#### AN ASSESSMENT OF BROADLEAF FOREST RESOURCES AND SUSTAINABLE YIELD IN BELIZE

Denis Alder

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#### SUMMARY

This study estimates broadleaf forest areas, growing stock and allowable cut of hardwood timbers, using data from several sources. Forest inventories performed from 1969-1981 are the main source. The original data is re-analysed using a post-stratification based on vegetation types. Forest areas are derived from gazetted protected areas, vegetation type maps, topographic, land use and land system information.

Broadleaf forest for timber production is considered in 3 categories: Forest reserves with slopes less than  $25^{\circ}$  (FR25), forested private lands (FPLs) and forested national lands (FNLs). They cover respectively areas of 965, 981 and 1087 km<sup>2</sup>. Total stocks of mature timber by 3 species groups are determined for each type of land, and updated from the original inventories to the present day using available timber production statistics. Annual allowable cut (AAC) based on a 40-year felling cycle and 60 cm minimum girth is calculated and compared with existing survey data on sawmill intake.

It is found that current sawmill log intake  $(61,000 \text{ m}^3/\text{year})$  is about 2/3 the total AAC from all categories of land  $(91,000 \text{ m}^3)$ , but twice the AAC for forest reserves alone  $(29,500 \text{ m}^3)$ . Elite species, especially Mahogany and Cedar, are being generally overcut. Total elite-species AAC is  $6,000 \text{ m}^3/\text{yr}$ , with sawmill intake about 20,000 m<sup>3</sup>.

Recommendations are made for measures which may assist in monitoring forest production and reduce overcutting of Elite species in the longer term.

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#### LIST OF ABBREVIATIONS

AAC	•	•	•	-	Annual Allowable Cut
FNL				•	Forested national land
FPL		•	•	•	Forested private land
FPMP		•		-	Forest Planning and Management Project
FR25				•	Forest reserves, slopes ≤ 25°
GIS	•	•.	•	•	Geographic Information System
LIC	•	•	-	•	Land Information Centre
MNR	•	•	•	•	Ministry of Natural Resources
ODA	•	•	-	•	Overseas Development Administration
OFI	•	•		•	Oxford Forestry Institute
PFB	•	•	•	•	Programme for Belize
PSP	•	•	•	•	Permanent Sample Plot
PVG	•	•	•	•	Provisional Vegetation Group
ç.	-	-	-	•	De Liocourt Quotient
RBCMA		•		•	Rio Bravo Conservation and Management Area
RISC	•	•	-	•	Reduced Instruction Set Computer
TFAP		•	•	•	Tropical Forestry Action Plan
TSIA				•	Transect Sampling Inventory Analysis

#### CONVERSION FACTORS

1 m<sup>3</sup> is 35.31 ft<sup>3</sup>

1,000,000 ft<sup>3</sup> is 28,317 m<sup>3</sup>

1 mi<sup>2</sup> is 2.59 km<sup>2</sup>

 $1 \text{ km}^2$  is 100 ha

1 km<sup>2</sup> is 247 ac

Belize's total hardwood AAC is 3,200,000 ft<sup>3</sup> (91,000 m<sup>3</sup>)

Belize's accessible broadleaf forest reserves are 236,000 ac (965  $\text{km}^2$ )

I used to believe there were forests in Belize, but now I do think that its only the ink on maps we do perceive

#### DISCLAIMER

The views and opinions expressed in this report are those of the author. Any errors or omissions are the author's responsibility. No endorsement by the Forest Planning and Management Project or the UK Overseas Development Administration is assumed or implied.



Figure 1 : Timber production areas and inventory transects 1969-1981

#### AN ASSESSMENT OF BROADLEAF FOREST RESOURCES AND SUSTAINABLE YIELD IN BEL12E

#### 1 INTRODUCTION

This report is based on a re-analysis and synthesis of several forest inventories that were carried out in the broadleaf forests of Belize between 1969 and 1981. Its aim is to provide a more correct assessment of the national broadleaf forest resource than has hitherto been available, and to give estimates of sustainable timber production.

Category	km²	Total km²	¢.	
Protected broadleaf forest National Parks Wildlife sanctuaries etc. Forest reserves, slopes >25°	1,011 873 2,616	4,500	20.7	
<i>Timber production areas</i> Forest Reserves, slopes ≤25° Forested National Lands Forested Private Land	965 1,087 981		4.4	
Total broadleaf forests		3,033 7,533	14.0 34.7	
Belize land area		21,694	100.0	

### Table 1 : Areas of broadleaf forest available for timberproduction

Table 1 shows the areas of broadleaf forest by categories of management. A considerable portion of the total land area comprises broadleaf forest that is completely protected (20.7%). Much of the Forest Reserve comprises mountainous areas with average slopes greater than 25°, and are too steep to be logged. These are included with the non-production forest area.

Only 4.4% of the land area comprises broadleaf forest that is within forest reserves on land with slopes of less than 25°. This constitutes the only land in Belize that with some expectation of sustainable management for hardwood timber production.

Some 9.6% comprises forested national and private lands (FNLs and FPLs) that have been identified by GIS (Gray & Belisle, 1993) as being outside present clearances, and are of too low an agricultural value to be likely to be cleared within the immediate future (for example for citrus). However, the long-term role of FNLs and FPLs in the timber economy of Belize remains an open question.

The figures given in Table 1 are slightly lower than those given in a preliminary study (Forest Department, 1993), where accessible forest reserves where estimated at 990 km<sup>2</sup> or 4.6% of land area. The differences are due to error corrections to digitized boundaries that have been applied to the GIS files since that assessment.

This report examines the production potential of Forest Reserves (considering only lands of less than 25° slope), FNLs and FPLs and considers how this relates to the present and possible future size of the timber industry in Belize.

#### 2 SOURCES OF DATA ON BROADLEAF FOREST RESOURCES

#### 2.1 Forest areas

There has been no general and integrated survey of the forest resources of Belize. In particular, recent information on forest clearance and agricultural conversion is lacking. Work is currently in hand in the Ministry of Natural Resources (MNR) to produce a forest cover map based on interpretation of satellite imagery. However, the database derives from 1987 imagery and does not appear to include any documented ground-truthing or forest inventory. Interpretation is manual from printed satellite imagery, and is proceeding slowly.

Certain alternative sources of information have therefore been adopted to try to estimate forest areas. The most important component of this is the work of Wright et al. (1959), who produced a vegetation map of Belize based on photointerpretation and ground survey (but not statistical sampling or inventory). Wright's maps have been digitized by the Land Information Centre (LIC) of MNR, and areas and locations of various broadleaf forest formations determined from them.

The LIC also has information on protected areas by various categories, and the Land System maps of King *et al.* (1992) in digital form. These have been processed and combined logically with Wright's maps to produce the categories in Table 1, and the more detailed breakdowns given elsewhere in this report. The principle assumptions involved are as follows:

- (a) Slopes less than 25° are derived directly from the Land System classification. This probably overestimates area constraints due to high slope, but conversely ignores access problems due to swamp conditions.
- (b) Forested National Lands were estimated from land-ownership information, broadleaf forest formations according to Wright's map, and areas of low agricultural value (classes 3 & 4) according to the criteria of King et al.(1992).
- (c) Forested Private Lands were similarly estimated using different ownership categories.

The classifications of FNL and FPL were defined by Bird (1993a) and the GIS coverages prepared by the LIC according to those criteria. As noted previously, some marginal variations in area estimates have occurred from earlier and later versions of these GIS files which are attributable to updates and error corrections and their effect on map topology. The figures given in this report are based on the most recent versions (November 1993) of these files.

The estimation of forest areas and accessibility therefore involves

in all cases assumptions which, if invalid in particular cases, could considerably vary the overall results. The Programme for Belize Rio Bravo Conservation and Management Area (RBCMA) exemplifies the problems involved. This area of 830 km<sup>2</sup> comprises 3.8% of Belize's land area and is similar in size to the total accessible area of reserved broadleaf forest (965 km<sup>2</sup>). It is partly classified as FPL (about 30%), partly as agricultural land of high value, and partly as riveraine, swamp and marsh formations (wetlands). The 'agricultural' component currently carry forest with a high proportion of valuable mahogany. The Programme for Belize (PFB) plan to keep a substantial part of this area, including some of the estimated FPL strictly for conservation. Other areas, including some classified as 'agricultural' will on the other hand be used for timber production (Wilson, 1993).

However, in spite of these caveats, the area estimates presented here are better approximations than the unqualified extent of broadleaf formations derived from Wright's 1959 map, or the totals of forest reserve without any allowance for accessibility.

#### 2.2 Forest inventories 1969-1981

Forest inventories carried out in the broadleaf forests between 1969 and 1981 of Belize are summarised in Table 2. Six distinct inventories were carried out, each with a similar design. Altogether, 144 transects were laid down, totalling 666.3 km in length. Figure 1 shows the transect locations, which are also available as a GIS file together with standardised species occurrence data. The sampling designs are discussed in more detail in Alder (1992), together with separate results for each inventory. The first to be performed was that in western and southern part of Chiquibul Forest, in an area that is now predominantly within the Chiquibul National Park. It was based on a sampling design proposed by Dawkins (1958) that used fixed size blocks as strata, and laid two transects within each.

Subsequent inventories copied this initial design, with only limited variations. The Chquibul main and mountain inventories were carried out by the Land Resources Division of ODA, and written up by Johnson & Chaffey (1972). The later inventories, except for that on the Belize Estates land, were assisted by ODA but carried out primarily by the Forest Department; results were produced only as internal file documents. All the inventories were processed at the Oxford Forestry Institute (OFI) by P.G. Adlard and H.L. Wright. The tabulations and analyses on file are based directly on the Oxford computer outputs.

The Belize Estates inventory was carried out privately, although also processed under contract by OFI, and covered land between and to the north of Gallon Jug and Hillbank. It is referred to in the computer documentation as the Hillbank inventory. Part of the area

Forest inventory	Year	Transect size(km)	No. Tr.	Area km²
Chiquibul main series	1969	8	24	768
Chiquibul mountain series	1971	5	17	200
Columbia/Maya Mountains	1975	5	34	425
Hillbank (Belize Estates)	1975	3.6-6	31	988
Cockscomb Basin	1978	4	24	240
Deep River	1981	2	14	28
Total		666.3	. 144	2,649

 Table 2 : Broadleaf forest inventories 1969-1981

covered falls into what is now the Rio Bravo Conservation and Management Area.

The average intensity of sampling varied according to species and size class. Mahogany and Cedar over 40 cm were measured on a total area of 2,665 ha in the sampling frame of 264,900 ha, or at almost exactly 1%. Other species over 40 cm were sampled at about 0.5%. Sampling for sizes from 20-40 cm was mostly at one-fifth these intensities. Alder (1992) gives more details.

The inventories were not stratified according to any natural features, either of vegetation, topography, soils, or etc. This was perhaps a little surprising, given the wealth of information that was even then available from Wright's vegetation map and aerial photography. It can be explained in terms of the first Chiquibul inventory, which took place in an area still in the early stages of recovery from Hurricane Hattie and which had been relatively uniform in its original vegetation. Dawkins (1958) design was perhaps appropriate in that situation. The subsequent inventories appear to have followed the first in their basic methodology without any careful definition of objectives or appraisal of methods.

#### 2.3 Post-stratification by vegetation groups

The objective of the present study has been to use the 1969-1981 inventory data to provide national estimates of the forest resource. To achieve this in a flexible way, so that suitably weighted tables could be derived for specified areas, it was necessary to post-stratify the pooled set of 144 inventory transects by vegetation type, land system, or any other suitable technique. The Land System maps of King et al. (1992) are relatively detailed, and could in principle form a very suitable basis for forest inventory stratification. However, the level of detail involved itself constituted a barrier to their use in this instance. A single inventory transect may cross a number of Land Systems, and would need to be subdivided to obtain reasonable resolution of vegetation differences. The same problem applies to Wright's vegetation maps, but is less acute as the information is initially more generalised.

A second problem with the Land Systems was completely practical. In the GIS files, the Land System map of Belize comprises some 56,000 polygons; the vegetation map has 1,600 polygons. A simple operation, such as the intersection of the 144 transects with the vegetation maps to form sub-transects by vegetation types, takes about 1 hour on a 486/50 computer with the simpler map. Processing time appears to rise with the square of the number of polygons, and any fairly straightforward operation with the full Land System map could be projected to take several days of computer time.

This problem could be resolved by using the more powerful computers installed at the LIC (Sun RISC workstations). Even so, the LICs normal work schedule would be disrupted for a considerable time, and available consultancy services under the FPMP were insufficient to cover the investigations required.

For these practical reasons, Wright's vegetation maps were adopted as the basis of stratification. It was necessary to defined pooled vegetation types, called Provisional Vegetation Groups (PVGs), such that each PVG that comprised broadleaf forest included two or more transects. This was achieved by determining with the GIS the proportion of each transect that fell into different vegetation types, then sorting them on the dominant type, and grouping them to arrive at suitable PVGs.

It had been originally hoped to split transects at the point where they crossed vegetation (or land system) boundaries to obtain a more refined analysis. In practice, there were many ambiguities with regard to the direction in which transects had been laid and measured, and it was not possible to map subplot positions onto precise locations. For the Hillbank and Deep River inventory, original field cards had been lost, and the data sets available from magnetic tape archives in Oxford had pooled subplot data within transects, completely losing positional information. The possibility of reliably splitting transects had therefore to be abandoned, and it was necessary to assign each transect in its entirety to one or other PVG.

