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CRUISER IDENTIFICATIONS AT SBK AND LOCAL USES OF TREES BY LOCAL PEOPLE

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ADMINISTRATION

TIMETABLE:

September 21	Arrive in Pontianak
September 26	Arrive at SBK
October 7	Relocate to km 106
October 28	Start of cruiser course
November 2	End of cruiser course
November 9	Start of local people survey
November 20	Return to Km 54
November 23	Return to Pontianak
November 30	Return to Herbarium Bogoriense
December	Report turned in

OTHER PERSONNEL:

Jaini	Undergraduate assistant from University Tanjungpura (UNTAN), Pontianak. Assisted in all aspects of the project
Ir. Eva Gusti	Junior forestry faculty, UNTAN. Received training in forest botany and assisted in the cruiser training course
Ir. Iskandar	Junior forestry faculty, UNTAN. Received training in forest botany and assisted in village surveys
Pak Damanik	Post-felling inventory staff at SBK. Assisted in petak surveys
Pak Ranggun	Kepala desa Riam Batang
Pak Biduran	Kepala desa Tumbang Tebarau

C

PREFACE

This report is one of a number of reports produced under the Government of Indonesia's Natural Resources Management Project (NRM) that is assisted by the United States Agency for International Development (USAID).

The NRM project, working with the Indonesian National Planning Board (Bappenas) and the Department of Forestry (Departemen Kehutanan), provides through a specially established project Policy Secretariat advice to Bappenas on natural resource issues relating to long term and short-term national planning. In addition, working with the Department of Forestry the NRM project carries out field activities in two pilot project areas one in West/Central Kalimantan and one in North Sulawesi including the preparation of management plans for the Bukit Baka-Bukit Raya National Park in Kalimantan and the Bunaken National Park in North Sulawesi. Each report addresses an aspect of the planned NRM project activities that are agreed on and laid out in an annual NRM Implementation Plan and each report aims at providing specific recommendations for future work in the area addressed.

This report looks at the cruiser identifications of trees in the SBK concession and also provides a general survey of plants used by local people in the Bukit Baka-Bukit Raya National Park on the borders of West and Central Kalimantan. The recommendations of this report will be utilized to support the project's activities inthe area.

D

NOTES

This study was based on one "terms of reference", however, this report is divided into two parts. The first concerns cruiser identifications of trees in the SBK concession and the ramifications of the problems encountered. The second concerns a general survey of the uses of plants by local people. There is some overlap between the two, but separating them will facilitate both reporting and reading.

During the course of this work numerous herbarium samples were collected. It will take two to three months to dry and mount them all. Once completed one set will stay at Bogoriense, one set at Universiti Tanjungpura, one set at the Arnold Arboretum of Harvard University and one set at SBK.

ACKNOWLEDGEMENTS

This study would not have been possible without the advice and support of the SBK staff, particularly Pak Yudin and Pak Edwin at Km 35. Pak Ranggun, kepala desa of Riam Batang and Pak Biduran, kepala desa of Tumbang Tebarau were an enormous source of support and help during the village surveys. My thanks to all.

During the study the assistance of Jaini, Ir. Eva and Ir. Iskandar of UNTAN and Ir. Zeffri made the volume of data accumulated possible.

Finally, many thanks to the NRMP long-term advisors, Mering Ngo, Elmo Drilling and Fernando Potess at SBK-Km 54 and Pak Sukarman in Pontianak for making everything flow smoothly and providing advice, knowledge and more whenever required.

F

EXECUTIVE SUMMARY

The principal aims of this study were to investigate the names used by timber cruisers and the uses of plants by local people in the SBK concession area.

TIMBER CRUISERS:

Timber cruisers provide the baseline data used for forestry statistics and planning. Their data provide information on tree location, size and identification. It was the identifications that were investigated.

Cruisers are generally Javanese males with no formal training in forest botany. Their training generally consists of on-the-job experience with an older cruiser for one to two years before running their own crews. These crews consist entirely of daily hired local labor. Identification rests almost completely on the knowledge of the daily hires.

The names written in cruiser data books are based on timber classification, names with no biological relevance. A basic, and incorrect, assumption is that the names provided by local people are equivalent in content and form to the names required by industry. This is not the case. For example, in Bahasa Osa, the language of many of the daily laborers, the genus containing ebony is called kumpang arang. This has been understood by cruisers as meaning the same as kumpang, the nutmeg family. These sorts of errors cause commercially important timbers to be classified with unimportant wood.

During timber cruising all trees > 25 cm dbh are recorded in data books. In the final statistics 50% of all identifications are made as unknown. In the cut class, trees > 50 cm dbh, this drops to 10%. For identified trees, the merantis were almost entirely correctly identified to timber class. Other Dipterocarpaceae were generally correctly identified. Most other timbers were unreliably identified.

Aside from lack of training, another source of error in identifications was the volume of work a cruising team must complete in one day. One team identifies, measures and maps 600 trees a day. Identification is based almost entirely on external bark characters, sometimes with slash features, too. Given the degree of similarity between many trees on these features, especially to an untrained eye, mistakes are bound to occur. Management, however, requires speed even though speed reduces accuracy.

G

In the unknowns are various species of specialized commercial interest such as fine furniture manufacture. Correct identification of these would result in better profits from selected trees.

Training in identification would reduce the number of unknown trees in cruiser books and the number of errors, without significantly reducing cruising speed. Training would require a book on the local timber trees, description of bark and leaf features, and cruisers would require binoculars to collect appropriate leaf samples among fallen litter.

The relevance of further training, and indeed current cruiser identifications, is in question. Chainsaw operators cut without any regard to the cruiser books. Their only concern is that trees look > 50 cm dbh, are not marked with a pohon inti strip on their zinc tags and do not appear, to their untrained eyes, to be of a species reserved for local people. Scalers do their own identifications based on timber characters. What are cruiser identification for?

PLANTS USED BY LOCAL PEOPLE:

This study was a survey of local uses of plants, principally trees, by the inhabitants of Tumbang Tebarau and Rima Batang. These villages are adjacent to one another and unconnected by any roads to any other village. The people are almost entirely dependant on the forest area for their needs.

Numerous tree species are used in the course of their everyday lives. It quickly became apparent that an analysis of their needs requires examination of destructive and non-destructive use of local resources, especially in the light of proposed plans to set up extractive reserves in the region. Past efforts have tended to concentrate on the non-destructive products. This study found substantial requirements for timber trees. Most of these were meranti, in direct competition with local logging concessions. Furthermore, the size classes required by local people are the same as those cut by commercial operations. Trees < 50 cm dbh are left by the companies for future cutting cycles, and are left by local people because the wood is not good enough for their purposes.

Logging practices impact upon the non-destructively extracted produce required by local people. The extent of damage of these resources and ways to mitigate their effects require further study.

H

OTHER ASPECTS:

There are currently no trained manpower or available scientific resources enabling correct identification of trees in West Kalimantan, in that region. A herbarium is required in addition to trained manpower to fulfill this need. Universiti Tanjungpura (UNTAN) is a logical site for such a facility, where it will be of service to faculty and students (including those who will enter the area's forestry industry), and outside researchers.

CRUISER STUDY

BACKGROUND:

A name is a label applied to any object used to communicate knowledge about that object. Often, the more precise the label used by a communicator, the more accurately the communicator **feels** the listener understands the message. An understanding requires that the communicator and listener concur on the definitions of the terms used. This is particularly important when terms are embedded in hierarchies. For example, suppose two people are discussing transport in Jakarta and one announces s/he is selling a vehicle. The other is interested in buying transportation but must now narrow down to specifics such as the model and make. Much needless conversation might have been avoided if the owner only announced s/he was selling a "Suzuki Katana". Provided the potential buyer understood that in Indonesia a Suzuki Katana is a car the conversation could proceed normally. However, if the buyer was fresh from the USA where a Suzuki Katana is not a car, and was also uninitiated in the car market of Indonesia, the buyer would assume the seller was discussing an extremely powerful motorbike rather than an urban jeep. The point is as follows - a label, or name, used by one person is only as good in communication as the mutual understanding of all terms used.

