, Richmond River Pine and White Pine.

Trade Name

Hoop Pine.

Papua New Guinea

Mauritius

成長・収穫に関する表，図，式など

Papua - New Guinea

Growth and yield records are also available from New Guinea and the table on page 47 points to the growth potential of Hoop Pine in the Bulolo Valley, where large areas have been planted with Hoop Pine. The Bulolo Valley Hoop Pine was reported to be making excellent progress when 1963 measurement was made.

Records from Yield Plots of A cunninghamii in the Bulolo Valley (New Guinea)

1 9 6 2

				Basal Area/Acre sq ft				Volume/Acre cu.ft				Predominant Height (ft.)			
Age (1)	Plot No. (2)	No of stems (3)		Standing (4)		C A I. (5)		Standing (6)		C A.I (7)		Height (8)		C A I. (9)	
Years		Acre	Hectare	sq ft	sq m.	sq.ft.	sq.m	cu.ft.	cu m.	cu ft.	cu m.	ft	m.	ft	m
5 5	17 A	360	889	38	8.7	-	-	368	25.8	-	-	34	10 36	-	-
	B	341	842	44	10 1	-	-	485	34.0	-	-	39	11.89	-	-
6 5	9 A	410	1013	78	17 9	15	3 4	976	68 3	231	16 2	47	14 33	7	2 13
	B	335	828	70	16 0	16	3 8	897	62.8	286	20.0	47	14.33	9	2 74
7 5	11 A	390	963	95	21 8	19	4 4	1358	95 1	417	29.2	56	17 07	8	2 44
	B	323	798	91	20 8	21	4 8	1389	97 2	654	45 8	54	16 46	7	2 13
8 5	8 A	432	1067	105	24.1	16	3.8	1992	139.4	715	50 1	56	17 07	5	1 52
	B	313	501	78	17 9	19	4 4	1418	99 3	566	39 6	59	17.98	6	1.83
9 5	14 A	443	1092	114	26 1	13	2 9	2338	163.7	472	33 0	63	19 20	7	2 13
	B	335	828	102	23 4	16	3 8	2302	161 1	615	43 1	62	18 90	6	1 83
10 5	4 A	320	791	131	30 0	15	3.4	-	-	-	-	77	23 47	9	2 74
	B	159	393	82	18 8	12	2 8	-	-	-	-	76	23 16	10	3 05
12 0	2 A	515	1272	200	45 9	11	2.5	-	-	-	-	87	26 52	5	1.52
	B	189	467	109	25 0	11	2 5	-	-	-	-	85	25.91	4	1 22

1 9 6 3

6 5	17 A	349	862	53	12.2	15	3.4	569	39.8	217	15.2	40	12 19	3	0 91
	B	316	781	56	12 8	15	3.4	698	48.9	251	17.6	49	14 94	10	3.05
7.5	9 A	410	1013	94	21.6	16	3.8	1411	98.8	435	30.5	55	16.76	8	2 44
	B	335	828	84	19.3	14	3.2	1251	87.6	354	24.8	55	16.76	8	2.44
8 5	11 A	410	1013	107	24 5	15	3.4	2121	148.5	812	56.8	66	20 12	10	3.05
	B	307	758	103	23 7	16	3.8	2204	154.3	891	62.4	64	19.51	10	3 05
9.5	8 A	438	1082	115	26.4	16	3.8	2520	176.4	664	46.5	62	18.90	6	1.83
	B	303	749	92	21 1	16	3.8	2112	147.8	754	52.8	63	19 20	4	1 22
10.5	14 A	437	1079	137	31.5	13	2.9	n.a.	n.a.	n.a.	n.a	66	20.12	3	0.91
	B	330	815	114	26.1	14	3.2	n.a.	n.a.	n.a.	n.a.	68	20.73	6	1.83
11.5	4 A	326	805	137	31.5	14	3.2	n.a.	n.a.	n a.	n.a.	80	24.38	3	0 91
	B	154	380	91	20 8	9	2.1	n a.	n.a.	n.a	n a.	77	23.47	1	0.30
13.0	2 A	515	1272	211	48 5	12	2.8	n a	n.a	n.a	n a.	92	28.04	5	1 52
	B	180	445	112	25 7	8	1.8	n.a	n.a.	n a	n.a	88	26.82	3	0 91

n a - not available

Source From Papua and New Guinea Department of Forestry, 1962/63 Annual Report

The yield table based on data from plots up to 40 years of age under combined pulp and sawlog operations is presented on page 50. (Hawkins and Muir, 1968).