Table 3 shows the PVGs, Wright's corresponding vegetation types, the volumes of the commercial species groups, total volume of all species, the sampling error of total volume, and the five most dominant species. The characteristic species differ somewhat from

those noted by Wright, except for the group A types, 1 and 1a. These differences reflect:

- (i) The nature of the transect sampling, which tends to be across mosaics of vegetation associations. Thus the marsh forest and Cohune Palm formations, M and O, are seen under the PVG analysis to be very similar to type A, the Mahogany-rich broadleaf forests. All have low average volumes, around 20 m<sup>3</sup>/ha, have Mahogany as the main tree component, with Bullet Tree and White Breadnut as important secondary components. In practice the transects in all three types are sampling a mosaic of closed broadleaf forest of type 1-1a, interspersed with open marsh forest of very low stocking, of types 20-22, or Cohune Palm formations of type 34.
- (ii) The fact that Wright's classification should be reviewed using a modern approach based on objective numerical vegetation classification. The transect data is not suitable for this purpose, due to the extended nature of the sampling units. Compact square or circulars plots are required. A study of this type would be well suited to a post-graduate research programme and would provide a useful revision of what may be a somewhat dated vegetation classification.

Table 4 shows the areas calculated by the GIS for the PVGs, based on the aggregation of Wright's original vegetation type areas, and intersection with the various land categories previously discussed. The totals for type A-O include all formations with a broadleaf component, and correspond to the areas given in Table 1.

It will be noticed that type B, the Sapodilla-Mahogany-Bullhoof dominated forest is shown as having no area within forest reserves. This type occurs principally in Chiquibul National Park, and is characteristic of it.

The Table 4 areas, together with the assignment of each transect to a specified PVG, provided the essential information required to produce the national estimates of forest resources. The TSIA program (Alder, 1992) was run on the same data set of 144 transects (all the broadleaf inventories) using the different stratum (PVG) area weights denoted by the last three columns in Table 4 to obtain average stand tables for forest reserve areas less than 25° slope, forested private lands, and forested national lands. The bold area totals (A-O) in table 4 were used to estimate total available stocks.

PVG	Veg.	No.	Volumes,	m <sup>3</sup> /km <sup>2</sup> ,	trees ≥ 50cm	diameter	SE	Characteristic tree species in forest inventory
	Туре	Transects	Elite	Prime	Select	All Spp.	*	(top 5 dominants, in order of volume, trees ≥ 30cm)
Ъ	1-12	15	303	378	656	1 974	14	Mahogany Bullet Tree Fiddlewood Sanodilla White Breadnut
n D	1-1a 2-2h	15 7	563	570	991	1,5/4	27	Sanodilla Mahogany Male Bullhoof Sillion Fiddlewood
D	2-20	,	503	041	001	4,04/	1.	Sapodilla, Manoyany, Male Bullioor, Sillion, Fidulewood
C	2c-2e	32	106	931	716	4,2/4	14	Sapodilla, Nargusta, White Breadhut, Sapotillo, Sillion
D	3-4b	15	115	1,070	927	4,127	14	Nargusta, Sapodilla, White Breadnut, Fiddlewood, Ironwood
Ē	5-7	6	106	691	304	2,165	22	Nargusta, Kaway, Ironwood, Fiddlewood, Hogplum
F	8-8c	12	300	1,228	1,472	7,294	16	Sillion, Fig, Ironwood, White Breadnut, Hogplum
G	9-9e	32	209	1,054	531	3,558	9	Nargusta, Polak, Banak, Ironwood, Bay Cedar
H	10-11g	5	64	538	700	2,124	44	White Breadnut, Nargusta, Yemeri, Bitterwood, Cotton
K	12-12c	7	38	1,998	1,085	5,971	13	Nargusta, Ironwood, Sapodilla, Santa Maria, Cramantree
L	13-16b	4	191	513	507	1,848	13	Nargusta, Fiddlewood, Mahogany, Yemeri, Fig
M	20-22	4	203	285	691	1,882	33	Mahogany, Bullet Tree, Fiddlewood, Sapotillo, White Breadnut
0	34	5	366	437	582	2,343	20	Mahogany, Sapodilla, White Breadnut, Bullet Tree, Santa Maria
Ρ	16-19b	0						Pine formations
S	23~28	0						Marsh and swamp formations
W	29-33	0						Mangrove formations

 Table 3 : Provisional Vegetation Groups - Definition, Commercial Volumes, Dominant Species

PVG	Total Wright <b>'</b> 58	Forest Reserves	≤ 25° in FRs	Private Lands	National Lands
A	185,066	14,861	14,761	10,721	10,612
В	156,256	. 0	0	16,790	13,975
С	262,717	90,750	16,135	24,566	11,856
D	94,141	28,770	8,519	2,124	9,038
E	104,067	19,208	10,221	6,411	5,729
F	82,376	7,154	2,209	7,504	33,283
G	181,235	90,778	5,548	7,949	2,741
H	166,758	75,437	18,837	6,686	7,381
К	51,442	14,258	5,568	0	C
L	116,011	9,815	7,686	1,284	3,540
М	199,012	6,649	6,645	6,126	296
0	112,294	460	377	7,923	10,221
Р	255,156	85,017	56,230	13,050	4,285
S	96,690	3,310	3,286	3,190	0
W	82,063	2,252	2,112	0	0
A-0	1,711,375	358,140	96,506	98,084	108,672
Total	2,145,284	448,719	158,134	114,324	112,957

Table 4 : Areas of PVGs by forest management category. The A-O total denotes all broadleaf formations.

It will be noted that the large areas shown for the classes of Wright's 1958 vegetation maps take no account of areas which have been converted to agriculture, form part of urban or rural settlements or other infrastructure, are excluded from the study as being potentially valuable agricultural land, fall within permanently protected forest in National Parks or Wildlife Sanctuaries or are on areas of steep slope (over 25°).

Appendix A gives the inventory tables for the forest areas, showing results for all classified timber species together with a number of common, ubiquitous trees that are not currently used for timber. Several of these have other uses. Botan Palm may be used for marine pilings. Sapodilla is important for chicle production, and is also a durable timber, but its use for timber is presently prohibited to protect the chicle industry.

Timber species are categorised in three major groups, as defined in Bird (1993b). The groups are termed Elite, Prime and Select. The species are listed explicitly for each group in the stand tables in Appendix A. The Elite group includes Cedar and Mahogany, together with several others of comparable market price and acceptance.

Prime and Select species are somewhat less valuable groups, with a correspondingly weaker marketability. However, all species are fully commercial and commonly used for construction or joinery in Belize.

Appendix B lists all the inventory transects, in order of their assigned PVG, together with locational information, occurrence of dominant species, and mean basal area and numbers of trees as indicators of average forest condition.

#### **3 FOREST RESOURCES AND ANNUAL ALLOWABLE CUT**

#### 3.1 Gross volumes from forest inventories

Table 5 shows gross volumes in  $m^3$  for the three groups of timber species, Elite, Prime and Select, and for the three categories of forest production areas, derived from the 1969-81 inventory estimates. These figures are extracted from the detailed tables in Appendix A.

Species	Volumes m	³, trees ≥60	Ocm diam
	FR≤25°	FNL	FPL
Elite	96,693	214,139	175,795
Prime	595,502	685,354	507,569
Select	627,443	849,056	583,989

Table 5 : Stock volumes of mature trees (≥60 cm diameter) from 1969-1981 forest inventories, by main species groups

#### 3.2 Estimated current standing volumes

Since 1975, approximately 245,000 m<sup>3</sup> of Elite species, mainly Mahogany and Cedar, and 446,000 m<sup>3</sup> of other hardwoods have been extracted from Belize's forests (Smith, 1991). Some 20% of this production may come from Forest Reserves, and the remaining 80% from private or national lands from uncontrolled fellings (TFAP, Although it is not known how the 446,000  $m^3$  'other 1989). hardwoods' may be split between the Prime and Select groups, the assumption has been made that production divides about 2:1 between the groups, reflecting the greater marketability of the Prime species. Similarly, there is no data on relative production from national and private lands. However, most of the FNL areas are in Toledo where there are no large sawmills, whereas the FPLs are close to major producers in northern Belize. It is therefore assumed that production divides between FNLs and FPLs in the ratio 1:3. From these estimates, Table 6 is derived, giving production by categories of species and land over the period 1975-1993.

If the production over the period 1975-1993 is deducted from the 1975 stock estimates, then figures are obtained for the current standing volumes of timber, without allowance for increment. These are shown in Table 7, and can be regarded as conservative estimates. The relative partitioning between FNL/FPL and Prime/Select is somewhat uncertain, due to the assumptions involved in distributing production between these categories.

Species	Log FR≤25°	production FNL	1975-93 m FPL	<sup>3</sup> Total
Elite	49,000	49,000	147,000	245,000
Prime	58,872	58,872	176,616 }	•
Select	30,328	30,328	90,984 }	446,000

Table 6 : Assumed breakdown of log production statistics 1975-1993 by land category and species group

#### 3.3 Increment and annual allowable cut

Annual allowable cut (AAC) should ideally constitute the volumes which can be sustainably removed over an indefinite period, taking into account all aspects of stand dynamics, environmental and social considerations, and so on. However, the information required to make an estimate of this figure is not available. What can be calculated are the consequences, in terms of timber production, of applying current FPMP recommendations of a general 40-year felling cycle and 60 cm diameter minimum felling limit. These are shown in Table 8, which is obtained simply by dividing the current stock figures from Table 7 by the felling cycle period, to give the annual amounts that will be produced neglecting new increment.

Species group	Volume (m <sup>3</sup> FR25	), trees $\geq 6$ FNL	0 cm diam. FPL
Elite	47,693	165,139	28,795
Prime	536,630	626,482	330,953
Select	597,115	818,728	493,005

Table 7 : Conservative estimates of current stocks of maturetimber

Clearly, growth has occurred since the 1975 inventory, and will continue over the next 40 year period. This may appear to imply that both tables 7 and 8 are underestimates of the true position. The level of growth, and especially its partitioning between species and forest types is very uncertain. In undisturbed natural tropical forest, net growth may well be zero or negative. Following logging or tree falls, rapid increment occurs for up to 20-30 years until the fully stocked condition is approached. However, even when net growth is zero, large trees in the canopy continue to grow at the expense of smaller, shaded trees. Mortality in the large tree component may or may not neutralize the effects of growth over broad areas.

Given the likelihood that fully stocked stands will show little net growth in the volume of the mature trees, Table 8 can be construed as a reasonable estimate of long-term sustainable AAC provided that replacement of the mature trees occurs over a 40-year recovery period after logging.

Species	Annua] FR25	l Allowable FNL	Cut, m <sup>3</sup> bole FPL	volume Total
Elite	1,192	4,128	720	6,041
Prime	13,416	15,662	8,274	37,352
Select	14,928	20,468	12,325	47,721
Total	29,536	40,259	21,319	91,113

**Table 8 :** Conservative estimates of annual allowable cut, based on a 40-year felling cycle and neglecting increment

This problem can be approached through a consideration of tree growth and mortality rates derived from permanent sample plots (PSPs). A number of PSPs were maintained under the British Honduras colonial administration, and Forest Department Annual Reports give some findings on growth rates for Mahogany (Forest Department, 1945, §45). The mean increment on five sites over a size range from 20 to 110 cm was 0.68 cm/yr. Mortality over an 8year period was 20.6%, an annual rate of 2.8%.

The increment figures for Mahogany are quite typical of those for other fast-growing tropical species such as many Dipterocarps, Wawa in Ghana, and so on. Other species may be expected to show rather slower growth rates, typically of the order of 0.5 cm/yr. A mortality rate of 2.8% is high but may be biased by consideration of high mortality among small trees. A more typical figure would be 1.5% per annum.

As a rule of thumb, if 0.5 cm/yr increment applies, then all trees in the size range 40-60 cm will grow to mature size (60+ cm) over 40 year period. However, with 1.5% annual mortality, only 55% of the trees will survive; the remainder will die. Consequently the ratio of tree numbers in the 40-60 cm class to those in the 60+ cm class must be greater than 1/0.55 or 1.8 if there is to be sufficient stock in the lower class to replace all the mature stock. Table 9 shows the ratios (conventionally known as Q or De Liocourt ratios) for each forested area and species group. It can be seen that all show sustainable replacment of the growing stock over a 40 year felling cycle. This assessment does depend on growth and mortality rates, and the PSPs now being established under the FPMP will allow the question of sustainability to be reviewed after remeasurements start to become available.

	FR25 N/km² Q			N/1	FNL N/km² Q			FPL N/km² Q		
Species	40-60	60+	ratio	40-60	60+	ratio	40-60	60+	ratio	
Elite	65	21	3.1	98	36	2.7	99	37	2.7	
Prime	211	117	1.8	266	123	2.2	250	103	2.4	
Select	221	115	1.9	287	157	1.8	270	124	2.2	

Table 9 : Ratios of immature to mature stock for species and forested areas. Values greater than 1.8 indicate sustainable replacement on a 40-year cycle.

It can be concluded that the best current estimates of sustainable annual cut are those given in Table 8. This may be compared with the present level of sawmilling activity in Belize. Plumtre (1993) surveyed some 28 mills, and arrived at an estimated log intake of some  $61,000 \text{ m}^3$ . Given the trends indicated in Smith (1991), probably about one-third this figure, or 20,000 m<sup>3</sup> will be Mahogany and Cedar, as against a total AAC of  $6,041 \text{ m}^3$ /year. The residual  $40,000 \text{ m}^3$  or so can be compared with an AAC for Prime and Select species of about 85,000 m<sup>3</sup>.

The statistics are fairly uncertain. The figures cited by Smith (1990) suggest total production of around 1.5 million ft<sup>3</sup> per annum, with those of Plumtre (1993) from the sawmill survey being 30% higher at 2.1 million ft<sup>3</sup>. The situation is affected to an unkown extent by undocumented imports, exports and fellings.

However, in general it may be concluded that Mahogany is clearly being overcut. This is probably occurring mainly on private lands (FPLs) and may be associated with clearances or conversion to agriculture. For other species as a group, there may be some capacity for increased production within the context of sustainable logging. Given the numerous uncertainties in the data, the situation needs to be closely monitored.