In forestry the same principle applies. Names abound in the timber industry such as meranti and kapur. These have various meanings, but those involved in concession management and industry generally base their terms on industry definitions. Taxonomic definitions are different and based on aspects of biology rather than timber use. The difference means that not only are different names applied to any one tree, but understanding of its place in a hierarchy is different, too. The taxonomist, or scientific namer in this case, groups it with other trees of similar biological affinity, generally on the basis of flowers and fruits. The forester (taken here as a general term for anyone in the forestry industry) groups it with other trees on the basis of timber characteristics, important for industrial purposes but biologically of little realized importance.

Into this mixture comes vernacular names. The familiar names of meranti, kapur, kumpang, bintangor, are local names. Foresters and biologists generally communicate using vernacular names, and rarely consider what one understands from the words of another. The vernacular names within an area are rarely considered and analyzed in the light of the languages (in terms of meanings of single words) of the forester and researcher. The point is that a local person, a forester and a researcher may all be using one word from three perspectives and languages. There are no precise definitions, there are no attempts to determine if one is being

fully understood. There is only the blind assumption that everyone knows what everyone else is talking about.

In a timber concession cruisers run teams who tag and map the location of all trees in a petak (an area of 100 ha), and measure and identify them. In this study the language of the timber cruisers was investigated. Specific questions were how do cruisers identify trees; how consistent is one cruiser in identification and how much do different cruisers agree on terms; **what do cruiser names mean?**

Timber cruiser data provides the foundation for forestry planning when names are used. Mutual understanding of all names are important if those names are to impart real meaning. When different meanings are understood from the same word, confusion is bound to arise.

METHODS:

Cruisers could not be accompanied in their mapping and tagging work because their field season ended before the beginning of the study. To assess cruiser reliability and consistency an uncut petak was chosen with trees already marked and tagged by cruiser teams for detailed study. This was petak 979 at Km 109. Petak 979 is scheduled for felling in April. Near this petak were others which had also been mapped and tagged by different cruisers. These were used initially to investigate intercruiser consistency.

Identification data from the petak 979 cruiser book were databased. Names were sorted and an attempt was made to find selected trees from each name by orientating in the forest with a copy of the petak map. This proved too slow as trees were often difficult to find. An error by as little as 20 m can cause a lot of lost time in searching for a particular tree in a 40 m wide circle. On some occasions particular trees could not be located at all. The second technique, and the one followed for the majority of the study, was to walk in the petak and select trees at random. Scientific names were recorded and in many cases herbarium samples were taken.

Additionally, an informal course was held for cruisers over four days to collect herbarium specimens, help them with identification and to collect data on cruisers and their work techniques. Fourteen cruisers in seven teams went out with chainsaw operators each day. They collected specimens of leaves and bark, and whenever possible flowers and fruits, from each tree felled. At night scientific names were given where possible and explanations given for how to identify more accurately. Drawings were made for major non-Dipterocarp groups.

To determine the impacts of cruiser identification in the concession, several days were spent with chainsaw operators and scalers to investigate how cruiser data are used in the field.

RESULTS:

Cruisers

Profiles

SBK has 22 cruisers. Thirteen of these are Javanese, two from West Java, 9 from Central Java and 2 from East Java. Eight come from Kalimantan and one is a Batak from Medan. All have completed SMA, and one SMKA. Their average age is 28 and the oldest is 32.

Training

One or two cruisers per year are sent for a two month training course in Samarinda. No instruction is given on this course on identification. One cruiser attended a 1.5 month identification course in Bogor. He has since been transferred to BINHUT.

Entry level cruisers are attached to a senior cruiser for two to three years before managing their own crews. **This is the only training most cruisers receive.**

Work methods

A team consisting of two cruisers and eight daily laborers, locally hired, survey a petak. Six hundred trees a day are mapped, tagged and identified. **The cruiser acts as a manager. Almost all identifications are given by local people to the cruiser, who writes these as a three letter code in his cruiser book.** Identifications are made entirely by bark and slash (characteristics exposed by a parang cut to a tree trunk) characters.

Cruiser data use

After cruisers have finished their survey the books are turned in to camp headquarters, who prepare summary statistics based on their data. They reduce some of the cruiser field names to "mix timbul" or "mix tenggelam", mixed floaters and sinkers, respectively. Mix means unknown. **Although these are the figures used in company and government planning, they have very little impact on field practices.**

Chainsaw operators will cut any tree over what they assume is 50 cm dbh, unless marked with a yellow band on its zinc tag indicating a "pohon inti". Ulin and tenkawang are, according to operators, also left. The operators are rarely from the area and have little idea about what they are cutting. Chainsaw operators are paid on volume cut, hence their interests are best served by cutting, not by questioning what it is that they are cutting. **This further supports the concept that chainsaw operators are the real forest managers, deciding what and how to cut** (Curran, personal communication).

Scalers write on logs their own identifications, the same as those used by the company in its summary statistics. **Identification in this case is based on felled and debarked logs only.**

PERCEPTIONS ON DATA ACCURACY:

Cruisers

The cruisers recognize their dependency on locally hired laborers for identification. They are confident that, under their management, the identifications provided by their teams they are recording are correct. Their confidence is not high in their personal identification abilities outside of the meranti group, however, by rehiring help that they have been happy with in the past, they do have confidence in their teams success rate with identifications.

Chainsaw operators

Chainsaw operators have no concerns about cruisers identifications and their accuracy.

Scalers

Like the chainsaw operators, the scalers have no concern for the cruisers data books. Scalers identify cut and debarked logs and classify according to the SBK export codes. Like the cruisers, scalers are given no formal training in wood identification, everything is learnt on the job from peers.

Management

Management assumes that cruiser errors are low, perhaps one to two trees per petak (100 ha). A need for further training is recognized, especially in the light of the number of unknown trees (see next section) that are reported.

The bottom line for management is that work performance is maintained. Whereas accuracy is required, speed is paramount. A balance is required between the two, but if sacrifices have to be made, they should not affect production targets.

Management is confident that any errors made at the concession will be picked up at the saw-mill, in the belief that the personnel there can accurately identify any timber.

ASSESSMENT OF DATA ACCURACY

Petak 979 statistics

In field data books cruisers record the following data for all trees over 25 cm diameter at breast height (dbh):

- Tree names as provided by daily hired labor reduced to a three letter code
- A "+" or "-" indicating a sinking or floating log. In the case of unidentifiable trees, this is determined by a parang cut. If the wood is hard it is assumed that it will sink, if soft that it will float
- dbh and height

The distribution of numbers according to names in the data book are given in table 1. A total of 4101 trees > 25 cm dbh were recorded. The largest group was the unknowns, recorded as "mix", comprised 1183 trees, or approximately 29% of the total. The summary statistics (table 2) provided by the concession office are often at odds with the data from the original cruiser book despite the total number of trees being equivalent. Additionally, many names are reduced to "mix" causing the unknown trees to rise to approximately 47% of the total. Trees of acceptable cutting size are > 50 cm dbh, and the total number in petak 979 in this class is 1115. The number of unknowns here drops to around 9% (table 3).

The largest group of trees is meranti, all members of Shorea in the Dipterocarpaceae. This is divided up according to wood type into meranti merah, meranti kuning and meranti putih. Together they make up almost 31% of all trees > 25 cm dbh, and about 63% of all trees > 50 cm dbh.

The non-meranti trees are sometimes put into two or more classes. For example, Sindora, an important timber group, is recorded as "sindur" and "paru-paru" in any one book. Eugenia a group of minor timber importance is recorded as ubah and sampak, among other names, reflecting a straight recording of local classification and reporting to the cruiser.

Field assessment

It must be stated that the majority of cuttable trees, those > 50 cm dbh, are merantis and these were identified correctly as merantis. The only errors found with merantis in the data books were when entries for two trees were inadvertently switched, probably the result of having several names called out by different team members at the same time and the cruiser mixing the entries.