Yield Table - Hoop Pine 9' x 8' (2.74 m x 2.44 m) Site Index 85'

Age (yrs) (1)	Whole stand per acre (2)	Thinned per acre (3)	Retained per acre (4)	Pulp yield cu.ft./acre (5)	Mill logs cu.ft./acre (6)	Total yield cu ft./acre (7)
13	500 (1235/ha)	150 (370 5/ha)	350 (864 5/ha)	500 (35 m³/ha)	-	500 (35 m³/ha)
18	350 (864.5/ha)	110 (271.7/ha)	240 (592.8/ha)	550 (38.5 m³/ha)	-	550 (38.5 m³/ha)
22	240 (592 8/ha)	40 (98 8/ha)	200 (494/ha)	200 (14 m³/ha)	420 (29.4 m³/ha)	620 (43 4 m³/ha)
28	200 (494/ha)	40 (98.8/ha)	160 (395 2/ha)	170 (11.9 m³/ha)	530 (37.1 m³/ha)	700 (49.0 m³/ha)
35	160 (395 2/ha)	40 (98.8/ha)	120 (296.4/ha)	150 (10.5 m³/ha)	630 (44.1 m³/ha)	780 (54 6 m³/ha)
42	120 (296.4/ha)	20 (49 4/ha)	100 (247/ha)	50 (3.5 m³/ha)	550 (38 5 m³/ha)	600 (42.0 m³/ha)
48	100 (247/ha)	20 (49.4/ha)	80 (197.6/ha)	40 (2.8 m³/ha)	970 (67.9 m³/ha)	1,010 (70.7 m³/ha)
55	80 (197.6/ha)	80 (197.6/ha)	-	170 (11.9 m³/ha)	7,000 (490 m³/ha)	7,170 (501.9 m³/ha)
				1,830 (128.1 m³/ha)	10,100 (707.0 m³/ha)	11,930 (835.1 m³/ha)

Mauritius

There are now 400 hectares of Hoop Pine in Mauritius, most of which is between 10 and 20 years old. The rate of planting is however only 20 hectares per year because of the lack of suitable and available land at low altitudes (below 100m) where the tree shows the best growth. See table on page 51.

Provisional Figures of Growth and Yield for *Araucaria cunninghamii* in Mauritius

(Supplied by Brouard 1968)

Age (yrs)	Main crop after thinning					Thinnings				
	Height (m) Dominant	Height (m) Mean	Mean G.B.H O B (cm)	Stocking s.p.h.	Total vol./ha. O.B. (m³)	Vol. removed/ ha O.B. (m³)	Total vol. removed to date/ha. O B (m³)	Total volume/ ha. O B. (m³) incl thinnings	Annual vol. inc./ ha. O.B. (m³) C.A.I.	Annual vol. inc./ ha. O.B. (m³) M.A.I.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
				Quality class I (upper)						
10	9.2 - 12.2	7.5 - 10 7	42 - 51	1,000 - 1,500	50 - 70	0 - 18	0 - 18	50 - 85	12	7
15	12.2 - 15.2	11.5 - 13.7	55 - 64	750 - 875	85 - 105	18 - 35	18 - 50	105 - 160	23	9
20	15.2 - 18.2	14.5 - 16.7	67 - 77	500 - 625	140 - 175	35 - 70	50 - 125	190 - 300	41	12
25	18.2 - 21.5	17.5 - 19.7	80 - 89	250 - 375	230 - 280	70 - 140	125 - 270	355 - 550		18
				Quality class II (lower)						
10	6 2 - 9 2	4 5 - 7.5	33 - 42	1,125 - 2,000	35 - 50	0 - 18	0 - 18	35 - 70	12	5
15	9.2 - 12.2	9.2 - 11.5	45 - 55	875 - 1,000	70 - 85	18 - 35	18 - 50	85 - 140	18	8
20	12.2 - 15.2	12.2 - 14.5	58 - 67	625 - 750	105 - 140	35 - 50	50 - 105	160 - 255	31	11
25	15.2 - 18.2	15.2 - 17.5	70 - 80	375 - 500	175 - 230	50 - 100	105 - 210	280 - 440		15

出典

Ntima, O.O. (1968). Fast growing timber trees of the lowland tropics No.3. Commonwealth Forestry Institute, Department of Forestry, University of Oxford.