#### 4 CONCLUSIONS AND RECOMMENDATIONS

As shown in table 1, total protected broadleaf forest resources in Belize, amount to some 25.1% of the land area. This situation has led studies such as TFAP (1989) to adopt an over-generous estimate of Belize's hardwood resources. In fact the real situation, from the viewpoint of timber production, is very different and quite marginal. Most of the forest is either not available for timber production, being dedicated as National Parks or Wildlife Sanctuaries, or it is too steep or too swampy to allow logging. The areas available for production and within forest reserves total only 965 km<sup>2</sup> or 4.4% of Belize's land area.

Outside forest reserves tracts of broadleaf forest occur on poor agricultural land either as national lands (FNLs) or under private ownership (FPLs). These probably constitute the main source of timber supply to sawmills at present. The areas involved are shown in Table 1. In all, timber production areas on forest reserves, FNLs, and FPLs total some 3,033 km<sup>2</sup> or 14% of Belize's land area.



Mahogany/Cedar Other Hwood

Figure 2 : Comparison of current sawmill intake and sustainable AAC for Mahogany/Cedar and other hardwoods.

Annual allowable cut totals 91,000 m<sup>3</sup> (Table 8), with current sawmill intake at about 61,000 m<sup>3</sup> (Plumtre, 1993). This situation is therefore in general satisfactory, although there is only a small margin for growth of the hardwood industry from its present levels. However, as Figure 2 exemplifies, the cutting of Mahogany and Cedar grossly exceeds the sustainable AAC for those species, by a factor of 3:1.

This situation is indicative of the creaming-out of these Elite species on forest reserves and outside reserves on FNLs/FPLs. With the FPMP, some measure of control is gradually being established within forest reserves, with the delineation of harvesting coupes, the production of felling plans, field inspection of logging operations, and the introduction in some cases of punitive measures to constrain loggers. If these measures are maintained and strengthened, then the over-cutting of Elite species can be brought under control in these areas.

On private lands and non-reserved national lands, very limited control is currently possible. It is likely in consequence that the proportion of Elite species produced within the hardwood sector will continue to decline as the resource is depleted. At some point, shortages of these valuable species may create sufficient economic incentive that private land owners actively attempt to encourage and retain them, through more controlled harvesting and suitable silviculture.

In statistical terms, the present study is relatively robust at the national level. However, it would be desirable to improve the monitoring of timber production over a period of time through a number of measures, which should be integrated with the improvement of the forest management process:

- Efforts should be made to improve the accuracy of systems to account for log removals from the forest. If possible, statutory instruments should be introduced to require the licensing of sawmills and the completion of statisical returns, and the maintenance of records on wood intake and output by species. The Forest Department would have a role in compiling the periodic returns and checking the correct maintenance of records. Administrative levies or the revocation of a sawmilling license would constitute a sanction.
- A number of hardwood management areas should be defined for reserved forest (eg Freshwater Creek, Chiquibul, Deep River, Columbia) where resources can be concentrated. 1:50,000 forest maps should be produced and low-intensity assessments<sup>1</sup> should be performed for each area, with delineation of felling coupes. Each plan should include yield projections, a certain number of PSPs, a work plan for boundary/coupe demarcation and maintenance, and a work plan for stock mapping.

<sup>&</sup>lt;sup>1</sup> At this stage, formal inventories are not required. Overflights, use of area photography, field inspections, and the existing body of inventory data, appropriately weighted and adjusted for local vegetation types, will be initially sufficient. Full inventories would overstretch the Forest Department's limited resources.

- A system for gazetting and formalizing the forest management areas, in an approach somewhat similar to Special Development Areas, would be desirable and would help to limit the possibility of *ad hoc* boundary changes for agriculture or other land uses.
- The PSP programme and proposed silvicultural experiments under the FPMP are important in providing more precise estimates of growth and forest dynamics, and hence of felling cycle, girth limits and AAC for particular areas. They also have a special role in defining the most appropriate forms of silviculture to encourage the regeneration of key species such as Mahogany.
- The Forest Department should seek (in the long term) to develop an extension strategy for private forest owners, offering standard management prescriptions and advice, assisting in nursery development and so forth. This can perhaps be best initially persued by developing the strongest possible communications with sawmillers and loggers through meetings, seminars, workshops and the like. These should be given a high public profile to encourage a climate of opinion favouring sustainable private forestry.
  - If possible, the export of Mahogany and Cedar, other than as manufactured products (mouldings, veneers, plywood, furniture, craft products), should be prohibited.

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#### Appendix A : Inventory tables for categories of forest land

Table A.1 : Tree numbers per km<sup>2</sup> for forest reserves, areas with slopes less than 25°

Species name	Tr 20-30	ees per 30-40	km² by 40-50	cm dia 50-60	neter c 60-70	lasses 70-80	≥80	Cumulat ≥20	ive N/R ≥40	ma² ≥60
Bastard Mahogany Black Poisonwood Cedar Granadilo Mahogany Mayflower Palo Mulatto Rosewood	12 69 33 9 351 9 35 54	3 15 19 3 205 10 17 14	1 8 3 1 16 1 5 9	0 1 2 1 10 1 5	0 0 1 0 6 0 1	0 1 0 3 0 0	0 1 0 4 0 1	17 95 60 15 594 20 58 85	2 10 8 2 38 2 7 17	1 3 1 1 3 0 1 3 0
Elite species	572	285	44	21	10	5	7	943	86	21
Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood Male Bullhoof Mylady Nargusta Quamwood Salmwood Santa Maria	7 49 31 46 79 66 107 226 50 49 89	6 24 16 11 40 31 81 17 15 28	4 10 6 26 14 11 27 9 2 19	1 3 3 15 5 4 24 3 0 11	0 1 3 1 9 2 4 17 2 0 7	0 3 0 4 1 2 14 2 3	0 1 2 4 1 28 0 3	19 88 69 67 177 119 161 417 84 66 160	6 15 22 11 58 22 22 109 17 2 44	1 2 17 3 7 59 4 0 14
Prime species	799	301	133	78	46	30	41	1,427	328	117
Balsam Banak Barba Jolote Bullet tree Carbon Cramantree Fiddlewood Glassywood John Crow Wood Monkey Apple Negrito Red Breadnut Red Wood San Juan Macho Timbersweet (Laurel) Waika Chewstick White Breadnut White Breadnut White Cabbage Bark White Poisonwood Wild Locust (Beefwood) Yemeri	5 6 4 50 11 18 64 55 1 46 33 43 3 79 10 126 2 38 5 183	1 3 21 7 8 62 18 4 13 16 12 13 16 12 25 4 94 8 5 56	2 3 2 14 3 27 3 2 7 3 2 7 3 2 1 4 4 6 0 7 2 46 0 2 1 2	1 4 3 10 3 2 18 1 2 0 0 3 3 0 3 1 20 0 0 3 3	0 4 3 7 1 1 1 1 1 1 1 1 1 1 1 1 1 2 0 2 0 10 0 0 0	0 1 3 2 1 7 1 0 1 0 1 0 1 0 1 0 1 0 1	0 2 3 5 1 2 8 0 1 2 0 1 0 10 0 0	$\begin{array}{c} 10\\ 24\\ 20\\ 110\\ 27\\ 35\\ 198\\ 77\\ 16\\ 6\\ 63\\ 58\\ 69\\ 5\\ 118\\ 17\\ 314\\ 2\\ 49\\ 11\\ 256\end{array}$	3 14 13 39 9 10 72 5 7 3 4 9 14 1 14 3 94 0 3 2 17	0 8 9 15 4 26 3 2 0 3 5 1 4 1 28 0 0 1 2
Select species	786	361	143	78	46	29	40	1,484	337	115

This table gives stratum-weighted means for an estimated area of 965 km<sup>2</sup>

(.../...)

# Table A.1 (continued /...) : Tree numbers per km<sup>2</sup> for forest reserves, areas with slopes less than 25°

Species name	Tr 20-30	rees per 30-40	km² by 40-50	cn dia 50-60	neter c 60-70	- 1asses 70-80	≥80	Cumula ≥20	ntive N/I ≥40	cm² ≥60
(/)										
Allspice Bay cedar Botan palm Bri bri Cherry Cojotone Cotton Fig Hogplum Kaway Mamey ciruela Moho Polak (Balsa) Prickly yellow Red Gombolimbo Sapodilla Sapotillo Sillion Tem Trumpet White Gombolimbo Wild Grape	$\begin{array}{c} 222\\ 78\\ 168\\ 9\\ 122\\ 82\\ 10\\ 30\\ 103\\ 21\\ 188\\ 288\\ 288\\ 288\\ 288\\ 12\\ 37\\ 114\\ 93\\ 111\\ 59\\ 0\\ 398\\ 58\\ 58\\ 47\\ \end{array}$	52 39 22 37 4 17 66 16 16 17 28 69 27 28 69 23 4 17 28 69 23 4 17 28 34 0 41 28 35	2 11 3 5 2 6 35 10 7 12 37 16 5 9 7	07012324 2073371623780033	0 0 1 1 4 8 7 1 0 1 0 1 1 7 6 7 0 0 1 2	1 0 2 4 3 0 1 0 0 8 2 3 0 0 8 2 3 0	2 0 4 4 2 3 0 0 0 0 0 12 3 2 1 0 1	276 144 177 123 171 129 24 66 237 69 250 369 250 207 207 207 207 207 207 207 207 207 20	2 27 3 9 9 11 19 68 32 14 15 9 9 8 34 36 3 6 13 13	0 9 1 7 9 14 13 2 1 1 1 37 11 12 2 0 1 3
Other ubiquitous species	2,342	750	216	110	63	30	36	3,545	454	128
Unclassified species	1,635	590	189	77	47	25	36	2,598	373	108
Total (all species)	6,133	2,287	726	363	211	119	159	9,999	1,578	489

This table gives stratum-weighted means for an estimated area of 965 km<sup>2</sup>

### Table A.2 : Tree bole volumes, m<sup>3</sup> per km<sup>2</sup> for forest reserves, areas with slopes less than 25°

Species name	Trees ≥ Bole volume m3/km²	20 cm dìa CV of mean	neter RME (P=.95) m3/km <sup>2</sup>	Trees ≥ Bole volume m3/km <sup>1</sup>	40 cm dia CV of mean	meter RME (P=.95) m3/km <sup>2</sup>	Trees ≥ Bole volume m3/km²	60 cm dia CV of mean %	meter RME (P=.95) n3/km <sup>2</sup>
Bastard Mahogany Black Poisonwood Cedar Granadilo Mahogany Mayflower Palo Mulatto Rosewood	12.1 48.6 47.6 10.0 418.6 13.5 34.4 60.5	17.9 17.5 18.7 22.1 9.8 29.5 21.3 16.5	7.9 31.9 30.1 5.6 338.5 5.7 20.1 40.9	6.2 13.9 27.4 4.8 100.0 3.9 10.5 32.5	19.8 24.0 24.8 29.6 13.2 25.7 18.9 14.6	3.8 7.4 14.1 2.0 74.2 1.9 6.6 23.2	4.5 1.2 21.3 1.9 57.1 0.7 2.1 11.4	25.9 41.5 29.8 56.5 16.2 45.9 35.1 26.6	2.2 0.2 8.8 39.0 0.1 0.7 5.5
Elite species	645.3	7.5	550.2	199.2	8.9	164.5	100.2	12.4	75.8
Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood Male Bullhoof Mylady Nargusta Quamwood Salnwood Santa Maria	17.3 60.9 86.4 44.4 219.6 93.1 168.4 580.4 70.8 28.6 182.3	19.2 15.4 16.5 16.4 9.0 15.8 12.0 11.4 15.0 14.2 19.8	10.8 42.6 58.4 30.2 180.7 64.3 128.8 450.9 50.0 20.6 111.6	10.8 26.1 62.5 19.8 155.6 37.9 61.1 430.2 45.3 2.8 122.7	21.5 20.5 20.4 14.8 10.7 18.0 28.3 7.9 18.2 20.0 19.7	6.3 15.6 37.5 14.1 123.1 24.5 27.3 363.5 29.2 1.7 75.3	3.4 7.9 36.4 7.5 82.2 9.2 30.9 346.2 24.9 0.3 68.3	45.3 35.4 32.0 22.7 13.5 26.2 41.8 9.1 22.2 54.3 17.2	0.4 2.4 13.5 4.1 60.4 4.4 5.6 284.7 14.0 45.3
Prime species	1,552.3	6.3	1,361.3	975.0	6.8	844.3	617.1	8.8	511.0
Balsam Banak Barba Jolote Bullet tree Carbon Cramantree Fiddlewood Glassywood John Crow Wood Monkey Apple Negrito Red Breadnut Red Breadnut Red Wood San Juan Macho Timbersweet (Laurel) Waika Chewstick White Breadnut White Breadnut White Poisonwood Wild Locust (Beefwood) Yemeri	$\begin{array}{c} 7.8\\ 73.4\\ 46.6\\ 134.5\\ 36.5\\ 48.5\\ 260.7\\ 38.0\\ 22.3\\ 19.0\\ 29.6\\ 44.2\\ 59.4\\ 4.5\\ 78.9\\ 11.3\\ 425.1\\ 1.1\\ 22.6\\ 10.6\\ 131.5\end{array}$	17.8 19.8 11.1 18.9 21.8 25.4 10.2 15.4 36.8 30.8 18.5 19.9 16.6 36.6 25.2 35.0 22.4 32.9 16.3 39.8 45.9	$\begin{array}{c} 5.1\\ 45.0\\ 36.4\\ 84.8\\ 20.9\\ 24.4\\ 208.4\\ 26.5\\ 6.2\\ 7.5\\ 18.9\\ 40.1\\ 1.3\\ 39.9\\ 3.5\\ 238.2\\ 0.4\\ 15.4\\ 2.3\\ 13.3\end{array}$	$\begin{array}{c} 5.0\\ 63.8\\ 44.2\\ 101.5\\ 28.4\\ 32.9\\ 186.9\\ 6.7\\ 17.7\\ 17.7\\ 5.3\\ 21.5\\ 31.1\\ 2.8\\ 34.7\\ 5.8\\ 338.4\\ 0.6\\ 4.2\\ 5.6\\ 28.3\end{array}$	21.6 21.6 21.6 23.1 23.5 26.8 11.6 18.3 38.4 32.7 25.9 26.4 48.0 37.6 27.6 40.2 27.5 45.0 31.6	2.9 36.8 34.1 55.4 15.3 15.6 144.5 4.3 4.4 2.6 10.6 15.0 0.1 2.0 1.5 155.1 0.1 1.9 0.7 10.7	$\begin{array}{c} 1.0\\ 45.5\\ 37.2\\ 64.1\\ 20.3\\ 21.9\\ 111.9\\ 0.6\\ 11.6\\ 16.3\\ 0.5\\ 12.3\\ 18.1\\ 2.2\\ 20.4\\ 1.7\\ 252.4\\ 1.7\\ 252.4\\ 1.6\\ 0.2\\ 1.0\\ 4.4\\ 6.6\end{array}$	33.2 25.6 11.9 29.2 24.9 28.5 14.7 39.3 43.3 34.9 27.1 38.7 47.3 60.1 43.7 34.6 61.0 87.9 54.2 32.6	0.4 22.7 28.5 27.4 10.4 9.6 79.6 0.1 1.7 5.2 5.8 4.4 0.2 0.3 81.0
Select species	1,506.0	6.8	1,305.9	983.0	12.9	734.3	650.2	18.2	418.0

This table gives stratum-weighted means for an estimated area of 965  $\rm km^2$ 

(..../....)