With non-merantis, and particularly those trees not in the Dipterocarpaceae, numerous errors were found. These errors are consistent with the attempts to directly link the local nomenclature with general timber nomenclature (table 4), and confusion caused by using a few visual characters from the trunk and slash to identify a tree.

Errors caused by nomenclature were numerous. The most common was over kumpang. Kumpang is generally accepted to refer to the family Myristicaceae, the nutmeg family. Trees are fairly easily identified as members of this family if the bark is deep-red to black, and the slash exudes a red semi-translucent exudate. Diospyros (Ebenaceae), the genus containing the ebony species, often has similar bark features, but the wood is very hard and has no exudate. Local Dayaks refer to Diospyros as "kumpang arang". The cruisers record this as KPG in their books. Until this was pointed out, ebony was assumed to be absent from the concession. Perhaps this is due to its common name being "kayu malam", not used by hired local labor. As a result, any Diospyros cut would be grouped with trees of the Myristicaceae and used for bridge building and other such purposes as this error is also made by scalers.

Kempili (the oaks) trees are members of Lithocarpus and Quercus (Fagaceae), and are occasionally confused with other groups. Some examples were found where the dark bark color caused it to be identified as kumpang, and in a few cases keruing. Keruing refers to Dipterocarpus (Dipterocarpaceae), and is indicated by being a large tree with small buttresses, sometimes with dammar, and numerous large lenticels. It is very easily confirmed by looking at a fallen leaf. In turn, Dipterocarpus is also confused with members of the Burseraceae.

One species of Sapotaceae, as yet unidentified to genus, is consistently called bintangor (Calophyllum: Clusiaceae). The reason is the orange brown bark, yellowish wood and exudate. The Clusiaceae always have opposite leaves and the Sapotaceae alternate. The leaves of Calophyllum are furthermore very distinct with numerous parallel veins at almost 90° to the midrib. These characters are easy to check from fallen leaves.

A similar error is made with "asam", generally accepted as meaning a mango relative. On bark characteristics alone it similar to members of the Burseraceae, especially a local species of Dacryodes, with which it is sometimes confused.

The reasons for the errors are consistent with using very limited data, the trunk alone, for identification. **In many cases this is like trying to identify a car by the tires it has.** Different timber groups can have the same sort of trunk if external features are looked at alone. Errors are bound to result from this practice.

Because of the dependency on a team of local hired laborers, **it is the local labor abilities which are of greater importance in tree identifications.** There is variability here, too. One species of Calophyllum was consistently found in clumps, generally on or near ridge tops. One clump was found to have individuals recorded correctly as bintangor, whereas others of the same clump were recorded as unknown. This was probably due to different daily hired laborers of different ability reporting different identifications to the same cruiser on different trees of the same species.

Further examples are found within the Myrtaceae, a large family with numerous species, and several different life-forms. Many were correctly identified as ubah. Others were recorded with different names applying to the same genus (table 4), based on the local classification which accords different names to those life-forms. In some petaks, various Myrtaceae were recorded as unknown.

DISCUSSION:

The questions initially addressed concerned reliability of identifications of trees among and between cruisers. The general conclusions, and their ramifications, are as follows:

- **Identifications are made by staff with no formal training in identification, and little understanding of the meanings of the names they are writing**

  Cruisers have no formal training in forest identification. They have no reference with which they can judge their personal and team performance, and at no time is their work checked. This has resulted in the present situation where for years, Diospyros, some of whose species are high value timbers, has been grouped with non-commercial trees of the nutmeg family; where perupok (Kokoona: Celastraceae), another high class wood, is lumped with the unknown species. **The ramifications from these sorts of errors are commercial losses for the concessionaire. The errors in identification of**

cuttable non-dipterocarp species make it impossible to assess the conservation status of those species in the concession area.

The errors in identification make it important to assess the potential that the concessionaire maps have to further research. In light of the type of errors found, the maps can only be relied on strongly for the Dipterocarpaceae but with less reliability for Dipterocarpus. All others must be treated with caution.

The short training course held demonstrated that the cruisers could pick up basic botanical training very quickly, and use the knowledge in the field. It is recommended that they be given short training courses to help in this regard, bearing in mind the other comments in this section. Both the cruisers and management would like to see development of the SBK herbarium collection, and this used as a resource for their staff.

A further point of concern is that it is cruiser data which are used for summary statistics given to private and government planners. Thus the baseline data for timber projections and policy planning are based on the data of largely Central Javanese young men with no formal training in forestry or botany, relying almost entirely on the knowledge of local people. To compound the problem further there is a mistaken assumption that names based on local taxonomy, scientific taxonomy and timber classification are interchangeable. The reality is that these are three languages being spoken with many of the same words. This is akin to trying to fit square pegs into round holes.

- **Identifications are made too quickly, with the primary target being productivity rather than accuracy, with an assumption that errors will be caught down-stream**

An experienced botanist can take up to an hour, sometimes more, to collect material from a tree to make an identification in a new area. The identification, if based on sterile (i.e. no fruits or flowers available) can generally be made to family, sometimes to genus and occasionally to species. In an ecological study in Sarawak of all trees > 1 cm dbh, one identifier with two assistants could cruise 250 trees a day, however, most of these trees were small and vegetative material very accessible. This contrasts completely with large timber trees. Binoculars must be used to scan the canopy for the leaves belonging to the tree in question. Catapult's can be used to dislodge leaves, but care must be taken that lower canopy trees, climbers and epiphytes are not being sampled instead. Fallen leaves can be

collected, but it is sometimes difficult to gauge if the correct leaves are being taken. In some cases the crown is totally obscured by lower canopy trees.

In an area where the flora is adequately known the minimum requirement for assessing family differences is a good pair of binoculars and basic training. Neither is available to timber cruisers. With an understanding of what they might be looking at in the field and binoculars to enable them to look at correct leaves and use those in the identification process, their error rate for non-dipterocarp species could be reduced tremendously.

It is recommended that cruisers be provided with binoculars to help them with their work. Given their production targets it is recognized that this will not eradicate errors completely, but it should reduce them to such a level that their results are made significantly more reliable for the non-dipterocarp species.

The question must also be asked, "who is meant to take ultimate responsibility for identification?". Until this is addressed there is little point in developing identification skills.

- **Identifications are reliable for most Dipterocarpaceae timber classes, however, the Dipterocarpaceae timber classes have no or little biological and ecological relevance. They are not akin to species or any other taxonomic groups**

The classification used by the cruisers is based on the end-use of the timber and hence wood characteristics. These are of little, if any, relevance to the field. The various meranti groups are a mixture of species in Shorea, and are not grouped according to biological affinity. More pressing is the lack of attention paid to ecogeographic characteristics of species within a broad band grouping such as "meranti merah". Although this is of little importance to the first cut, it will affect regeneration and second cut production. The effects will be felt owing to current selection practices for pohon intis. These trees are assigned as those > 50 cm dbh. As Curran (personal communication) has correctly pointed out, there is no biological relevance in this. Logging practices may be selecting against fast growing, tall growing, and healthy species and genotypes. Should cruisers develop the ability to recognize species of their merantis, a better idea of what species grow where, and their basic ecological requirements will be available. **Only with basic data on this topic can pohon intis be defined in a way that makes sense biologically and for conservation of both biodiversity and profit margins.**

- **Questions concerning intra and inter-reliability of cruiser identification are irrelevant as generally it is daily hired labor who give names**

  Because cruisers are so dependent on their locally hired laborers for field identification, and because these laborers can be changed at the end of each year's survey, the question of inter and intra-reliability of cruiser identification is irrelevant. Overall the teams are reliable at correctly assigning the major Dipterocarpaceae timber groups, and unreliable at others.

- **It is unclear what relevance, if any, cruiser identifications have in the daily running of concession operations considering that operators cut on the basis of timber size and pohon inti labels, and that scalers put their own identifications into their own data books, based on gross wood characters from debarked logs**

  A question which badly needs to be answered is **"what are the cruiser identifications for?"**. Furthermore, **if cruiser identification was better, what difference would this make?** Currently it is largely the chainsaw operator who is the final arbitrator of a tree's fate - to be cut or not to be cut. For final production figures, the scaler's books are probably more important.