樹種：ARAUCARIACEAE（ナンヨウスギ科）
Araucaria angustifolia（パラナマツ）
国：ブラジル

データ採取地の立地環境

Locality:	Paraná, Santa Catarina and Rio Grande do Sul
Altitude:	600 – 950 m
Data source:	temporary sample plots
Number of plots:	921
Size of plots:	100 m^2

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site[1/] class

Age (years) \ Site class	2	3	4
10	14.1	6.9	3.3
15	19.2	9.4	4.5
20	20.7	10.0	4.9
25	20.5	10.0	4.8
30	19.7	9.6	4.6
35	18.7	9.1	4.4

1/ In the present study, this is production class.

Remarks: MAI is based on stocking density of 1000 stems/ha. No measurement specification has been indicated but MAI is volume of standard (limpa) timber under bark.

BRAZIL (2)

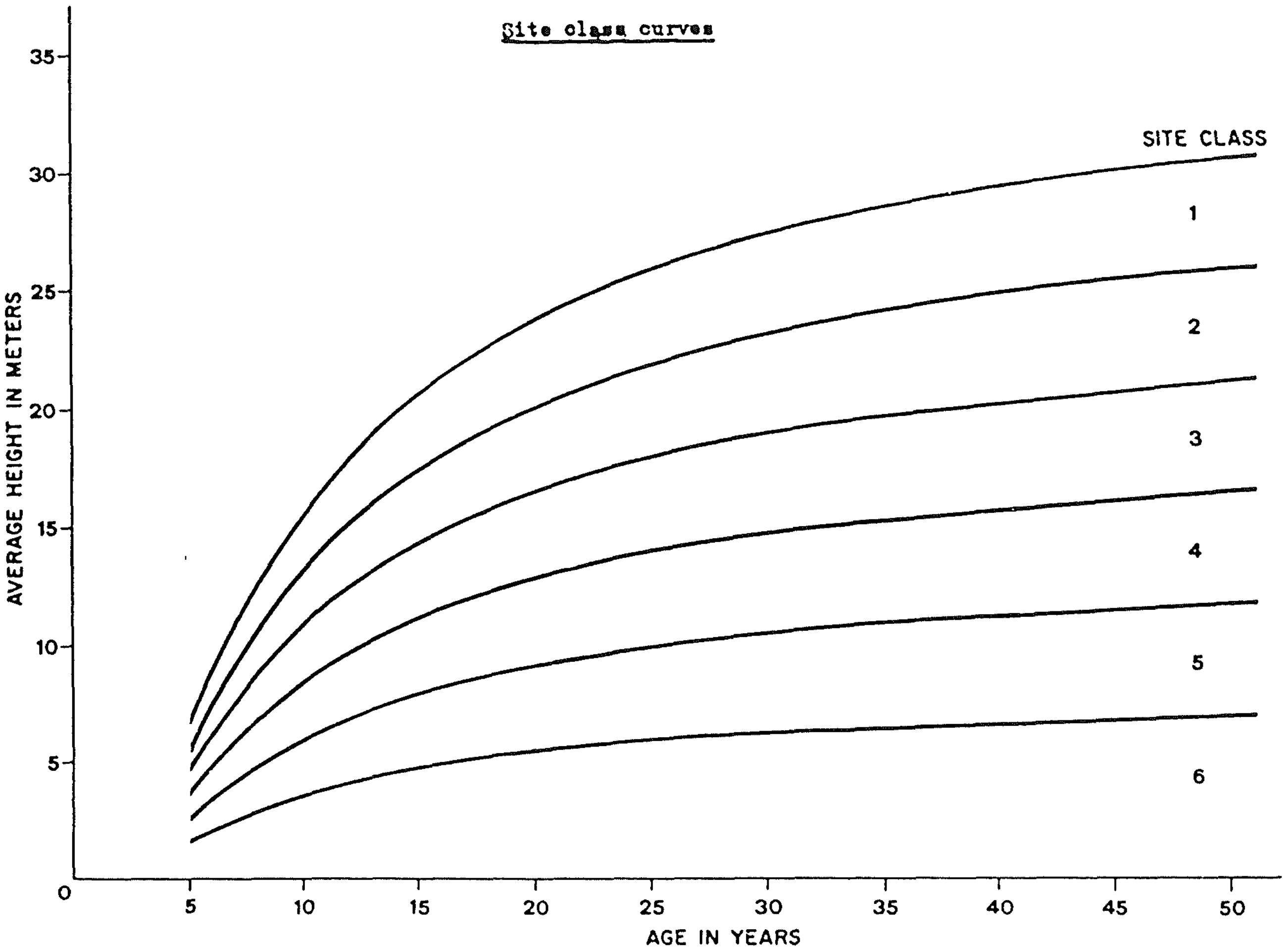
Locality:	same as in (1)
Yield:	15 m^3/ha/year at 23 years' age
Remark:	only stem wood was measured. No other details.