## Table A.2 (continued/...) : Bole volumes, m<sup>3</sup> per km<sup>2</sup> for forest reserves, areas with slopes less than 25°

	Trees ≥	20 cm dia	meter	Trees ≥	40 cm dia	meter	Trees ≥	50 cm dia	meter
Species name	volune m3/km <sup>2</sup>	nean %	(P=.95) m3/km <sup>2</sup>	volune n3/km <sup>2</sup>	mean %	(P=.95) m3/km <sup>2</sup>	volune m3/km <sup>2</sup>		(P=.95) m3/km <sup>2</sup>
(/)									
Allspice Bay cedar Botan palm	112.4 122.8 55.4	10.3 11.4 14.8	89.7 95.3 39.4	2.8 43.7 0.3	19.2 17.0 85.0	1.8 29.1	0.1 19.0	110.5 19.4	11.8
Bri bri Cherry Cojotone	50.1 79.9 73.4	26.3 15.8 17.9	24.3 55.3 47.7	4.4 16.8 16.0	37.9 22.9 30.4	1.1 9.3 6.5	0.2 6.0 3.7	82.2 31.6 70.0	2.3
Cotton Fig Hogplum	99.3 88.1 177.5	17.0 13.3 9.7	66.2 65.1 143.7	89.8 65.4 136.1	18.4 16.7 11.0	57.4 44.0 106.8	81.7 50.7 66.6	19.9 19.9 16.0	49.8 31.0 45.7
kaway Mamey ciruela Moho	137.4 119.8 159.5	12.4 10.9 12.5	103.9 94.2 120.6	84.1 23.8 23.1	12.4 18.9 18.7	63.6 15.0 14.6	44.2 7.2 6.0	13.4 36.7 32.3	32.5 2.0 2.2
Polak (Balsa) Prickly yellow Red Gombolimbo	72.8 36.1 89.9	20.9 12.7 12.4	42.9 27.1 68.1	34.5 12.7 30.3	19.1 19.4 14.1	21.5 7.9 21.9	3.1 2.6 4.2	24.4 24.7 35.7	1.6 1.3 1.3
Sapoulla Sapotillo Sillion	160.8 162.0	10.5 20.6 17.1	2/0.2 95.8 107.6	258.5 108.9 110.4	26.6 21.3	198.4 52.0 64.3	164.9 75.2 63.9	14.4 33.9 25.7	25.3 31.7
Trumpet White Gombolimbo Wild Grape	12.5 156.0 63.4 66.4	24.3 14.5 16.7	81.6 45.4 44.6	5.9 24.2 25.8	43.1 23.4 15.7	0.9 13.1 17.9	0.1 8.1 11.6	109.1 56.7 25.6	5.8
Other ubiquitous species	2,435.3	5.4	2,179.0	1,129.4	7.6	961.3	630.2	9.8	509.2
Unclassified species	1,810.3	5.4	1,618.4	859.9	8.5	717.3	<b>495.</b> 1	10.5	393.2
Total (all species)	7,949.3	3.9	7,336.7	4,146.5	6.9	3,586.9	2,492.8	9.0	2,054.7

This table gives stratum-weighted means for an estimated area of 965  $\rm km^2$ 

### Table A.3 : Tree numbers per km<sup>2</sup> for forested national lands

Bastard Mahogany Black Poisonwood Cedar Granadilo Mahogany Mayflower Palo Mulatto Rosewood Elite species Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood	18 80 39 8 330 11 43 46 573 573 4 573 45 85 236	3 33 25 3 216 9 23 22 335 335 4 21 17	1 14 3 1 18 15 62 3 7	1 3 1 13 1 5 10 36	0 1 2 0 8 0 1 3 15	0 1 0 5 0 0 2 10	1 3 6 0 1 0 12	26 131 75 12 597 22 81 98 1,042	4 19 11 2 51 2 15 30 134	2 1 6 0 20 0 2 5 
Elite species Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood	573 4 38 37 45 85 236	335 4 21 17	62 3 7	36 <u>1</u>	15	10	12	1,042	134	36
Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood	4 38 37 45 85 236	4 21 17	3 7	1	٥					
Male Bullhoof Mylady Nargusta Quamwood Salmwood Santa Maria	178 231 28 45 77	47 84 68 81 18 15 49	9 9 29 36 16 26 9 4 23	4 6 3 19 18 5 18 5 0 15	2 3 14 3 13 5 0 6	0 1 0 8 3 1 10 6 2	0 1 1 6 1 0 17 4 0 4	13 72 75 78 208 382 273 396 76 65 177	5 13 21 15 76 63 26 85 29 51	1 2 6 3 28 9 5 41 15 0 13
Prime species 1	,005	421	170	96	54	33	36	1,815	389	123
Balsam Banak Barba Jolote Bullet tree Carbon Cramantree Fiddlewood Glassywood John Crow Wood Monkey Apple Negrito Red Breadnut Red Wood San Juan Macho Timbersweet (Laurel) Waika Chewstick White Breadnut White Cabbage Bark White Poisonwood Wild Locust (Beefwood) Yemeri	9 6 2 39 23 13 52 52 17 6 45 76 38 17 6 91 17 149 3 50 51 33	6 7 17 19 4 60 21 16 4 16 20 17 1 28 5 105 15 31	2 1 16 9 29 4 6 1 3 13 6 0 6 2 62 1 3 2 1	1 2 2 11 7 22 2 2 2 2 2 2 2 2 2 2 2 2 2	1 2 9 3 1 3 0 1 1 0 4 2 0 1 20 0 1 1	0 1 2 6 4 0 7 1 1 2 1 0 0 0 10 0 0 0 0	1 2 6 9 4 2 11 0 1 3 0 5 2 0 1 0 12 0 0	20 19 21 106 71 24 193 80 44 18 65 126 70 2 130 24 392 4 70 12 181	5 7 13 50 28 7 81 7 10 9 4 30 15 1 10 2 138 1 5 5 17	2 4 9 23 12 30 1 3 5 0 11 5 0 2 0 43 0 2 2
Select species	827	401	182	105	62	37	58	1,672	444	157

This table gives stratum-weighted means for an estimated area of 1,087 km<sup>2</sup>

## Table A.3 (continued/...) : Tree numbers per km<sup>2</sup> for forested national lands

Species name	11 20-30	ees per 30-40	km² by 40-50	cm dia 50-60	meter c 60-70	lasses 70-80	≥80	Cumula ≥20	tive N/! ≥40	km.² ≥60
(/)					<u></u>					
Allspice Bay cedar Botan palm Bri bri Cherry Cojotone Cotton Fig Hogplum Kaway Mamey ciruela Moho Polak (Balsa) Prickly yellow Red Gombolimbo Sapotillo Sapotillo Stantillo Tem Trumpet White Gombolimbo Wild Grape	278 143 121 91 95 83 12 46 152 24 6 152 24 379 236 30 45 117 137 96 266 105 33	68 60 12 23 27 42 12 33 96 17 102 61 21 21 21 21 21 21 21 21 21 21 21 21 21	2 18 1 2 12 6 6 13 9 9 21 26 13 9 9 21 26 13 20 7	1 8 10 25 10 23 7 8 4 5 2 6 1 14 30 6 5	06 0313 91 18 30 11 24 83 0 22 24 84 00 22	1 2 6 6 4 1 1 1 1 1 0 3 19 0 1	0 1 2 0 7 16 3 6 2 0 0 1 14 4 9 1 0 2	349 238 136 117 150 134 47 133 331 314 67 521 314 67 78 375 521 314 67 78 375 195 448 375 195 4289 192 63	3 2 2 3 28 9 23 54 82 35 40 17 16 12 30 150 49 165 1 3 29 16	0 8 0 7 12 31 20 18 6 1 2 3 47 15 61 1 0 2 5
Other ubiquitous species	2,653	997	361	197	116	59	68	4,451	802	244
Unclassified species	2,075	716	282	113	58	36	40	3,319	529	134
Total (all species)	7,133	2,870	1,056	547	305	174	214	12,299	2,297	694

This table gives stratum-weighted means for an estimated area of 1,087 km<sup>2</sup>

# Table A.4 : Timber bole volumes, m<sup>3</sup> per km<sup>2</sup> for forested national lands

Species name	Trees 2 Bole volume m3/km <sup>2</sup>	20 cm dia CV of mean %	neter RME (P=.95) n3/km²	Trees ≥ Bole volume m3/km <sup>1</sup>	40 cm dia CV of mean	meter RME (P=.95) m3/km²	Trees ≥ Bole volume m3/km²	50 cm dia CV of nean	meter RME (P=.95) m3/km <sup>2</sup>
Bastard Mahogany Black Poisonwood Cedar Granadilo Mahogany Mayflower Palo Mulatto Rosewood	30.9 78.2 82.2 7.5 470.5 14.8 58.0 87.5	30.9 18.7 31.8 22.3 9.2 22.3 17.2 17.5	12.2 49.5 30.9 4.2 385.3 8.4 38.4 57.4	22.2 27.4 56.3 3.2 151.7 4.7 27.2 56.2	41.6 22.1 44.2 30.5 10.9 30.9 30.9 30.4 15.2	4.1 15.6 7.6 1.3 119.2 1.9 11.0 39.5	18.8 3.9 49.5 0.7 97.5 1.9 7.6 17.1	50.2 40.8 49.7 72.7 12.8 68.1 52.3 26.0	0.3 0.8 1.2 73.1 8.4
Elite species	829.6	7.0	715.9	349.0	9.4	284.3	197.0	14.3	141.9
Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood Male Bullhoof Wylady Nargusta Quamwood Salmwood Salmwood Santa Maria	12.4 53.3 76.4 59.1 302.9 289.4 263.0 440.7 145.8 31.7 217.7	19.8 16.2 13.9 18.1 14.9 15.8 9.6 11.7 19.5 21.7 12.9	7.6 36.4 55.6 38.1 214.4 199.5 213.3 339.7 90.2 18.2 162.6	8.2 24.9 49.3 29.5 232.4 111.3 63.0 289.4 125.0 6.7 144.4	22.0 20.7 16.7 17.0 17.6 27.8 15.9 7.5 21.2 45.4 13.0	4.7 14.8 33.2 19.7 152.4 50.6 43.4 246.7 73.0 0.7 107.7	2.0 8.6 23.9 12.9 146.2 27.8 19.1 217.9 98.2 1.8 73.0	36.7 31.8 25.6 27.2 23.4 35.0 32.5 8.5 23.3 78.2 17.6	0.6 3.2 11.5 6.0 79.1 8.7 7.0 181.6 53.4 47.8
Prime species	1,892.5	4.7	1,716.3	1,084.2	7.1	934.3	630.5	10.0	506.8
Balsam Banak Barba Jolote Bullet tree Carbon Cramantree Fiddlewood Glassywood John Crow Wood Monkey Apple Negrito Red Breadnut Red Wood San Juan Macho Timbersweet (Laurel) Waika Chewstick White Breadnut White Breadnut White Cabbage Bark White Poisonwood Wild Locust (Beefwood) Yemeri	$\begin{array}{c} 20.4\\ 47.4\\ 61.0\\ 172.9\\ 109.2\\ 34.2\\ 299.6\\ 44.4\\ 37.6\\ 39.9\\ 32.3\\ 116.0\\ 62.2\\ 2.3\\ 69.8\\ 12.6\\ 457.4\\ 3.5\\ 32.4\\ 13.7\\ 98.0 \end{array}$	23.9 19.9 20.9 16.3 32.5 50.4 8.0 14.2 33.3 31.4 21.2 21.4 20.7 54.1 21.5 74.4 12.0 64.2 26.3 34.1 33.5	10.929.036.0117.739.60.4252.932.013.115.418.967.536.940.4350.215.74.633.6	$\begin{array}{c} 13.5\\ 33.8\\ 56.7\\ 146.5\\ 86.3\\ 25.2\\ 232.7\\ 11.5\\ 21.5\\ 35.4\\ 5.7\\ 75.4\\ 32.1\\ 1.6\\ 32.1\\ 1.6\\ 32.1\\ 1.6\\ 6.5\\ 9.7\\ 28.9\end{array}$	26.9 21.7 21.3 18.5 30.1 47.9 8.9.4 37.3 34.1 18.1 22.4 29.8 71.6 31.3 47.5 14.0 60.1 29.9 34.0 26.6	6.4 19.4 33.0 93.4 35.4 1.5 194.4 7.1 5.8 11.7 3.7 42.4 13.3 7.3 0.2 260.8 2.7 3.2 13.9	$\begin{array}{c} 9.3\\ 25.1\\ 51.3\\ 105.0\\ 61.0\\ 17.4\\ 148.5\\ 2.5\\ 10.0\\ 30.3\\ 0.3\\ 47.9\\ 17.3\\ 1.1\\ 7.1\\ 0.7\\ 231.6\\ 1.2\\ 1.0\\ 5.7\\ 6.7\end{array}$	39.3 24.8 22.7 21.4 35.7 49.1 11.4 5.9 5.5 20.7 40.1 69.6 39.9 50.9 19.1 80.3 85.0 44.2 35.8	2.1 12.9 28.5 61.0 18.3 0.7 115.2 1.0 9.2 28.4 3.7 1.5 0.0 145.0 0.8 2.0
Select species	1,767.0	5.7	1,568.9	1,207.3	8.4	1,008.4	781.1	11.1	611.5

This table gives stratum-weighted means for an estimated area of 1,087  $\rm km^2$ 

(.../...)