  Were cruisers to be better trained in field identification and confidence placed in their abilities, and were pohon inti designations and harvesting strategies to be founded on cruiser data, the cruisers identification role would be greatly enhanced. **Until such a time, it can only be concluded that despite errors in cruiser identifications, these are currently unimportant in the day-to-day operations of the concession.** Development of cruiser skills in identification would be a wasted effort until their data are used in all down-stream activities of the concession.

LOCAL USES OF PLANTS

BACKGROUND:

In and around the SBK concession are villages with a history of dependance on the forest for the necessities of life. In this study a preliminary survey was made of the species used, the purposes they have, and the volumes required for every day living.

STUDY SITE:

The villages of Riam Batang and Tumbang Tebarau were selected for this part of the study. They are the most isolated habitations in the vicinity of SBK operations. The nearest road is a recently made skid trail off Km 80, which ends approximately 6 km from the villages. A working assumption was that this isolation would foster greater reliance on forest products and land use than would be encountered elsewhere.

Riam Batang and Tumbang Tebarau are situated beside one another. Riam Batang is the older of the villages. The residents are unsure of how long it has been there. Tumbang Tebarau moved beside Riam Batang in 1977 in order to have better access to Majur, the local market town reported to be two days away.

All heads of household have, or are planning to build, housing. All have boats and ladang areas. This includes the older residents.

Tumbang Tebarau contains 19 head of families, and Riam Batang 42. The 42 families of Riam Batang reside in 14 houses - 26 are in various stages of planning and/ or construction. The river Seruyan provides the major transport link for the village. This is used to raft down logs and boards for building, and provides easy access to ladang areas.

METHODS:

The villages were visited twice in two weeks, each visit of four days duration. During the first week the forest used by the residents for timber and non-timber forest products (NTFPs) was randomly surveyed with local informants. They were asked to pick out trees used, provide the local name, uses and other pertinent information (table 5). In the second week interviews were conducted within each village in walks or meetings held with village heads and helpers to discuss the species used, and to determine numbers of trees, within species, used on a yearly basis for timber (table 6).

RESULTS:

In Riam Batang, despite having 42 head of households, all families abide in 14 homes. Sixteen houses are in the process of being built and eight are still in planning. This village is better established and subsequently better off than Tumbang Tebarau. Ulin, a relatively expensive commodity, is used more often within Riam Batang. The houses are slightly larger, requiring more timber. Within the village, 1/3 of all houses are constructed exclusively from meranti.

To provide a sense of scale, 4000 shingles can be cut from one ulin tree of 60-80 cm dbh. These will last for at least 30 years. Floors and walls require 100-200 boards, which can be provided by one tree, at least 60 cm dbh. The size of the trunk is a very important factor in wood duration. A meranti tree of < 50 cm dbh will last for 8-10 years. A tree of > 80 cm will last at least 15 years.

It is recognized by the villagers that they have used their timber reserves in the vicinity. Prime trees are now a two hour walk from the villages (about 6 km) and it can take as long as five days to bring in timber. Some villagers still search for prime trees alone. Many pay others to doing the looking for them.

Wood is generally sought along rivers. After felling trees are rolled down to the water and formed into small rafts. Sinking wood is attached to floater logs. Two to three days effort is involved from commencing the search for wood to landing it in the village. Some wood is floated further down to the market town of Majur, for sale. Informants were unsure of the quantities involved.

Contractors

Riam Batang has three contractors. They work alone and have their own chainsaws. Ulin is the most important resource, followed by meranti merah and then meranti kuning. Riam Batang requires 10,000 boards per year. More boards are made from meranti than ulin. One cubic meter of wood makes 45 boards. Generally, 20 meranti trees a year are cut. 120 cm dbh trees are preferred for meranti, but 80-100 dbh trees are acceptable. Ten ulin trees are cut per year for Riam Batang alone, and the preferred size class is 70-100 cm dbh. Trees < 50 cm dbh are definitely not acceptable as they split and have too high a water account.

According to the villagers, including contractors, bangkirai and keladan are "class 1" timbers. Ulin is a class of its own, exceeding all other available woods. It is referred to as the best wood in the world.

The contractor estimates there are enough trees for the next 10 years if the concessionaires stay away. Should meranti and ulin be in short supply other trees can be used, notably menuang. This is not an option the contractor would ever like to take.

The figures in table 6 are a broad summary and must be treated with some caution and in view of the following breakdown and interpretation of names.

Housing

Most houses in Tumbang Tebarau are 5 x 7 m. The smallest is 4 x 6 m, and the largest 9 x 12 m. In Riam Batang most houses are 5 x 8 m, with two houses 8 x 12 m, which require 1.5 times the amount of timber needed for the former. Two houses are constructed from ulin only, but 1/3 of all houses are built solely from meranti.

A 5 x 8 m house requires three trees to build, generally one ulin and two merantis. Ulin is used for shingle, and sometimes as boarding for floors and the lower part of walls. Meranti merah is the preferred class of meranti as it is not fibrous, planes easily, is long lasting and bug resistant. Meranti is used for boards, and also for roofing in lesser quality houses. Each tree will be approximately 15 m long and 80 cm dbh.

Two to three new houses are constructed in Tumbang Tebarau each year in order to house new families or to replace old buildings. Maintenance requires ten trees per year for the village above the requirement for new houses. Ulin will last for 30-40 years, meranti for < 20 years. When replacing a house, ulin will be recycled, hence it is replaced about half as frequently as meranti.

Boats

Each family owns at least one boat, and many possess two. The number of boats belonging to the Tumbang Tebarau is about 30. Riam Batang villagers also possess at least one boat per household, but this may increase to three or four during heavy tengkawang fruiting years. The additional boats are the same quality as the normal everyday vessels.

The villages also have four large boats (klotok) with engines used for transporting up to eight people or goods rapidly. Young ulin or bangkirai trees are preferred. If a large tree is taken for boat building it will be split into four, and then cut into boards.

Boats are made individually. A good bangkirai boat will last for about four years. Boats can be made from various other timbers, which are not as long lasting. The most popular alternative is bintangor (Calophyllum: Clusiaceae), which will generally last for two years before requiring replacement. Medang (Lauraceae) is also widely seen as acceptable.

A further important requirement is "dammar kelulut", which is used to seal seams and leaks. This is bees wax. It is reported to be in plentiful supply. Each boat requires 2 kg of dammar kelulut, and two collections are made per year. Usually it is found at the entrance to a hole in a tree inhabited by bees. If the hole is not large enough, villagers will bore it out.

Ladang

Each family requires two pondoks per ladang, usually in the size range of 4 x 6 m to 5 x 8 m. One is built for people, the other for rice. Those used for people will not be discussed in detail. If boards are available they will be used, but generally they are made from waste wood cut during ladang clearance, supplemented by bamboo and various palm leaves, plus some rattan for cordage.

The pondoks built for rice present other issues. The infrastructure of the pondok is built from available waste products. The walls, however, are built from melapi bark. Three trees are needed per pondok, each tree generally in the 30-50 cm dbh size class. Melapi trees are actively sought out and cut using hand tools. **Because chainsaws are not available to cut the timber into boards the timber is left to rot at the felling area.** If the trees are close to the village the timber will be used for boat building. The bark is recyclable, and generally lasts for three years thus being used in three different pondoks, following the cycle of ladang clearance. Between the villages, this still represents a lot of wasted melapi timber. The villagers of Riam Batang estimate that they take 20-30 trees per year. Kapuak is a lesser quality alternative, as is mersawa (both Artocarpus: Moraceae).

According to villagers, SBK has offered melapi bark from its bark stripping stations. There seems to be confusion about transport of melapi bark to river access points. The villagers believe transport is not available, but SBK claim to have offered this service free of cost.