Comments

In Brazil MAI seems to culminate between 20 – 25 years' age with 10 – 25 m^3/ha MAI on average site conditions.

Araucaria angustifolia - Brazil (1)

Site class curves



出典

(1) Heinsdijk, D. 1962 Conifer plantation in Brazil. Preliminary study of volume and yield of A. angustifolia, etc. Boletim No. 5.

(2) Kissin, I. 1950 The growth and yield of A. angustifolia. Aus. bras. Econ. Flor. Inst. Nao Pinho 3(3).

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：ARAUCARIACEAE(ナンヨウスギ科)
Araucaria hunsteinii (クリンキーパイン)
国：ニューギニア

(Syn. A. klinkii Lauterbach)

Local Names

Rassu or Pai

Trade Name

Klinki Pine

New Guinea

データ採取地の立地環境

New Guinea

Information on growth data of plantation-grown A. hunsteinii from New Guinea is at present very limited because only small areas have reached sufficient age for yield plots establishment (White, 1968). However, there are indications that early development of A. hunsteinii is very encouraging as the data on page 68 from yield plots in New Guinea shows. (See page 74)

成長・収穫に関する表，図，式など

4.61

Data from Yield Plots (New Guinea)

Plot No	Age (yrs)	No. trees per acre	per ha	Predominant ht.* ft.	(m)	Mean diam (o.b) ins	(cm)	Basal area per acre	per ha	B A. C.A.I.
5	8.5	234	(578)	41	(12.5)	5.6	(14.2)	45.6	(10 5)	11.2
6	8 5	332	(820)	45	(13.7)	5.4	(13 7)	60.1	(13.8)	13.0
4	12.5	206	(509)	67	(20 4)	9.2	(23.3)	107 7	(24 7)	11.4
3	13.5	316	(781)	77	(23.5)	8.7	(22.0)	140.8	(32 3)	12.3
2	16 5	136	(336)	93	(28 4)	13.6	(34 5)	126.6	(29.0)	6 8
7	16.5	290	(716)	90	(27.4)	9 9	(25 1)	165 8	(38.0)	10.0

* Mean height of the tallest 20 trees per acre (49 per ha.)

White points out that thinning has been very variable from plot to plot and that cultural history has markedly influenced diameter growth For example in plot 2 above the trees were reduced by 40 per acre (99 per ha) in 1966 White thinks that an improvement could be expected in C.A.I. of the basal area at the next measurement

The Malayan table below shows an enumeration result from the eighth year (in girth classes) at which time a thinning to favour the more vigorous stems had removed 36 trees of 5.72 square feet (0.52 r basal area.

Age	No. of trees	No. per girth classes breast height o.b. ins. (cms) 0-30.5 cms (0-12 ins)	30.5-45.7 cms (12-18 ins)	45.7-61 cms (18-24 ins)	61-76 cms (24-30 ins)	76-91 cms (30-36 ins)	Basal Area m^2 (sq. ft.)
8	80	4	27	43	6	-	1.50 (16.37 sq
9	80	1	11	43	24	1	2.022 (21.98 s
10	80	1	2	26	43	8	

出典

Ntima, O.O. (1968). Fast growing timber trees of the lowland tropics No.3. Commonwealth Forestry Institute, Department of Forestry, University of Oxford.

熱帯林の成長データ集録（その1）

熱帯林情報 No. 3

平成8年3月30日

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