## Table A.4 (continued/...) : Timber bole volumes, m<sup>3</sup> per km<sup>2</sup> for forested national lands

	Trees ≥	20 cm dia CV of	meter RME	Trees ≥ Bole	40 cm dia	meter RMR	Trees ≥ Bole	60 cm dia CV of	ameter RMR
Species name	volume m3/km²	mean %	(P=.95) m3/km²	volune m3/km²	Rean %	(P=.95) m3/km²	volune m3/km²	nean	(P=.95) n3/km²
(/)								·	
Allspice Bay cedar Botan palm	147.7 186.3 48.8	11.7 13.5 18.3	113.9 137.1 31.3	5.5 53.2 3.6	34.5 16.0 85.0	1.8 36.5	2.2 18.2	68.9 23.5	9.8
Bri bri Cherry Cojotone	46.5 115.7 71.1	23.2 21.5 13.1	25.4 67.0 52.8	3.6 68.7 14.2	33.7 32.6 19.8	1.2 24.9 8.7	0.1 35.6 2.9	87.7 43.7 55.9	5.1
Fig Hogplum Kaway	250.1 234.4 156.2	15.5 14.0 13.1 11.8	109.8 181.6 174.4	138.0 211.0 175.0 99.5	15.3 15.1 13.3 10.8	96.5 148.4 129.4 78.4	116.0 175.5 94.0 60.5	17.3 16.6 18.1	76.7 118.6 60.7 45.0
Mamey ciruela Moho Polak (Balsa)	277.1 143.0 93.6	12.1 14.8 27.1	211.3 101.4 43.9	73.3 26.5 35.4	23.5 19.8 21.7	39.5 16.2 20.4	26.1 4.1 5.8	45.4 34.7 36.2	2.9 1.3 1.7
Pričklý yellów Red Gombolimbo Sapodilla	47.0 126.4 475.0	16.9 11.8 8.5	31.4 97.3 396.3	18.9 48.9 363.2	20.1 15.5 8.7	11.5 34.0 301.4	5.8 10.7 199.9	38.9 38.3 8.5	1.4 2.7 166.6
Sapotillo Sillion Tem	199.8 693.6 5.5	20.3 20.1 20.9	120.3 420.5 3.2	157.1 526.3 5.3	22.2 21.9 21.2	88.6 300.7 3.1	102.9 318.5 4.9	25.3 24.8 22.2	51.8 163.8 2.8
White Gombolimbo Wild Grape	98.4 119.2 58.8	20.7 20.9	04.2 70.9 34.8	44.7 37.9	19.8 29.1	27.3 16.3	9.0 20.6	29.2 38.1	3.8 5.2
Other ubiquitous species	3,751.6	7.4	3,204.1	2,112.3	9.1	1,736.7	1,213.3	10.6	962.2
Unclassified species	2,332.3	7.1	2,009.4	1,138.9	9.2	934.6	586.8	11.1	458.9
Total (all species)	10,572.9	5.2	9,497.3	5,891.7	7.3	5,045.0	3,408.7	9.2	2,791.0

This table gives stratum-weighted means for an estimated area of 1,087 km<sup>2</sup>

### Table A.5 : Tree numbers per $km^2$ for forested private lands

Species name	Tr 20-30	ees per 30-40	km² by 40-50	cm dia 50-60	neter c 60-70	lasses 70-80	≥80	Cumulat ≥20	ive N/k ≥40	am.² ≥60
Bastard Mahogany Black Poisonwood Cedar Granadilo Mahogany Mayflower Palo Mulatto Rosewood	23 91 51 12 413 10 32 42	2 39 29 4 271 10 14 21	1 14 3 1 21 2 5 16	1 4 3 1 15 1 2 11	0 1 2 0 9 0 0 3	0 0 1 0 5 0 1	1 2 8 0 0 1	28 149 92 18 742 23 53 94	2 19 12 2 58 3 8 32	1 6 0 22 0 1 5
Elite species	673	390	62	37	17	- 9	12	1,199	136	37
Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood Male Bulhoof Mylady Nargusta Quanwood Salnwood Santa Maria	6 33 53 58 261 206 148 43 48 89	4 18 19 13 35 98 70 62 21 11 59	3 8 10 9 21 37 16 22 9 2 24	1 4 7 4 13 18 5 18 4 0 15	0 1 3 2 9 4 3 1 3 0 8	0 1 0 5 2 1 10 3 2	0 1 0 3 1 0 19 1 0 4	15 65 84 143 421 301 293 84 61 200	5 14 23 15 50 62 26 82 20 2 53	1 2 6 3 17 7 5 42 7 0 14
Prime species	986	411	161	89	46	25	32	1,750	353	103
Balsam Banak Barba Jolote Bullet tree Carbon Cramantree Fiddlewood Glassywood John Crow Wood Monkey Apple Negrito Red Breadnut Red Wood San Juan Macho Timbersweet (Laurel) Waika Chewstick White Breadnut White Cabbage Bark White Poisonwood Wild Locust (Beefwood) Yemeri	5 5 3 60 111 10 55 63 63 63 63 63 51 37 106 1 7 7 166 1 34 4 91	2 4 3 26 9 3 3 22 6 1 27 16 14 0 30 30 118 11 3 26	1 2 20 4 12 32 5 3 1 5 6 5 0 7 1 71 0 2 1 7	1 2 15 3 1 23 2 2 2 1 1 3 2 0 2 0 31 1 0 2	0 2 11 13 13 0 1 1 0 1 1 0 1 0 1 0 1 0 0 1 1 5 0 0 1	0 2 2 7 2 0 7 1 0 1 1 0 0 0 7 0 0	0 2 3 9 2 10 0 1 0 1 0 2 10 0 1 0 7 0 0	9 19 17 148 34 18 203 92 19 7 101 80 61 2 147 12 415 2 47 9 129	3 10 11 62 14 5 84 8 7 3 6 13 10 0 11 2 131 1 3 2 11	1 7 27 6 20 22 0 4 30 22 0 4 30 29 0 1 1
Select species	788	388	175	95	52	31	41	1,570	395	124
	1						1	•		

This table gives stratum-weighted means for an estimated area of 981  $\rm km^2$ 

(.../...)

# Table A.5 (continued/...) : Tree numbers per km<sup>2</sup> for forested private lands

Species name	Tr 20-30	ees per 30-40	km² by 40-50	cm dia 50-60	neter c 60-70	lasses 70-80	280	Cumula ≥20	ative N/I ≥40	km² ≥60
(/)	<u> </u>							·		
Allspice Bay cedar Botan palm Bri bri Cherry Cojotone Cotton Fig Hogplum Kaway Mamey ciruela Moho Polak (Balsa) Prickly vellow Red Gombolimbo Sapodila Sapotillo Sillion Tem Trumpet White Gombolimbo Wild Grape	334 93 122 97 70 57 18 34 132 20 465 316 34 465 316 34 47 119 161 101 101 101 101 101 101 44	80 45 8 23 21 26 14 19 7 8 8 4 33 19 52 111 59 88 0 28 32 18	3 13 0 2 5 5 7 7 41 10 30 11 9 6 20 75 6 20 75 6 43 1 2 10 4	170142677835262820042	05 01 13 40 62 01 11 30 62 01 11 30 61 15 00 11	2 1 0 2 3 4 3 1 1 0 0 1 2 2 7 1 0 1	0 2 1 0 6 6 2 4 1 0 0 1 8 4 2 0 1	418 167 130 124 103 91 57 79 309 626 416 83 75 198 458 197 296 4 332 296 4 332 296 71	4 29 1 3 11 8 25 26 81 31 15 16 8 7 187 187 187 187 10	1 8 12 12 15 14 1 1 2 60 12 26 12 26 13
Other ubiquitous species	2,743	996	322	171	89	40	51	4,411	672	179
Unclassified species	1,994	668	218	96	49	25	30	3,082	419	105
Total (all species)	7,185	2,853	939	488	253	129	166	12,012	1,975	548

This table gives stratum-weighted means for an estimated area of 981  $\rm km^2$ 

# Table A.6 : Timber bole volumes, m<sup>3</sup> per km<sup>2</sup> for forested private lands

Species name	Trees≥ Bole volume m3/km²	20 cm dia CV of nean	neter RME (P=.95) n3/km <sup>2</sup>	Trees ≥ Bole volume m3/km²	40 cm dia CV of nean	meter RME (P=.95) n3/kn <sup>2</sup>	Trees ≥ Bole volume m3/km²	50 cm dia CV of nean	meter RME (P=.95) n3/kn <sup>2</sup>
Bastard Mahogany Black Poisonwood Cedar Granadilo Mahogany Mayflower Palo Mulatto Rosewood	18.4 88.3 76.1 10.5 569.6 14.8 33.5 90.6	21.8 17.7 19.1 25.2 8.6 19.8 14.5 12.7	10.5 57.7 47.5 5.3 473.2 9.0 24.0 68.0	9.0 28.8 44.4 3.9 169.3 4.4 13.1 61.7	28.5 17.2 24.8 31.8 10.3 19.9 20.8 11.8	4.0 19.1 22.8 1.5 135.2 2.7 7.7 47.5	6.7 3.6 35.9 1.2 107.0 0.9 3.8 20.0	37.3 44.5 29.3 62.6 11.4 47.9 36.1 21.1	1.8 0.5 15.3 83.2 0.1 1.1 11.7
Elite species	901.7	6.9	779.8	334.7	8.0	282.0	179.2	10.2	143.4
Bastard Rosewood Billy Webb Bitterwood Black Cabbage Bark Ironwood Male Bullhoof Mylady Margusta Quanwood Salmwood Salmwood Santa Maria	13.6 52.0 83.1 56.2 191.4 311.0 283.3 413.1 90.0 26.4 229.2	26.0 15.4 12.4 15.5 10.2 18.3 8.9 8.6 15.6 13.2 13.4	6.7 36.4 62.9 39.2 153.1 199.2 233.7 343.1 62.5 19.6 169.2	8.2 27.3 53.1 28.0 140.3 107.7 62.1 307.2 63.5 3.2 142.9	25.2 20.1 14.1 15.3 12.2 36.4 15.5 8.3 18.9 25.8 13.5	4.2 16.5 38.4 19.6 106.8 43.2 257.4 39.9 1.6 105.0	2.6 9.5 23.9 9.2 79.6 22.5 18.5 240.5 40.1 0.5 70.6	37.4 29.0 21.4 22.8 15.8 46.0 32.4 9.5 22.4 68.6 16.8	0.7 4.1 13.9 5.1 55.0 2.2 6.7 196.0 22.4 47.4
Prime species	1,749.3	5.5	1,561.3	943.4	7.3	809.1	517.4	8.2	434.7
Balsam Banak Barba Jolote Bullet tree Carbon Cramantree Fiddlewood Glassywood John Crow Wood Nonkey Apple Negrito Red Breadnut Red Wood San Juan Macho Timbersweet (Laurel) Waika Chewstick White Breadnut White Breadnut White Cabbage Bark White Poisonwood Wild Locust (Beefwood) Yemeri	$\begin{array}{c} 8.5\\ 58.2\\ 41.6\\ 213.5\\ 52.8\\ 25.0\\ 295.4\\ 48.6\\ 23.9\\ 15.4\\ 50.3\\ 57.8\\ 46.0\\ 1.6\\ 77.5\\ 7.7\\ 404.4\\ 1.4\\ 21.7\\ 8.5\\ 68.3\end{array}$	18.4 14.6 11.2 14.5 24.8 28.6 7.1 12.2 30.7 24.8 19.7 17.8 15.0 46.6 13.9 39.8 11.5 43.7 17.1 35.6 32.7	$\begin{array}{r} 5.4\\ 41.5\\ 32.5\\ 152.9\\ 27.2\\ 11.0\\ 254.3\\ 37.0\\ 9.5\\ 7.9\\ 30.9\\ 37.6\\ 32.5\\ 0.1\\ 56.4\\ 1.7\\ 313.5\\ 0.2\\ 14.4\\ 2.6\\ 24.5\end{array}$	5.5 48.6 39.4 173.6 42.3 17.7 224.6 11.7 17.5 13.8 8.0 28.8 18.9 0.9 20.0 3.5 293.1 1.0 3.4 4.9 18.4	20.6 15.8 11.5 17.0 25.0 32.4 7.3 15.9 35.5 26.9 20.2 20.6 56.0 26.3 40.4 13.6 45.5 23.9 37.2 23.7 22.7	3.3 33.5 30.5 115.8 21.6 6.5 192.5 8.0 5.3 6.5 5.2 17.4 11.3 9.7 0.7 214.8 0.1 1.8 1.3 10.2	2.7 36.8 33.9 118.3 30.2 11.8 134.8 1.2 10.1 11.6 0.6 16.0 8.8 0.7 7.8 1.4 159.9 0.4 0.3 3.4 4.3	35.8 17.4 12.6 18.9 27.6 38.3 9.2 47.7 41.6 28.7 76.9 76.9 18.3 30.5 57.4 36.8 57.1 20.5 62.6 85.0 46.0 30.7	0.8 24.3 25.6 74.5 13.9 2.9 110.6 0.1 1.9 5.1 10.2 3.5 2.2 95.8 0.3 1.7
Select species	1,528.0	4.3	1,397.8	995.5	6.6	867.4	595.3	9.1	489.5

This table gives stratum-weighted means for an estimated area of 981 km<sup>2</sup>

(.../...)