Ulin is never used in pondok building as it is too valuable to waste on such a temporary structure. Anyone using ulin for this purpose would be viewed as "sombong", arrogant and conceited.

A further need, costly in trees, is tugal, hard planting poles. These are generally made from ulin. About two poles are needed

per person. Although good for 7-8 years, they are generally replaced far more frequently. These are made from ulin saplings, and probably take a heavy toll on local regeneration of ulin resources.

Minor needs require little input. The major timber need outside of those outlined above are pounding poles to thresh rice. Tough wood is needed, however, ulin is not used as it is too slippery and the rice would fly everywhere. Bintangor is generally preferred. A pounding bowl lasts for many years.

River toilets

The village has three riverine outhouses constructed from two large logs, approximately 80 cm dbh, and 15 boards. These structures require replacement few months to two years. The trees are those that have already fallen, and tend to be partially rotted and/ or hollow centered. Their construction places little strain, if any, on local resources.

Miscellaneous timber

Figures here are very rough. A family will cut a tree maybe every couple of years to manufacture furniture and gather aesthetically pleasing wood for parang sheaths etc. The village head of Tumbang Tebarau estimated his village probably took two gomal (Cratoxylum: Hypericaceae) trees per year.

Non-timber forest products

Before discussing the use of non-timber products, the classification of source must first be understood. Five types of area are recognized:

Uma	Ladang
Uma alat	Plants put in uma
Kelucat	Area after ladang, owned by last ladang owner
Kebun	Mini-"plantation", owned by planter
Hutan	Forest trees, not owned

Uma is a ladang area, an area actively cleared, planted with rice, tended and harvested. It applies only to the rice crop. Uma alat are useful plants planted with rice in the ladang. Some may be of agroforestry relevance and this aspect requires further research. Kelucats are informally sown. A ladang can be planted twice with a five year interval, then the land cannot be used for rice again. During the rice cycles fruit and other seeds are dropped in the area. All trees growing from this informal sowing remain the property of the original ladang planter. Kelucat is therefore regenerating secondary forest with a strong bias toward

fruit trees. It is sometimes also planted with useful species from different areas, or more formally planted with especially favored durian and other fruit tree genotypes, hence at least some of the trees in kelucats have gone through a preliminary selection process. Kelucat extends to the areas around the houses in the village where trees used for food, kapok and shade are grown. Limited space around the village means that most products come from kelucats and forest. The most popular trees to plant in kelucat are species of durian, rambutan, petai, mawang, manga(wild species of mango) and kemayau, cempedak, pinang, engkala, kelapa, kopi, rattan and pisang. Tengkawang is planted by five families only. This leads them to be regarded as "industrious". Each has 5-20 trees, planted two years ago. They are expected to fruit in another 10-15 years.

Near the houses the same species are planted, as well as species of nangka and langsat.

Out of the general fruiting season all tree produce is used domestically. During fruiting seasons the forests and kelucats are reported to provide about 50% of village needs, each. If fruits are sold to outsiders, these are almost entirely those from the forest in fruiting seasons when there is more than enough for the village. Forest trees are perceived as being more important than those in kelucats.

Kebuns are "mini-plantations", areas cleared and intensively managed. The three most important kebun crops are cassava, coffee and rattan. Cassava and coffee are used domestically. The coffee is a an indigenous species of the Rubiaceae (the same family as coffee, which is currently being identified).

Rattan, especially 'rotan sega', has been intensively planted around riverine areas. The process was started about 40 years ago, according to informants, and was intensified in the 1970's when a demand started for unprocessed rattan. Within the last six years the price offered to rattan producers has dropped from Rp 1500 /kg to Rp 800 /kg. Raw rattan is bought by Dayak middlemen in Majur, the local market town.

Rattan is only planted in areas where rice will never be planted again. About 1000 seeds are planted per ladang. A hole is made with a planting pole and three seeds inserted. Six to eight years are needed before harvestable rattan is available.

Uma, uma alat, kelucats and kebuns are owned by those currently farming them, and in the case of kelucats, the previous farmer. Hutan produce is common ownership. For example, when durians fall from a tree, a villager can put up a small shelter, and gather the fruits as they fall. The villager can do nothing to prevent another villager setting up another shelter adjacent to the first. The same fruit and other species planted in kelucats

are taken from the forest. An important unplanted group is kapuak (Artocarpus: Moraceae). Each family cuts about three a year, each in the 5-10 cm dbh size class. Although the fruits can be eaten, this is the most important rope providing tree. The rope is made from the bark and lasts for approximately one year. It is marginally supplemented in this role by mahabai (Annonaceae).

DISCUSSION:

The villages of Tumbang Tebarau and Riam Batang are entirely dependent on the forest surrounding them, and their knowledge of the fauna and flora of the area demonstrated this amply. There is, without any doubt, overlapping needs between the villages and the concession around the land they use. This report indicates the major requirements and uses of the people and without doubt it is incomplete. Much more need to be investigated into minor forest products, the number of trees visited and the volumes of produce taken. **A further critical need is definition of destructive and non-destructive requirements.**

A further point is that the people of the villages have a tremendous knowledge of the genetic resources. They know, for example, what durians can be grafted to others. Such information is critically important to ongoing efforts in Indonesia for germplasm conservation and development at the national level. The knowledge of local people, and the areas they inhabit, urgently require further investigation of the extent and potential utilization of these resources.

TABLES

Table 1: Timber group totals for trees > 25 cm dbh in petak 979

ASAM	20
BANGKIRAI	66
BAYUR	17
BENUANG	89
BINTANGOR	50
BRUNGAN	3
CEMPAKA	19
DURIAN	27
DURIAN BURUNG	3
GARV	1
GERONGGANG	2
IPANK	4
JELUTONG	2
KALAM	30
KAPUAK	18
KAPUR	2
KEDONDONG	4
KEMAYAU	3
KEMPAS	3
KEMPILIK	84
KERANJI	4
KERUING	22
KULIM	25
KUMPANG	255
MANGGRIS	27
MEDANG	141
MAHABAI	79
MELAPI	98
MENJALIN	46
MENTAWA	64
MERANTI X	1
MERANTI KUNING	412
MERANTI MERAH	735
MERANTI PUTIH	107
MERAWAN	96
MERSAWA	22
NYATOH	26
PARU-PARU	16
PETAI	3
PULAI	5
RAMBUTAN	10
RENGAS	7
RESAK	4
RESAK NANGKA	10
SAMPAK	22
SIMPOR	65
SINDORA	9
TENGKAWANG	35
UBAH	125
UNKNOWN	1183
TOTAL =	4101

Table 2: SBK compiled statistics for cuttable trees in petak 979

Petak	Sign	Species	No.	Volume	Class
979	-	Bangkirai	81	280.45	Dipterocarpaceae
979	+	Bayur	16	17.67	Jenis campuran
979	+	Benuang	51	177.05	Jenis campuran
979	+	Bintangor	19	21.39	Non-Dipterocarpaceae
979	+	Durian brg.	30	64.46	Non-Dipterocarpaceae
979	+	Geronggang	2	4.61	Non-Dipterocarpaceae
979	+	Jelutong	2	6.54	Non-Dipterocarpaceae
979	-	Kapur	0	0	Dipterocarpaceae
979	-	Kempas	11	23.09	Jenis campuran
979	-	Keruing	81	168.78	Dipterocarpaceae
979	-	Kulim	25	16.32	Non-Dipterocarpaceae
979	-	Manggris	32	170.88	Jenis campuran
979	+	Medang	141	165.69	Jenis campuran
979	+	Melapi	104	494.54	Dipterocarpaceae
979	+	Meranti kuning	462	3485.37	Dipterocarpaceae
979	+	Meranti merah	787	2922.89	Dipterocarpaceae
979	+	Meranti putih	109	237.01	Dipterocarpaceae
979	+	Merawan	103	298.67	Dipterocarpaceae
979	-	Mersawa	16	55.72	Dipterocarpaceae
979	-	Mix. tenggelam	1212	1123.5	Jenis campuran
979	+	Mix. timbul	711	659.47	Jenis campuran
979	+	Nyatoh	27	36.78	Non-Dipterocarpaceae
979	+	Paru-paru	22	65.14	Non-Dipterocarpaceae
979	-	Rengas	8	14.88	Jenis campuran
979	-	Resak	14	17.71	Dipterocarpaceae
979	+	Tengkawang	35	122.49	Dipterocarpaceae
979	-	Ulin	0	0	Non-Dipterocarpaceae