## Table A.6 (continued/...) : Timber bole volumes, m<sup>3</sup> per km<sup>2</sup> for forested private lands

Species name	Trees ≥ Bole volume m3/km <sup>2</sup>	20 cm di CV of mean %	ameter RME (P=.95) m3/km <sup>2</sup>	Trees ≥ Bole volume m3/km²	40 cm dia CV of mean %	ameter RME (P=.95) m3/km <sup>2</sup>	Trees ≥ Bole volume m3/km²	60 cm dia CV of nean %	meter RME (P=.95) m3/km <sup>2</sup>
()				ļ			)		
Allspice Bay cedar Botan palm Bri bri Cherry	177.7 138.9 43.5 49.9 60.8	12.5 10.2 15.4 19.6	134.2 111.2 30.4 30.7 42.3	7.5 45.9 0.9 4.2 25.6	33.6 11.6 85.0 29.4 26.7	2.6 35.5 1.8 12.2	3.0 18.5 0.2 12.3	67.4 15.3 83.0 35.3	13.0
Cojotóne Cotton Fig Hogplum Kaway	50.6 149.6 117.2 210.2 138.7	11.6 15.5 12.2 12.6 11.1	39.2 104.2 89.1 158.4 108.6	12.1 125.1 92.0 152.1 84.8	23.0 13.2 14.8 10.8 9.6	6.6 92.8 65.2 120.0 68.9	2.6 97.9 69.8 67.7 46.5	60.4 13.7 16.0 11.1 10.6	71.5 47.8 52.9 36.9
Mamey ciruela Moho Polak (Balsa) Prickly yellow	314.3 181.4 114.4 41.2	10.8 14.1 29.9 10.6	247.7 131.4 47.3 32.6	66.8 22.5 35.1 13.7	16.3 14.4 16.4 13.8	45.4 16.1 23.8 10.0	13.8 3.5 4.6 4.1	33.5 24.7 23.6 23.6	4.7 1.8 2.5 2.2
Ked Gombolimbo Sapodilla Sapotillo Sillion Tem	120.9 594.4 174.1 387.1 16.3	10.4 8.3 23.8 12.8 20.0	96.2 498.1 93.0 290.1 9.9	42.4 457.6 125.2 262.8 15.9	12.2 8.9 30.8 15.6 20.3	32.3 377.6 49.6 182.3 9.6	6.1 254.9 88.3 133.1 14.4	28.7 9.5 40.0 21.3 21.1	2.7 207.6 19.1 77.6 8.5
Trumpet White Gombolimbo Wild Grape	113.2 71.0 47.9	18.5 15.9 14.1	72.2 48.9 34.6	2.4 28.6 21.1	38.2 25.8 17.5	0.6 14.2 13.8	0.1 9.6 10.9	109.1 64.7 24.7	5.6
Other ubiquitous species	3,313.3	4.7	3,010.3	1,644.3	6.4	1,438.9	862.0	8.7	715.1
Unclassified species	2,044.9	4.7	1,857.6	901.0	7.0	778.0	456.5	9.6	370.2
Total (all species)	9,537.1	3.4	8,893.7	4,818.9	4.9	4,351.5	2,610.4	6.6	2,275.0

This table gives stratum-weighted means for an estimated area of 981 km<sup>2</sup>

#### Appendix B : Inventory transect summaries

The listings on the following page give reference numbers, map coordinates, PVG and Wright's vegetation types for each inventory transect, together with basal area, tree numbers per km<sup>2</sup>, and a list of up to 10 species commonly occurring, in order of dominance. The species list includes those which make up 50% of the basal area, in order of their dominance. The figures in brackets are the percentage of basal area attributable to that species.

Basal area provides a useful indicator of forest condition. Typically closed tropical forest dominated by mature trees will have basal areas around 25  $m^2$ /ha or higher. It can be seen that few of the transects approach this figure.

Basal areas of the order of  $15-22 \text{ m}^2/\text{ha}$  are typical of logged selection forest during the recovery period.

Lower basal areas indicate either young stands, as with the Chiquibul transects sampling post-hurricane forest, or mosaics of open woodland, swamp, and closed forest.

The transects are listed in order of PVG, and can be related to the summaries in Table 3.

The transect ID is the same as the field TRANS\_ID in the GIS coverage file TRANS, a copy of which has been provided to the LIC. The first digit relates to the inventories, as follows:

#### No. Inventory

- 1 Chiquibul main series, 1969
- 2 Chiquibul mountain series, 1971
- 3 Columbia River, 1975
- 4 Maya Mountains, 1975 (sampled in the same operation as Columbia River)
- 5 Cockscomb Basin, 1978
- 6 Hill Bank Belize Estates inventory, 1975
- 8 Deep River inventory, 1981

The UTM coordinates give the mid-point of each transect, with an error of the order of  $\pm 200$  m. The orientation is either East-West or North-South, aligned with the UTM grid.

ID	East	North	nend prin. D.	rvu	Types	m²/ha	≥20cm	Frincipie species, in order of dominance, with % of basar Area
6543	2010.00	1064100	6200 TW	1	101010	12.2	10711	Mahomanii/10.2% Homplum/10.2% Allaniae/7.2% Fiddlewood/E.0% Codar/E.7% Ded Combolimbe/2.5%
004J 66/7	321200	1060000	6300 EN 6400 EN	n X	10;210 10:010	10 1	17/11	Ranogany(15.2%), hoghiam(10.2%), Allopice(7.3%), Fluite#oou(3.5%), Cedal(3.7%), Red GommanD(3.3%) Wabagany(16.0%) Wanala(10.2%), Bullat trop(7.0%) Drawinian Trans(7.7%) Alloping(7.1%) White Draadnut(6.0%)
6507	321300	1050000	6400 EM	л Х	12:21	10.1	10000	Manuyany(10.3%), Mapula(10.2%), Dullet ulet(1.0%), FLOVISION Hite(1.1%), AllSpice(1.1%), Mille Diedulut(0.0%) Wabarany/16 1%) Manala/D 5%) Dad Combalimba/6 7%) Maralum/5 6%) Dilly Wabb/5 4%) Bibita Draadnut/5 2%)
0000	JZ1000	1303400	0000 100	n	10, 14	16./	10444	Quanwood(4.1%)
6588	321700	1956800	6000 EW	A	1a: 34	10.7	13553	<pre>Mahogany(17.9%), Hogplum(8.3%), Fiddlewood(5.8%), White Breadnut(5.2%), Provision Tree(4.7%), Sapotillo(3.3%), Red Gombolimbo(2.7%), Billy Webb(2.7%)</pre>
6607	311200	1952300	5200 EW	A	1a: 23	10.0	13980	Mahogany(26.3%), Sapodilla(8.3%), White Breadnut(7.7%), Black Poisonwood(5.6%), Black Cabbage Bark(5.5%)
6609	311200	1951300	5200 EN	Å	1a: 23	11.7	16565	Mahogany(36.2%), White Breadnut(8.4%), Black Poisonwood(4.7%), Billy Webb(4.0%)
6631	295800	1950200	5300 EW	A	1a: 34	12.7	14870	Mahogany(16.3%). Sapodilla(11.5%). Bullet tree(10.3%). Mamey ciruela(5.2%). Santa Maria(4.6%). Provision
								Tree(4.2%)
6636	295100	1947800	6700 EN	A	1a:21a	11.4	13028	Mahoqany(25.5%), Bullet tree(13.6%), Male Bullhoof(6.7%), Mamey ciruela(5.3%)
6678	316200	1947000	5000 BW	A	1a: 23	10.3	13705	Mahogany(26.9%), Fiddlewood(10.2%), Bullet tree(7.0%), Billy Webb(6.4%)
6683	321500	1949500	5600 EW	A	1a:21a	8,1	11432	Mahogany(34.3%), Bullet tree(8.9%), Mapola(6.4%), Cedar(5.1%)
6712	304700	1944200	3900 NS	A	1a:21a	10.5	10560	Mahogany(14.9%), Fiddlewood(9.0%), Bullet tree(7.9%), Billy Webb(7.2%), Santa Maria(4.5%), Bitterwood(3.5%)
6731	294000	1940600	4800 EW	A	1a: 34	11.4	12735	Mahogany(12.0%), Bullet tree(6.7%), Sapodilla(6.7%), Mamey ciruela(6.6%), Fiddlewood(5.2%), Male Bullhoof(4.5%)
6810	306700	1934200	4800 NS	A	1a: 34	13.6	14015	White Breadnut(8.1%), Mahogany(6.6%), Fiddlewood(6.4%), Sapodilla(6.1%), Santa Maria(6.1%), Mamey ciruela(6.1%)
6814	308700	1934200	4800 NS	A	la: 34	12.6	12945	Bullet tree(9.6%), Santa Maria(6.6%), Fiddlewood(6.3%), Mamey ciruela(6.1%), Mahogany(6.1%), Red Gombolimbo(4.0%)
6863	310400	1930100	4500 EW	A	1a: 34	12.2	12691	Wild Mammee(15.1%), Male Bullhoof(10.5%), Sapotillo(9.0%), Mamey ciruela(8.6%), Fiddlewood(7.2%)
6135	284000	1957800	5100 EW	В	2a: 2b	17.0	18215	<pre>Mamey ciruela(14.1%), Sapodilla(12.7%), White Breadnut(10.4%), Allspice(7.5%), Male Bullhoof(6.0%)</pre>
6139	283900	1955900	5100 EW	B	2a: 22	18.5	21330	Male Bullhoof(9.8%), Mamey ciruela(9.5%), Sapodilla(9.2%), Fiddlewood(5.8%), Allspice(5.3%), Cotton(4.9%), Prickly Yellow(4.9%)
6159	293900	1956100	4500 EW	В	2 <b>b:</b> 2a	12.1	14667	<pre>Mahogany(12.2%), Sapodilla(11.4%), White Breadnut(6.8%), Mylady(6.5%), Sillion(6.4%), Red Gombolimbo(5.8%), Santa Maria(4.1%)</pre>
6165	273800	1952900	5100 EW	В	2a:	12.4	14185	Sapodilla(11.9%). Mamey ciruela(11.4%). Male Bullhoof(9.2%). Santa Maria(5.6%). Mahogany(5.5%). Sillion(5.4%)
6169	273800	1951000	5100 EW	B	2a:	12.6	12170	Sapodilla(12.8%), Mamey ciruela(9.0%), Male Bullhoof(8.5%), Bullet tree(6.7%), White Breadnut(6.6%)
6224	283900	1948700	5000 EW	В	2b:	17.5	17965	Sapodilla(16.8%), Mahogany(10.8%), Mamey ciruela(5.9%), Sillion(5.9%), Bullet tree(5.4%), Santa Maria(5.3%)
6229	283900	1946300	5000 EW	В	2b: 23	16.6	16505	Male Bullhoof (18.9%), Hogplum(10.4%), Sapodilla(6.1%), Mamey ciruela(5.1%), Santa Maria(4.6%), Mahogany(4.6%)
1011	273200	1863400	7700 EW	С	2e: 2d	9.6	12594	White Breadnut(11.9%), Mapola(6.3%), Allspice(6.2%), Hooplum(5.7%), Sapodilla(4.8%), Botan palm(4.3%)
1012	273100	1860600	8000 EW	C	2d:	8.2	10994	Allspice(10.5%), White Breadnut(9.4%), Sapodilla(6.8%), Mapola(6.2%), Palo Mulatto(4.1%), Mamey ciruela(4.0%)
1021	273000	1855500	8000 EW	C	2 <b>d:</b> 3	8.5	10213	White Breadnut(10.8%), Male Bullhoof(8.7%), Botan palm(6.9%), Nargusta(5.5%), Hogplum(5.5%), Sapodilla(4.4%)
1022	273000	1849400	8000 EW	C	2d: 3	9.1	9906	White Breadnut(13.3%), Sapodilla(9.3%), Male Bullhoof(5.0%), Pumpkin stick(4.3%), Botan palm(4.1%)
1032	273000	1842000	8000 EW	С	2d:	8.0	8219	Sapodilla(12.3%), Nargusta(7.0%), White Breadnut(6.9%), Mapola(5.8%), Male Bullhoof(5.2%), Moho(4.6%)

Transect UTM coordinates Leng Dirn. PVG Veg. BA N/km² Principle species, in order of dominance, with % of Basal Area

ID	East	North	D.		Types	m²/ha	220cm	
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1041	273000	1838800	8000 EW	C	2d: 3b	11.9	12606	White Breadnut(12.4%), Mapola(11.5%), Sapodilla(10.8%), Sapotillo(6.6%), Wild Guava(4.3%), Moho(2.3%)
1042	2/3000	1834/00	8000 EW	C O	20: 30	1.3	10000	Sapoullia(20.2%), Margusta(11.6%), Mapoia(5.7%), Bay Cedar(5.1%), ironwood(5.8%), Toadskin(5.6%)
1051	281000	1802300	SOUCH EN	C O	20:188	/.9	10309	<pre>mapoia(11.0%), Allspice(9.7%), Sapodilla(8.7%), White Breadhut(7.4%), Floolewood(5.6%), Sapotillo(5.1%) white Breadhut(7.4%), Floolewood(5.6%), Sapotillo(5.1%)</pre>
1052	281000	1929900	8000 EM	C	20: 3	9.2	10188	<pre>white Breadnuc(12.2%), Sapodilla(9.3%), Allspice(/.1%), Mapola(6.3%), Mamey Ciruela(5.5%), Nargusta(5.4%), Bastard Rosewood(3.9%)</pre>
1092	289000	1861000	8000 EW	С	2d: 9e	7.6	7863	Nargusta(11.3%), Sapodilla(10.6%), Botan palm(8.3%), Sapotillo(7.5%), White Breadnut(6.1%), Faisan(5.0%)
1122	289000	1836300	8000 EW	С	2d: 3b	11.0	8944	Nargusta(14.7%), Mapola(12.1%), Sapodilla(11.0%), White Breadnut(4.9%), Ironwood(4.8%), Fiddlewood(4.6%)
2031	295200	1861500	5000 NS	C	2 <b>d:</b> 7	6.2	5520	Sapodilla(10.5%), Nargusta(9.1%), Mapola(6.1%), Juan pech(5.5%), Wild Grape(5.5%), Negrito(5.4%), Allspice(5.2%)
2032	297500	1861500	5000 NS	С	2d: 3a	7.0	6670	Fiddlewood(11.7%), Moho(10.7%), Sapodilla(9.9%), Mapola(7.3%), Botan palm(5.7%), Nargusta(5.5%)
2041	300600	1861500	5000 NS	C	2d:	6.5	7700	Moho(24.4%), Hogplum(9.3%), Nargusta(9.0%), Mapola(8.4%)
2042	302800	1861500	5000 NS	C	2 <b>d:</b> 3	8.2	9610	Moho(29.6%), Pumpkin stick(10.1%), Hogplum(9.9%), Bay cedar(7.5%)
2061	294500	1856800	4400 NS	C	2d: 9e	7.9	8130	Sapodilla(15.7%), Red Breadnut(9.5%), Hogplum(8.6%), Moho(7.3%), Mapola(4.9%), Negrito(4.5%)
2062	295800	1856800	4400 NS	C	2d: 9e	11.4	10410	Sapodilla(10.2%), Moho(7.7%), Mapola(7.6%), Hogplum(7.0%), Nargusta(5.9%), Ironwood(5.6%), Juan pech(5.4%), Botan palm(3.8%)
2072	301600	1856800	4400 NS	. C	2d: 3a	6.3	5660	Moho(19.6%), Nargusta(12.5%), Mapola(8.5%), Cedar(7.6%), Hogplum(6.5%)
2081	306300	1856800	4500 NS	C	2d: 9e	8.9	10240	Moho(29.6%), Ironwood(12.4%), Bay cedar(6.1%), Hogplum(6.0%)
3231	282500	1815900	5000 EW	C	2 <b>d:</b> 12a	14.0	10765	Nargusta(13.5%), Santa Maria(7.2%), Trumpet(6.3%), Candlewood(5.2%), Ironwood(5.2%), Sapodilla(4.8%), Wild
								Guava (4.3%)
3232	282500	1814200	5000 EW	C	2 <b>d:</b> 4a	15.8	13624	Nargusta(10.0%), Sapotillo(9.4%), Sapodilla(6.7%), Mapola(4.1%), Timbersweet (Laurel)(3.6%), Black Poisonwood(3.4%)
3282	278500	1811500	3000 EW	C	2 <b>d:</b> 4a	20.7	13850	Sapotillo(17.1%), Sapodilla(16.0%), Timbersweet (Laurel)(4.6%), Nargusta(4.2%), White Gombolimbo(4.2%), Mamey ciruela(4.2%)
3291	282500	1811200	5000 EW	С	2d:	17.3	13850	Sapodilla(8.7%), Sapotillo(6.6%), Mamey ciruela(5.0%), Carbon(4.3%), White Breadnut(4.1%), Cherry(3.8%)
3292	282500	1809000	5000 EW	С	2d: 8	23.5	16070	Sillion(14.7%), Ironwood(4.4%), White Breadnut(3.9%), White Gombolimbo(3.7%), Wild Orange(3.6%), Carbon(3.6%)
3341	277500	1808500	5000 EW	С	2d: 8	21.0	14131	Cornstick (Aceituna)(10.8%), Sillion(8.8%), Carbon(4.9%), Fig(4.5%), Red Breadnut(4.3%), Ironwood(4.1%), Santa
								Maria(4.0%)
3361	287500	1805800	5000 EW	С	2d: 8a	17.2	13815	Mamey ciruela(7.5%), Mapola(6.7%), Sapotillo(6.1%), Candlewood(3.6%), Cherry(3.6%), Fiddlewood(3.2%), Male
								Bullhoof(3.2%)
4102	307500	1825100	5000 EW	С	2 <b>d:</b> 4a	14.0	11240	Sapodilla(9.5%), Nargusta(7.7%), John Crow Wood(6.5%), White Breadnut(6.3%), Mylady(4.4%), Mapola(4.4%)
4112	312500	1827500	5000 EW	С	2d:	14.2	14480	Sapodilla(13.6%), Bay cedar(5.2%), Mapola(5.0%), Mylady(4.8%), White Breadnut(4.4%), Bullet tree(4.3%), Polak
								(Balsa)
4201	301500	1819800	5000 EW	C	2d: 4a	12.5	13075	Sapodilla(7.2%), Sillion(6.3%), Trumpet(4.7%), Nargusta(4.6%), Bay cedar(3.8%), Ironwood(3.7%), Moho(3.4%)
4202	301500	1818200	5000 EN	C	2d: 4a	15.1	13885	Sapodilla(15.4%), Narcusta(5.5%), Sapotillo(5.4%), Cherry(4.0%), Santa Maria(3.7%), Cramantree(3.7%)

ID	East	North	Deng Dirit. D.	140	Types	m²/ha	lynu ≥20cm	remembre species, in order of dominance, with 8 of basar area
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4432	311600	1817100	3100 EW	С	2d: 16	5.1	5187	John Crow Wood(10.7%), Nargusta(10.7%), Sapodilla(8.7%), Fiddlewood(8.0%), Bitterwood(5.7%), Sapotillo(4.9%)
1061	281000	1852000	8000 EW	D	3: 2d	11.9	14531	White Breadnut(13.6%), Allspice(9.8%), Sapodilla(9.5%), Mapola(7.8%), Sapotillo(5.6%), Hogplum(4.6%)
1062	281000	1849900	8000 EW	D	3; 3a	9.6	11706	White Breadnut(10.7%), Mapola(10.0%), Hogplum(6.3%), Fiddlewood(5.9%), Allspice(5.1%), Sapodilla(4.9%)
1072	281000	1841900	8000 EW	D	3:3b	12.4	12475	Sapodilla(11.1%), Nargusta(8.8%), Mapola(8.6%), White Breadnut(8.5%), Allspice(5.4%), Fiddlewood(5.2%)
1081	281000	1840200	8000 EW	D	3: 3b	11.7	11381	Mapola(11.6%), Sapodilla(9.2%), Nargusta(7.5%), White Breadnut(6.8%), Ironwood(6.5%), Fiddlewood(3.6%)
1082	281000	1835200	8000 EW	D	3:4a	11.6	10219	Sapodilla(14.9%), Nargusta(10.7%), White Breadnut(8.2%), Ironwood(7.8%), Mapola(7.6%), Male Bullhoof(4.1%)
1101	289000	1856400	8000 EW	D	3: 2d	8.5	9238	Nargusta(11.9%), Sapodilla(11.3%), Mapola(7.4%), Mamey ciruela(6.2%), Botan palm(5.7%), White Breadnut(4.9%)
1102	289000	1850500	8000 EW	D	3a: 2d	10.0	11188	Sapodilla(8.7%), Fiddlewood(6.8%), Mamey ciruela(6.5%), Nargusta(6.2%), White Breadnut(5.5%), Wild Grape(4.9%)
1111	289000	1847400	8000 EW	D	3a:11a	6.3	7194	Nargusta(21.0%), Fiddlewood(12.0%), Oak(11.3%), Billy Webb(7.5%)
1121	289000	1838600	8000 EW	D	3 <b>b:11</b> a	11.9	10481	Sapodilla(17.8%), Nargusta(12.0%), Mapola(9.0%), Sapotillo(4.7%), Ironwood(4.6%), Timbersweet (Laurel)
2071	299800	1856800	4400 NS	D	3a: 2d	7,2	7061	Moho(12.0%), Nargusta(11.8%), Mapola(7.2%), Hogplum(5.4%), Juan pech(4.5%), Ironwood(4.4%), Bay cedar(3.5%)
3211	273500	1818900	5000 EN	D	4a: 12	11.1	9177	Nargusta(26.8%), Sapodilla(15.3%), Mamey ciruela(5.4%), Wild Grape(5.3%)
3371	269500	1801800	5000 EW	D	4b: 8	23.2	18505	Sapotillo(9.0%), Sillion(5.7%), Ironwood(5.7%), Parrot(5.2%), White Gombolimbo(5.2%), White Breadnut(4.7%), Red
								Breadnut(4.6%)
4101	307500	1825700	5000 EW	D	4a: 2d	14.1	12470	Sapedilla(17.0%), John Crow Wood(11.2%), Nargusta(7.5%), Sapetillo(7.1%), Mapela(5.8%), White Breadnut(5.3%)
8222	312600	1808900	2000 NS	D	4b:	7.1	6988	Nargusta(20.1%), Yemeri(14.0%), Cotton(7.8%), Billy Webb(6.0%), Ironwood(5.1%)
2011	300300	1866500	5000 NS	E	7: 9e	8.2	7930	Hogplum(8.8%), Mapola(7.0%), Moho(5.1%), Fiddlewood(4.3%), Sapodilla(4.0%), White Breadnut(3.9%), Oak(3.8%)
4421	312500	1825000	5000 EW	E	6a: 4	7.7	7143	Nargusta(16.5%), Wild anatto(9.1%), Santa Maria(4.8%), Kaway(4.6%), Cotton(4.6%), Wild Grape(4.6%)
4422	311600	1822700	3200 EW	Ē	6a: 4	8.0	7106	Mapola(13.4%), Nargusta(7.3%), Pine(5.7%), Ironwood(5.7%), Sapotillo(5.4%), Black Poisonwood(3.9%), Cherry(3.8%)
4431	311600	1819100	3200 EW	E	6a: 4	5.7	6395	Nargusta(24.3%), Sapodilla(11.7%), Fiddlewood(6.6%), Rosewood(6.5%), White Breadnut(4.5%)
5061	342600	1855600	4000 EN	Е	5: 9	5.4	5725	Bri bri(17.1%), Bay cedar(10.8%), Kaway(10.8%), Trumpet(10.1%), Hogplum(8.9%)
8152	317300	1810400	2000 NS	E	6: 8c	3.7	4450	Santa Maria(19.7%), Nargusta(16.4%), Yemeri(15.9%)
3342	277500	1807000	5000 EW	F	8: 2d	19.9	14495	Sillion(15.1%), Ironwood(5.6%), Parrot(5.3%), Fig(5.2%), White Breadnut(4.8%), Red Breadnut(4.6%), Cornstick
								(Aceituna)
335 <b>1</b>	282500	1807600	5000 EW	F	8a: 8	19,3	14215	Sillion(19.0%), Ironwood(7.7%), Carbon(7.1%), White Breadnut(4.6%), Cornstick (Aceituna)(4.1%), Cohune palm(4.0%)
3352	282500	1803400	5000 EW	F	8a: 6a	20.3	16530	Mapola(10.1%), Sapotillo(6.2%), Cedar(4.6%), Cherry(4.2%), Ironwood(3.7%), Moho(3.3%), Fig(3.1%), Mamey
								ciruela(3.1%)
3362	287500	1802100	5000 EW	F	8a: 6a	15,0	13233	Fig(6.9%), Cherry(5.4%), Mamey ciruela(4.6%), Cohune palm(3.8%), Moho(3.5%), Cotton(3.4%), Ironwood(3.1%)
3372	269500	1800500	5000 EW	F	8:4b	21.5	17665	Sillion(9.2%), White Breadnut(6.1%), Hogplum(5.4%), Fig(5.4%), Wild Orange(5.4%), White Gombolimbo(4.8%), Red
								Breadnut(4.2%)
3391	277500	1803000	5000 EW	F	8: 8a	17.0	15180	Sillion(8.1%), Fig(5.6%), Cohune palm(5.4%), White Breadnut(5.3%), Hogplum(4.6%), Carbon(4.1%), Bay cedar(3.5%)
3392	277500	1802500	5000 EW	F	8a: 8	18.9	15160	Sillion(12.7%), Fig(6.1%), Bay cedar(4.0%), Quanwood(3.8%), Cohune palm(3.6%), Hogplum(3.2%), Barba Jolote(2.8%)
8131	312500	1812900	2000 NS	F	8c:14a	6.0	6905	Narqusta(24.0%), Yemeri(15.8%), Fig(8.5%), Santa Maria(6.1%)

Transect UTM coordinates Leng Dirn. PVG Veg. BA N/km<sup>2</sup> Principle species, in order of dominance, with % of Basal Area