Table 3: Total for each timber group that could be cut in Petak 979

ASAM	3
BANGKIRAI	38
BENUANG	40
BINTANGOR	2
BRUNGAN	1
CEMPAKA	1
DURIAN	8
GERONGGANG	1
JELUTONG	2
KALAM	9
KAPUAK	1
KEDONDONG	1
KEMPAS	2
KEMPILIK	5
KERUING	4
KUMPANG	18
MANGGRIS	14
MEDANG	11
MELAPI	55
MENTAWA	5
MERANTI KUNING	280
MERANTI MERAH	380
MERANTI PUTIH	37
MERAWAN	43
MERSAWA	11
NYATOH	3
PARU-PARU	4
PULAI	2
RENGAS	3
RESAK NANGKA	1
SIMPOR	4
SINDORA	4
TENGKAWANG	18
UBAH	3
UNKNOWN	101
TOTAL TREES =	1115

Table 4: SBK, Local (Osa language) and scientific names

SBK	Local	Family	Genus	Comments
Asam	Asam mangga	Anacardiaceae	Mangifera	Various places
Asam	Asam pau	Anacardiaceae	Mangifera	Various places
Asam	Asam mawang	Anacardiaceae	Mangifera	Various places
Asam	Asam kemantan	Anacardiaceae	Mangifera	Ridges
Asam	Asam bubuk	Anacardiaceae	Mangifera	River banks
Asam	Asam pelam	Anacardiaceae	Mangifera	Various places
Asam	Asam raba	Anacardiaceae	Mangifera	Ridges
Bangkirai	Resak	Dipterocarpaceae	Vatica	
Bayur	Kontol bayur	Dipterocarpaceae	Shorea	Generally grows by
Benuang	Kalam	Datiscaceae	Octomeles	Wet places
Benuang	Menuang	Datiscaceae	Octomeles	Wet places
Benuang	Jabon	Datiscaceae	Octomeles	Wet places
Bintangor	Bintangor biasa	Clusiaceae	Calophyllum	
Bintangor	Bintangor tenaga	Clusiaceae	Calophyllum	
Bintangor	Bintangor batu	Clusiaceae	Calophyllum	
Bintangor	Bintangor besi	Clusiaceae	Calophyllum	
Cempaka				
Durian	Durian tongkol	Bombacaceae	Durio	White fleshed
Durian	Durian biasa	Bombacaceae	Durio	Red fleshed
Durian	Durian tekawai	Bombacaceae	Durio	Red fleshed
Geronggang	Tomal empak	Hypericaceae	Cratoxylum	Foothills
Geronggang	Tomal biasa	Hypericaceae	Cratoxylum	Slopes
Geronggang	Tomal renah	Hypericaceae	Cratoxylum	Foothills
Jelutong	Pantung	Apocynaceae	Tabernaemontana	Various places
Jelutong	Jelutong pipit	Apocynaceae		Ridges
Jelutong	Jelutong rana	Apocynaceae		
Jelutong	Jelutong kapur	Apocynaceae	Dyera	Slopes
Kapuak	Kapuak	Moraceae	Artocarpus	
Kapur	Kelansau	Dipterocarpaceae	Shorea	
Kapur	Keladan	Dipterocarpaceae	Shorea	
Kedondong	Kedondong ali	Burseraceae		Ridges
Kedondong	Kedondong batu	Burseraceae		Ridges
Kelampai	Kelampai			Various places
Kempili	Kempili padi	Fagaceae	Lithocarpus	Dry places
Kempili	Kempili balatong	Fagaceae	Lithocarpus	Dry places
Kempili	Kempili berangan	Fagaceae	Castanopsis	River banks
Kempili	Kempili bambang	Fagaceae	Lithocarpus	Dry places
Keruing	Kontoi merah	Dipterocarpaceae	Dipterocarpus	Various places
Keruing	Kontoi putia	Dipterocarpaceae	Dipterocarpus	Various places
Keruing	Kontoi kuning	Dipterocarpaceae	Dipterocarpus	Various places
Kumpang	Kumpang apl	Myristicaceae		Hill areas
Kumpang	Kumpang batu			River
Kumpang	Kumpang arang	Ebenaceae	Diospyros	Hill areas
Kumpang	Kumpang balik			Hill areas
Mahabai	Mahabai biasa	Annonaceae		River banks
Mahabai	Mahabai duri	Annonaceae		Hill areas
Mahabai	Mahabai pandai	Annonaceae		River banks
Manggris	Tapang	Fabaceae	Koompassia	
Medang	Medang penahang	Lauraceae		Various places
Medang	40 types. Main ones:			
Medang	Medang pahong	Lauraceae		Various places
Medang	Medang tekuyong	Lauraceae		Various places
Medang	Medang simat	Lauraceae		Various places
Medang	Medang putinbeliong	Lauraceae		Various places
Medang	Medang kapur	Lauraceae		Various places
Medang	Medang pawas	Lauraceae		Various places
Medang	Medang sanda	Lauraceae		Various places
Medang	Medang kala	Lauraceae	Litsea	Various places
Medang	Medang bulu	Lauraceae		Various places
Medang	Medang burung	Lauraceae		Various places
Medang	Melapi kuning	Dipterocarpaceae	Shorea	
Melapi	Melapi merah	Dipterocarpaceae	Shorea	
Melapi	Melapi putis	Dipterocarpaceae	Shorea	
Melapi	Menjalin bana	Polygalaceae ???	Xanthophyllum ???	
Menjalin	Menjalin biasa	Polygalaceae ???	Xanthophyllum ???	
Menjalin	Menjalin telor	Polygalaceae ???	Xanthophyllum ???	
Mentawa	Mentawa singa	Dipterocarpaceae	Artocarpus	Hill areas
Mentawa	Mentawa biasa	Dipterocarpaceae	Artocarpus	Hill areas
Mentawa	Mentawa asu	Dipterocarpaceae	Artocarpus	Hill areas
Meranti kuning	Omang besi	Dipterocarpaceae	Hopea	Wet areas
Meranti kuning	Kontoi seluang kuning	Dipterocarpaceae	Shorea	Large # of species
Meranti merah	Kontoi seluang merah	Dipterocarpaceae	Shorea	Large # of species
Meranti putih	Kontoi seluang putih	Dipterocarpaceae	Shorea	Large # of species
Merawan	Omang telor	Dipterocarpaceae	Hopea	Wet areas
Merawan	Kontoi engkerawan kuning	Dipterocarpaceae	Hopea	Slopes
Merawan	Omang lilin	Dipterocarpaceae	Hopea	Wet areas
Merawan	Kontoi engkerawan merah	Dipterocarpaceae	Hopea	Slopes
Merawan	Kontoi engkerawan putis	Dipterocarpaceae	Hopea	Slopes
Mersawa	Mentawa	Dipterocarpaceae	Anisoptera	
Nyatoh	Nyatoh beras	Sapotaceae		Hills
Nyatoh	Nyatoh duri	Sapotaceae		Hills
Nyatoh	Nyatoh batu	Sapotaceae		Various places
Nyatoh	Nyatoh biasa	Sapotaceae		Various places
Pulai	Pulai	Apocynaceae	Alstonia	Slope
Rambutan	Mantot	Sapindaceae	Nephelium	Slopes
Rambutan	Kedabang	Sapindaceae	Nephelium	Slopes
Rambutan	Titidahan	Sapindaceae	Nephelium	Slopes
Rambutan	Perut koli	Sapindaceae	Nephelium	Slopes
Rambutan	Peleti	Sapindaceae	Nephelium	Slopes
Rambutan	Ori	Sapindaceae	Nephelium	Slopes
Rambutan	Linang	Sapindaceae	Nephelium	Slopes
Rambutan	Sibau	Sapindaceae	Nephelium	Slopes
Rambutan	Nadap	Sapindaceae	Nephelium	Slopes
Rambutan	Sibau babi	Sapindaceae	Nephelium	Slopes
Rengas	Rengas kebaca	Anacardiaceae		Ridges
Rengas	Rengas biasa	Anacardiaceae		Ridges
Rengas	Rengas bangkap	Anacardiaceae		Banks
Resak	Resak nangka	Dipterocarpaceae	Vatica	
Resak	Resak bara	Dipterocarpaceae	Vatica	