T	ransect ID	East North	Leng Dirn. m.	PVG	veg. Types	BA m²/ha	N/km.² ≥20cm	Principle species, in order of dominance, with % of Basal Area
	8132	313300 1812800	2000 NS	F	8c:11g	5.8	7175	Nargusta(29.5%), Ironwood(10.2%), Fiddlewood(9.8%), Yemeri(5.3%)
	8171	311800 1811000	2000 NS	F	8c:14a	5.6	7475	Nargusta(23.9%), Yemeri(20.7%), Fiddlewood(12.2%)
	8172	312800 1810900	2000 NS	F	8c: 4b	5.1	6563	Nargusta(38.7%), Yemeri(13.8%)
	8221	311600 1809000	2000 NS	F	8c:11g	4.4	5716	Nargusta(25.9%), Yemeri(24.6%)
	1091	289000 1863000	8000 EW	G	9e: 7	8.9	10219	White Breadnut(17.3%), Sapotillo(7.4%), Juan pech(7.0%), Sapodilla(6.6%), Hogplum(5.0%), Mapola(4.4%), Moho(3.5%)
	2012	303000 1866500	5000 NS	G	9e: 7	5.8	7320	Moho(17.1%), Hogplum(9.4%), White Breadnut(5.6%), Pumpkin stick(4.1%), Billy Webb(4.0%), Cedar(3.8%)
	2021	306100 1868500	5000 NS	G	9e: 7	5.2	5670	Moho(18.9%), Bay cedar(11.4%), Hogplum(10.1%), Nargusta(9.8%)
	2051	305500 1861500	5000 NS	G	9b: 2d	9.7	8152	Cedar(26.7%), Moho(15.7%), Hogplum(6.3%), Mapola(5.2%)
	2052	307300 1861500	5000 NS	G	9e: 9b	8.3	11990	Moho(48.9%), Hogplum(7.7%)
	2082	308700 1856700	4500 NS	G	9b: 2d	6.4	7910	Moho(29.0%), Ironwood(12.8%), Nargusta(9.9%)
	2111	295000 1846500	5000 NS	G	9e: 3	5.3	5400	Moho(16.0%), Mapola(14.3%), White Gombolimbo(9.2%), Ironwood(5.6%), Bay cedar(3.6%), Hogplum(3.2%)
	4071	322500 1836200	5000 EW	G	9d: 9b	9.8	9711	Cohune palm(13.9%), Cornstick (Aceituna)(12.2%), Bullet tree(6.6%), Cherry(6.1%), Sapotillo(5.6%), Mapola(3.9%)
	5011	323900 1855800	4000 EW	G	9:	14.5	14888	Nargusta(17.7%), Polak (Balsa)(12.5%), Trumpet(8.8%), Moho(8.0%), Black maya(5.8%)
	5012	323900 1854500	4000 EN	G	9:	16.4	13763	Polak (Balsa)(13.3%), Nargusta(9.1%), Trumpet(8.7%), Sillion(6.9%), Quamwood(5.3%), Banak(4.7%), Kaway(4.1%)
	5021	327600 1856600	4000 EW	G	9:	10.1	9700	Moho(16.7%), Nargusta(13.0%), Ironwood(6.8%), Polak (Balsa)(5.7%), Tem(5.4%), Sillion(5.3%)
	5022	327600 1854700	4000 EW	G	9:	9.8	9316	Moho(11.0%), Sillion(10.7%), Nargusta(10.6%), Bri bri(5.9%), Polak (Balsa)(5.7%), Banak(5.6%), Hogplum(5.1%)
	5031	331300 1855100	4000 EW	G	9:	9.6	10194	Trumpet(7.6%), Banak(7.2%), Barba Jolote(6.8%), Wild Grape(6.7%), Tem(6.5%), Prickly yellow(6.5%), Bay cedar(4.4%)
	5032	331300 1853400	4000 EW	G	9;	10.8	8819	Nargusta(11.5%), Baking p. stick(11.5%), Bay cedar(7.9%), Mammee(6.9%), Hogplum(5.0%), Santa Maria(5.0%), Wild
								Grape(4.6%)
	5041	335100 1854900	4000 EW	G	9: 9a	9.7	10777	Negrito(9.0%), Hogplum(7.7%), Nargusta(7.6%), Tem(6.4%), Prickly yellow(5.4%), Polak (Balsa)(4.4%), Bay
	FA ( A		4000 TEI	•	0. 0-	10.1	A155	Cedar(4.28)
	5042	335100 1854000	4000 EW	G	9: 9a	12.1	915/	White Gombolimbo(19.2%), Bay Cedar(9.7%), Bri Dri(7.9%), Mammee(6.3%), Trumpet(6.1%), Banak(4.9%)
	5051	338800 185/000	4000 EW	G	9:	6.1	/169	Nargusta(10.9%), Trumpet(9.4%), Banax(9.0%), Bri Dri(5.6%), Prickly yellow(5.3%), Negrito(5.2%), Bay Cecar(4.9%)
	5052	338800 1854000	4000 KW	G	9a:	8.7	18601	Trumpet(18.6%), Ironwood(6.9%), Bri Dri(6.7%), Negrito(6.3%), Frickly Yellow(5.5%), Polak (Balsa)
	5062	342600 1854300	4000 EW	G	9: 5	8.2	7638	Bri Dri(10.9%), Kaway(10.0%), Hogpium(9.0%), Banak(6.5%), Ironwood(5.7%), Trumpet(4.7%), Polak (Baisa)
	5071	320100 1851300	4000 KW	G	9:110	747	8450	Hogplum(9./%), Black maya(8.6%), fronwood(/.2%), Salmwood(6.0%), Bri Dri(5.2%), Mono(5.0%), Nargusta(4.2%), Bay cedar(4.1%)
	5072	320100 1850500	4000 EW	G	9:	10.6	10788	Narqusta(10.4%), Moho(9.8%), Polak (Balsa)(6.5%), Salmwood(6.3%), Banak(5.9%), Quamwood(5.8%), Bri bri(5.7%)
,	5081	323900 1851300	4000 EW	G	9:	32.3	46788	Moho(15.6%), Trumpet(14.5%), Polak (Balsa)(12.5%), Bay cedar(8.2%)
	5082	323900 1847100	4000 EW	G	9: 9d	20.8	31413	Moho(19.7%), Black maya(10.7%), Ironwood(7.5%), Quanwood(6.7%), Trumpet(6.7%)
	5091	327600 1850200	4000 EW	G	9:	8.0	7282	Narqusta(16.6%), Ironwood(12.3%), Moho(10.0%), Bay cedar(7.5%), Hogplum(5.4%)
	5092	327600 1849500	4000 EW	G	9:	10.1	6288	Kaway(10.8%), Hopplum(8.2%), Bits(8.2%), Bay cedar(7.4%), Ironwood(6.5%), Banak(6.2%), Polak (Balsa)
	5101	331300 1851900	4000 EW	G	9:	16.4	15804	Narqusta(13.9%), Bay cedar(10.2%), Negrito(8.5%), Tem(5.3%), Mammee(5.0%), Banak(4.8%), Trumpet(4.6%)

Transect	UTM coc	rdinates	Leng Dirn.	FVG	Veg.	BA	N/km²	Principle species, in order of dominance, with % of Basal Area
ID	East	North	n.		Types	m²/ha	≥20cm	
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5102	331300	1850600	4000 EW	G	9:	8.7	8163	Nargusta(10.6%), Polak (Balsa)(7,9%), Tem(6.7%), Trumpet(6.1%), Hogplum(4.9%), Yemeri(4.9%), Bay cedar(4.6%)
5111	335100	1852700	4000 EW	Ĝ	9:	9.3	8506	Bay cedar(10.2%), Polak (Balsa)(7.7%), Banak(7.1%), Trumpet(6.7%), Bri bri(5.8%), Mammee(5.5%), Horplum(5.4%)
5112	335100	1849800	4000 EW	G	9: 9d	36.0	57358	Trumpet(18.8%), Guama(9.3%), Negrito(7.9%), Bay cedar(7.5%), Moho(4.6%), Hogplum(4.3%)
5121	338800	1852800	4000 EW	G	9: 9a	7.8	8150	Trumpet(13.4%), Banak(8.7%), Bri bri(8.0%), Hogplum(6.7%), Tem(5.7%), Bay cedar(5.1%), Ironwood(4.8%)
51.22	338800	1850200	4000 EW	G	9e: 9a	20.8	36200	Trumpet(18.1%), Bri bri(11.0%), Maculis(7.0%), Negrito(6.0%), Black maya(5.0%), Bay cedar(4.2%)
4072	322500	1833800	5000 EN	H	11c: 9d	8.4	6119	White Breadnut(17.9%), Trumpet(11.8%), Cohune palm(10.4%), Softstick(4.9%), Cojotone(4.0%), Cotton(3.9%)
8031	316700	1818600	2000 NS	H	11g:	6.0	8479	Yemeri(37.0%), Nargusta(24.2%)
8032	317700	1818600	2000 NS	H	11g: 15	10.1	14000	Nargusta(27.4%), Yemeri(24.1%)
8112	317300	1812500	2000 NS	H	11g:14a	3.6	4417	Nargusta(32.0%), Yemeri(13.2%), Hogplum(8.8%)
8151	316600	1810500	2000 NS	H	11g: 16	3,5	3983	Tubroos(26.7%), Yemeri(19.2%), Santa Maria(9.7%)
3161	282700	1821500	4800 EW	K	12a:12c	19.5	13643	Timbersweet (Laurel)(13.5%), Nargusta(11.9%), Santa Maria(9.3%), Cherry(8.2%), Cramantree(6.2%), Red Wood(5.3%)
3212	273500	1816800	5000 EW	K	12: 4a	13.1	11315	Sapodilla(21.2%), Nargusta(16.6%), Ironwood(4.8%), Wild Grape(4.5%), Mapola(4.1%)
3281	277500	1813900	5000 EW	K	12a: 4a	8.7	9250	Candlewood(13.6%), Santa Maria(10.8%), Wild Guava(9.0%), Nargusta(5.9%), Cherry(5.6%), Ironwood(5.0%), Botan
								palm(4.4%)
4111	312500	1831200	5000 🖼	K	12a:	14.3	16641	Moho(8.8%), Nargusta(4.7%), Cohune palm(4.4%), Kaway(4.0%), White Breadnut(3.9%), Trumpet(3.9%), Cherry(3.8%)
4131	298900	1826900	2200 EW	K	12a:12c	14.3	11932	Sillion(10.8%), Nargusta(10.5%), Ironwood(8.2%), Mamey ciruela(3.9%), Fig(3.9%), Wild Grape(3.8%), Pigeon
								plum(3.7%)
4132	297500	1823900	5000 EW	K	12a: 2d	16.0	14763	White Breadnut(7.9%), Cramantree(6.8%), Ironwood(6.3%), Sapodilla(6.1%), Nargusta(5.7%), Trumpet(5.2%), Fig(4.0%)
1112	289000	1845100	8000 EW	L	16a: 9e	6.0	8181	Oak(18.8%), Pine(15.1%), Nargusta(13.8%), Fiddlewood(7.2%)
8111	316400	1812500	2000 NS	L	14a:	4.9	4500	Nargusta(33.4%), Yemeri(9.9%), White Breadnut(7.4%)
8121	314400	1812700	2000 NS	L	14a:11g	6.7	7028	Fiddlewood(24.4%), Nargusta(23.8%), Yemeri(6.7%)
8122	314900	1812700	2000 NS	L	14a:11g	5.3	5088	Nargusta(15.9%), Fiddlewood(13.2%), White Tamarind(11.4%), Mahogany(9.3%), Tubroos(7.7%)
6653	305300	1948600	4700 NS	M	21a: 1a	7.3	9195	Mahogany(22.4%), Bullet tree(14.7%), Fiddlewood(7.2%), Sapodilla(6.8%)
6676	316200	1948000	5000 EW	M	21a: 34	9.9	12355	Sapotillo(13.2%), White Breadnut(12.4%), Mahogany(8.7%), Provision Tree(7.5%), Wild Mammee(6.1%), Hogplum(5.4%)
6687	320400	1947600	3300 EW	M	21a: 1a	5.0	5904	Mahogany(21.4%), Fiddlewood(4.4%), Cotton(3.8%), Black Poisonwood(3.8%), Bullet tree(2.2%), Nargusta(1.9%), Red
								Gombolimbo(1.9%)
6716	306800	1944600	3400 NS	M	21a: 34	13.1	13680	Mahogany(18.7%), Bullet tree(12.0%), Fiddlewood(5.7%), Provision Tree(4.8%), Hogplum(3.6%), Black Cabbage
6155	294300	1957900	5500 EW	0	34: 2a	16.0	20685	Manogany(17.5%), Saponilla(11.1%), White Breadnut(6.6%), Mamey ciruela(5.4%), Builet tree(3.6%), Fiddlewood(3.3%)
6562	311200	1959600	5100 EW	0	23: 34	7.7	9310	Manogany(13.6%), Hogplum(10.6%), Quamwood(6.9%), Sapodlila(5.1%), Cedar(4.9%), Black Cabbage Bark(4.4%)
6569	311200	1956200	5000 EW	0	34: la	8.8	12250	Manogany(15.9%), Mamey Cirueia(5.9%), White Breadhut(6.0%), Cedar(4.8%), Santa Maria(4.1%), Black Cabbage
60 C /	00 10 00	1050100	(000 TE	^		10 ¢	10150	Bark(J. DK)
6734	294000	1939100	4800 KW	U	34: la	12.0	13120	manogany(10.5%), Mate Butthoor(8.5%), Butter tree(7.3%), Sapoatita(7.2%), Santa Maria(7.0%), Mamey Ciruela(6.6%)

Transect	UTM COC	rdinates	Leng Dirn.	PVG	Veg.	BA	N/km²	Principle species, in order of dominance, with % of Basal Area
ID	East	North	M.		Types	m²/ha	≥20cm	
					-			

6865 310400 1929100 4500 EW 0 34: 25 9.6 10021 Mahogany(9.7%), Wild Mammee(7.5%), White Breadnut(7.1%), Sapodilla(5.3%), Fiddlewood(5.2%), Nargusta(4.6%), Male Bullhoof(4.3%)