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Resak	Resak kasa	Dipterocarpaceae	Vatica	
Resak	Resak tanduk	Dipterocarpaceae	Vatica	
Simpor	Juhing riga	Dilleniaceae	Dillenia	Wet areas
Simpor	Juhing biasa	Dilleniaceae	Dillenia	Grows on slopes
Simpor	Pahing	Dilleniaceae	Dillenia	Hill areas
Sindur	Paru paru/ Sindur	Fabaceae	Sindora	Three types
Tengkawang	Tengkawang tikus	Dipterocarpaceae	Shorea	Slopes
Tengkawang	Tengkawang tungkol	Dipterocarpaceae	Shorea	Banks
Tengkawang	Tengkawang ramai	Dipterocarpaceae	Shorea	Slopes, ridges
Tengkawang	Tengkawang bukit	Dipterocarpaceae	Shorea	Slopes, ridges
Ubah	Ubah ganga	Myrtaceae	Eugenia	Slopes and ridges
Ubah	Ubah belompin	Myrtaceae	Eugenia	Slopes and ridges
Ubah	Ubah bungkang	Myrtaceae	Eugenia	Ridges
Ubah	Ubah rangkai	Myrtaceae	Eugenia	Ridge tops
Ubah	Samak puduk	Myrtaceae	Eugenia	Ridges and slopes
Ubah	Ubah ranah	Myrtaceae	Eugenia	Wet places
Ubah	Ubah ubai	Myrtaceae	Eugenia	River banks

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Table 5: Some local uses of plants

Akar emprenit
Rosaceae
Wild raspberry. Young leaves/ buds used as medicine for sick stomach; berries eaten in field

Bayur
Burseraceae Dacryodes
Wood used for boards and joints (pacal)

Berangan kukuelong
Fagaceae Castanopsis
Good for boat building if ulin and meranti are not available; fruits eaten domestically <3>

Brangkasi lapis
Sapindaceae Lepisanthes
Spring traps; fruits eaten in field

Buhu
Palmae
Heart of palm eaten; leaves used as leaf shingle

Durian tongkoi/mahoa
Bombacaceae Durio
Fruit edible. THIS IS AN IMPORTANT SPECIES

Juhing riga
Dilleniaceae Dillenia
Living fences; pondoks

Kapok
Bombacaceae Cieba
Introduced. Planted for stuffing material. Tree sown near houses. Can sell for Rp 1500 /kg

Kapuak pihang
Moraceae Artocarpus
Fruits edible

Kayu bansolam
???
Living fence; can be eaten but fruits are sour

Kayu majik
???
Very strong wood used for support poles (doesn't get much bigger than 30 cm dbh) - apparently resistant to wood borers and easily tolerates wet conditions. I think this tree merits further investigation

Kemantan
Anacardiaceae Mangifera
Fruits eaten, sweeter than mawang. Seeds planted in ladang. Wood good for boards - Rp 250/ m <4>

Kemenyang
Fabaceae Pithocellobium
Fruits and leaves good for eating - can be sold for Rp 500 /gantang. Very pungent, like petai. "Industrious" people plant 2-3 trees, generally enough for 10 families or so. Five years from seeding to fruiting. Outdoes alang-alang (reported) <5-6>

Kontoi lelapi
Dipterocarpaceae Shorea
Bark very important for wall material. Timber important for structural support

Kopi
Rubiaceae Lasianthus
Local coffee, grown in kebuns <7>

Kumpang balik

Linang
Sapindaceae Nephelium
Rambutan type fruit. THIS SPECIES IS CONSIDERED VERY IMPORTANT. Planted in old ladang areas for future

Linang
Sapindaceae Nephelium
Rambutan type fruits. Probably the most important fruit for most families. Fruits sold for Rp 500/ gantang <9-10>

Mahabai
Annonaceae Various
Good for rope, which is made from bark

Manggris ???
Fabaceae Koompassia
Seeds eaten, said to be good for infant disorders, especially to the stomach. Tree searched for honey nests too

Manyam
Euphorbiaceae Glochidion
Used for making household tools

Maraung/ Katot
Theaceae(?)
Used for poles and sticks if near pondok - of limited use

Mawang
Anacardiaceae Mangifera
Fruits eaten. Seeds planted in ladang. Wood good for board - Rp 250/ m <4>

Mbak berok
Euphorbiaceae Baccaurea
Fruits eaten. Not as important as Mbak kapur

Mbak empahong
Euphorbiaceae Baccaurea
Fruits eaten. Not as important as Mbak kapur

Mbak engcharia
Euphorbiaceae Baccaurea
Fruits eaten. Not as important as Mbak kapur

Mbak kapur
Euphorbiaceae Baccaurea
Fruits heavily sought after. One gantang (tin) can be sold for Rp 500, and one tree will produce up to 50 gantang per year. Planted in ladang, 5-6 years to fruiting <3-4>

Mbak selentik
Euphorbiaceae Baccaurea
Fruits eaten. Not as important as Mbak kapur

Medang bulu
Lauraceae
Used for house tiles - second only to ulin for this purpose

Medang kala
Lauraceae Litsea
Fruits eaten; wood for boards. Planted in ladang. FAST GROWING AND SEEDS HAVE A HIGH SURVIVAL RATE, but does prefer wet areas such as by rivers <5-6 on account of fruits>

Medang simat
Lauraceae

Mentawa leucine
Moraceae Artocarpus
Very important for rope from bark; fruits are eaten, said to be very good; trunk can be hollowed to make a rice holder or sapeh (local instrument analogous to a guitar)

Nadap/ nadam
Sapindaceae Nephelium
Rambutan type fruits. Trees said to yield up to 200 kg each, probably a very rough estimate. Families will plant 2-3 in each ladang, and during ladang clearance this species will be not be cut. Fruits sold for Rp 500/ gantang <6>

Ngingur
Actinidiaceae Saurauia
Living fence (just cut a stick, put it in the ground and it quickly roots and grows); fruits edible but important

Pangil
Verbenaceae Clerodendron
Ash put on leaves and rub on a pregnant woman's body to reduce heat and dry her skin. Widely planted near houses

Pantung
Apocynaceae Tabernaemontana
Used for latex extraction for rubber like its relative, jelutong and pulai. Rubber sells for Rp 900 /kg if a transport source is available. Wood is good quality but is generally not cut because of the value of the latex <9 - where used>

Pohon maja
Dipterocarpaceae Shorea
Good dammar producer. Sells for Rp 900 /kg. Not sought too often now

Sampak kuar
Annonaceae Goniothalamus
Medicine for bad stomach; pregnant woman use it to reduce heat, and to reduce post-natal swelling

Sampok
Burseraceae Canarium
Fruit heavily sought in forest, said to be sweet and tasty; fruits sold for Rp 500/ kg; wood hard

Sintuk
Lauraceae Cinnamomum
Important body tonic and general "pick-me-up" - roots used. Species numerous

Tekala
Zingiberaceae
Medicine for sick stomach; stems used for ladang pondoks; stems fruits and flowers eaten. Said to be used every day <10>

Tekawai
Bombacaceae Durio
Most popular durian in region. Fruits ripen after "normal" durian, not as pungent. Lives 20 years, but can be grafted to better stock. Fruits keeps for 7-10 days (durian 3-4!). Sold for Rp 500 /fruit <8>

Temau
Hypericaceae Cratoxylum
Shingles (sirap) for boats - sold for Rp 35,000/ 1000 tiles and said to be better than Ulin for tiling boats; boards - said to be better than meranti (Shorea); general furniture - the villages take two trees per year

Timau beras
Moraceae Ficus
Red geocarpic (grow from long "ropes" from the trunk on or slightly under the soil) fruits, popular as asam with all sorts of dishes, including rojak; fruits sometimes eaten fresh in the field - sweet tasting; leaves used as a fertilizer <3>

Timau bunsi
Moraceae Ficus
Red geocarpic (grow from long "ropes" from the trunk on or slightly under the soil) fruits, popular as asam with all sorts of dishes; fruits sometimes eaten fresh in the field - sweet tasting; leaves used as a fertilizer <2>

Timau pak
Moraceae Ficus
Red geocarpic (grow from long "ropes" from the trunk on or slightly under the soil) fruits, not good for eating as are its relatives

Ubah
Myrtaceae Eugenia
Wood used for boards; poles

Ulin
Lauraceae Eusideroxylon
The most favored wood of all for toughness, durability and aesthetic quality <10+>

Umbin
Euphorbiaceae Baccaurea
Fruits eaten. Superficially, looks like a red star fruits. Planted in ladang, 5-6 years to fruiting. Fruits can be sold for Rp 500/ gantang <3>

* In the uses and comments column, numbers in angled brackets (i.e. <2>) are informants ratings of importance on a 1-10 scale where 1 represents almost no use and 10 represents a vitally important species. Please see table 4 for other names, species not necessarily encountered during this survey, but for which information was collected

Table 6: Local uses of timber trees

Tumbang Tebarau

Purpose	Species	Use	dbh	Total
Already in place or planned				
House building	Ulin	Shingle, boards	>80 cm	19
	Meranti	Boards	>80 cm	38
Boat building	Various	Boards/ dugout	>50 cm	30
Yearly requirements				
House maintenance	Ulin		>80 cm	5
	Meranti		>80 cm	11
Boat maintenance	Various		>50 cm	10
Ladang	Melapi	Bark wall	<50 cm	20
	Ulin	Planting poles	< 5 cm	24

Riam Batang

Already in place or planned				
House building	Ulin	Shingle, boards	>80 cm	56
	Meranti	Boards	>80 cm	196
Boat building	Various	Boards/ dugout	>50 cm	45
Yearly requirements				
House maintenance	Ulin		>80 cm	12
	Meranti		>80 cm	50
Boat maintenance	Various		>50 cm	30
Ladang	Melapi	Bark wall	<50 cm	30
	Ulin	Planting poles	< 5 cm	60

APPENDIX I - HERBARIUM DEVELOPMENT

Herbarium Requirements in West Kalimantan

Background:

A herbarium is a collection of pressed and mounted plant specimens. When available with good field data, a herbarium is analogous to a reference library. Herbaria are staffed largely by taxonomists, who are consulted by foresters, ecologists, agriculturalists, students - anyone with an interest in some aspects of plants such as survey of what grows where, levels of diversity for impact assessments, and relationships among species.

West Kalimantan has vast floral diversity, a lot of which is unknown. Until herbarium collections are taken and made accessible to the area's potential user community, little headway can be made in training staff such as local foresters and biologists in the local biodiversity. This point is not academic. For example, timber harvesting is done with identification made to rough groups. These groups are compilations of species. Many of the species are unknown (as is 30% of the flora of Kalimantan in general). Of those that are known, almost no data are available on their ecological requirements. Until identifications are made and requirements understood, selection of trees to be left for regeneration in production forest cannot be made on a sound basis. The baseline data necessary for this sort of a problem can only be found in a herbarium.

Additionally, West Kalimantan has a lack of manpower presently able to use and sustain such a collection. What is needed is a training program in botany and the ability to use taxonomic information as well as a herbarium. These topics were discussed at the Department of Forestry at Universiti Tanjungpura (UNTAN), Pontianak, a logical site for herbarium and educational development.

UNTAN:
The department of forestry at UNTAN has junior and senior faculty, who teach approximately 500 undergraduates. Despite the interest of the students in forestry, and the importance of the industry to the area, they have no access to a herbarium or basic texts. There is no expertise in botany in the department. Teaching of identification is to a few families based on vegetative characters, which is of little value in many plant families and useless in others. Theoretical aspects of botany, such as functional structure, is taught as a class in the department of agriculture. No-one is teaching/ being taught how to use botanical keys. The end-result is that there are no staff in the Department of Forestry at UNTAN who can reliably identify a tree, who knows how to, or is

able to, access the relevant literature. There are no resources available locally to confirm identifications for other researchers such as silviculturalists, who require reliably identified material to be able to accurately report their results.

Discussions at UNTAN concerning herbaria and staff and student training requirements highlighted the following priorities:

1 To set-up a reference herbarium at UNTAN into which all researchers in the area will be requested to deposit voucher (reference) collections of collected material.
2 To develop basic botanical ability at the Department of Forestry, UNTAN, at the undergraduate and faculty levels.
3 To ensure that botanical training is made available to the user community at UNTAN, and to aid development of parataxonomic skills within interested institutions such as the Department of Forestry and commercial concerns.

A possible strategy to implement these points would be:

1 A herbarium should be built adjacent the Department of Forestry offices. The first collections to be installed would be those from the NRMP botanical reference survey at PT. S.B.K. and Bukit Baka - Bukit Raya National Park.
2 Funds would be sought to enable selected junior and senior staff from UNTAN to go to Herbarium Bogoriense to undertake a short course on herbarium management. These same staff will receive instruction in identification techniques using both the herbarium and the Kebun Raya (botanical gardens) of Bogor.
3 The same staff will photocopy copious amounts of relevant literature to stock the herbarium at UNTAN.
4 Upon their return the staff, along with a short-term instructor, will pass on skills to junior faculty and develop undergraduate training programs in botanical identification and its relevance to forestry. These classes could be extended to staff from institutions such as PHPA and the Department of Forestry.

The outputs of this exercise would be:

1 A reference herbarium available to staff, researchers and students both inside and outside UNTAN
2 UNTAN staff trained in basic botany and able to use this knowledge in other applied fields
3 Enhanced undergraduate training in the Department of Forestry, UNTAN.
4 A supply of reference material and manpower available to the user community

NRM/ARD CONSULTANCY REPORTS

NO.	TITLE	AUTHOR
1.	Procurement Plan For Research Equipment at Bukit Baka and Equipment Installation at Samarinda Forestry Research Station	Roy Voss
2.	Agroforestry in Bukit Baka/ Bukit Raya	W.G. Granert
3.	Pengukuran dan Pemetaan Topografi Sebagian Daerah Taman Nasional Bukit Baka/Bukit Raya	Sahri Denny, cs
4.	Applied Research Recommendations for Production Forest Management An Economic and Ecological Review of the Indonesian Selective Cutting and Replanting System (TPTI)	Lisa Curran & Monica Kusneti
5.	Balancing Forest and Marine Conservation with Local Livelihoods in Kalimantan and North Sulawesi	Jill M. Belsky
6.	Proposal to the GOI and USAID for the Development of Comprehensive Environmental and Natural Resources Accounts (CENRA) for Economic Planning and Management	Henry Peskin & Joy Hecht
7.	Bukit Baka Mini–Hydraulic System Implementation Plan	Michael Johnson
8.	Final Report: Bukit Baka – Bukit Raya 1992	Roy Voss
	Station Protocol: Bukit Baka – Bukit Raya 1992	Roy Voss
	Research Protocol: Bukit Baka – Bukit Raya 1992	Roy Voss

NO.	TITLE	AUTHOR
9.	Environmental Education and Awareness in Bukit Baka (vol.1)	Nancy Bergau
	Environmental Education and Awareness in Bukit Baka Guide to Environment and Fire Campaign (vol.2)	Nancy Bergau
10.	Recommendations for Controlled Timber Harvesting in the SBK Forest Concession	John Hendrison