MoreLKS: Manual for a Computer Programme on Cameroonian Lesser-Known Timbers and End-Use Requirements

M.A. Zijp
J.E. Polman
T. Tongo Bokam
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MoreLKS: MANUAL FOR A COMPUTER PROGRAMME 
ON CAMEROONIAN LESSER-KNOWN TIMBERS 
AND END-USE REQUIREMENTS 

M.A. Zijp, J.E. Polman and T. Tongo Bokam 

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Programme version 2.01 k 

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ABSTRACT


MoreLKS, version 2.01 k, is a computer model for assessing the suitability of tropical timbers for major end-uses on the European and Cameroonian markets. It allows a comparison of various Cameroonian lesser-known species with many other timbers. The manual provides a detailed description on how to use the model.

Key words: lesser-known timbers, timber quality, Cameroon

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FOREWORD

About Tropenbos
The Tropenbos Foundation was established in 1988 by the Government of the Netherlands with the objective to contribute to the conservation and wise use of tropical rain forests by generating knowledge and developing methodologies, and to involve and strengthen local research institutions and capacity in relation to tropical rain forests.

The Tropenbos Programme carries out research on moist tropical forest land at various locations around the world. At present (semi-) permanent research sites are located in Colombia, Guyana, Indonesia, Côte d'Ivoire and Cameroon. At the different locations, research programmes follow an interdisciplinary and common overall approach, with the aim to exchange data and make results mutually comparable.

About the Tropenbos-Cameroon Programme and ITTO Project PD 26/92
The present publication has been produced in the framework of ITTO Project PD 26/92, which is an integral part of the Tropenbos-Cameroon Programme (TCP). The Tropenbos-Cameroon Programme was established in 1992 by the Cameroonian Ministry of Environment and Forests (MINEF) and the Tropenbos Foundation.

The general objective of TCP is to develop methods and strategies for natural forest management directed at sustainable production of timber and other forest products and services. These methods have to be ecologically sound, socially acceptable and economically viable. TCP consists of fourteen interrelated projects in the fields of ecology, forestry, wood science, economy, social sciences, agronomy and soil science (for a description of these projects, see Foahom & Jonkers, 1992. A programme for Tropenbos research in Cameroon. The Tropenbos Foundation, Wageningen, the Netherlands).

In 1994, ITTO and CfC decided to co-finance six of these projects, which together form ITTO project PD 26/92. The 'Office National de Développement des Forêts' (ONADEF) is the agency responsible towards ITTO and CfC for the implementation of the Project PD 26/92. The research on which this publication is based, was financed by the International Tropical Timber Organization (ITTO), the Tropenbos Foundation and the implementing agencies Wageningen Agricultural University (WAU) and ONADEF. ITTO provided by far the largest financial contribution.

About the present study
The MoreLKS software programme used in the present study is based on an earlier version of the same programme, developed by an earlier ITTO project (project PD 18/78). The program was expanded by adding 30 lesser-known timbers from Cameroon and a number of end-uses relevant for the Cameroonian local market. The revised programme permits the user, who seeks suitable timber for a specific application, to compare the qualities of Cameroonian lesser-known timbers with a wide range of other timbers.
The software has its limitations, however. Only common applications are included in the database, and if the information on a species is incomplete, MoreLKS may rank the species wrongly as unsuitable because a certain essential quality is unknown, and therefore assumed to be very poor. The programme has been devised in such a way, that the last limitation can be reduced in the future, when more information becomes available. New data can be added, and it is also possible to add other species.

The revised MoreLKS programme was designed to provide the Cameroonian timber sector with a powerful tool to promote timbers, which are presently difficult to sell. If such promotion is successful, the sector can broaden the range of species harvested. This would help Cameroon not only in making a fuller use of its timber resources, but also in achieving sustainable forest management. Sustainable forest management can only be accomplished if sufficient trees of each timber species are preserved for future yields. This becomes easier when more species are marketable.

Dr W.B.J. Jonkers
Scientific Coordinator
Tropenbos-Cameroon Programme
INTRODUCTION

This manual describes the use of a computer model for assessing the suitability of tropical timbers for a variety of end-uses. The model is a modification of the MoreLKS model, prepared in the framework of ITTO project PD 18/87 rev. 1(1). This version was produced in the framework of ITTO project PD 26/92 rev. 2, which in its turn is an integrated part of the Tropenbos-Cameroon Programme.

The computer program was adapted especially for Cameroon and includes, besides the species incorporated in the original model, 30 common lesser-known Cameroonian timbers. The model is a tool for Cameroon to promote its timbers on the national and international markets. It is also used by the Tropenbos Cameroon Programme to predict which species may become marketable in the future, and therefore should be considered as such in forest management and silvicultural studies.

MoreLKS is the abbreviation of Matching Of Requirements of End-uses with Lesser-known Species (LKS), a software program written for IBM-compatible computers. The program shows the applicability of a timber for five major end-uses in western Europe and some end-uses for the local market in Cameroon, based on a number of technological properties. This is the user’s manual for that program. Although this manual is in English, it is possible to select the French language in the computer program. This will make it easier for French oriented users to benefit from the program.

The system is based on the principle of screening a number of material-specific properties of timber against formulated end-use criteria, on two different quality levels: the preferable and the minimum level. The result of a screening will be expressed by the classification "acceptable" or "non-acceptable" for one of the two levels and furthermore by expressing the degree of suitability for the relevant specific end-use, based on the qualitative potential of a wood species. These parameters result in a final outcome concerning the suitability or non-suitability of a timber species for one of the specific end-uses involved.

The programme allows adjustments and enlargement of the database. New data and new species can easily be entered. The programme also allows comparison with other timber species, as data on more than 200 tropical timbers are provided.

Acknowledgements

We thank the International Tropical Timber Organization and the Tropenbos Foundation for funding the development of the programme and the publication of this manual. Furthermore, we would like to thank the Prospect-team from Oxford Forestry Institute for making information available. Also we thank the CIRAD-Forêt for supplying data to the original database. End-use requirements for western European end-uses have been made available by Mr P.B. Laming. Last but not least we would like to thank Dr W.B.J. Jonkers for his critical review of this document.
HOW TO USE THE MANUAL

This manual for the MoreLKS programme is divided into five sections.

Where to find what:
  To get an overview of the programme and project:
    ▶ consult the "OVERVIEW" section.
  For installation and use of the programme:
    ▶ consult the "USER's GUIDE" section.
  Searching for a word:
    ▶ consult the "INDEX" section.
  Information on properties and end-uses:
    ▶ consult the "PROPERTIES AND END-USES" section
  Look up menus:
    ▶ consult the "REFERENCE GUIDE" section
  Is a species present?:
    ▶ consult APPENDIX B, C or D.

Conventions used:

In this manual the keys on your keyboard are shown in uppercase. (for instance: RETURN, PGUP or SHIFT). Text to be typed by you is indicated by another font: like this.
OVERVIEW

This section provides information on the potential use of the program and why it was made. A short step-by-step training is included.

Why the MoreLKS programme was developed

MoreLKS was developed to provide information on the potential marketability of timber species which are not or seldom used at present. This information can be used in estimating the economic value of the forest, and in preparing a list of species which are likely to contribute to future harvests. The project also has an important commercial application, that is, it will facilitate the promotion of lesser-known timbers on the local and international markets.

There are several hundreds of Cameroonian tree species which are not or seldom harvested in commercial timber exploitation, but which qualify for introduction on the national or international timber market (see Samgba Ahanda, 1991; Erfurth and Rushe, 1976). The use of such lesser-known timber species from Cameroonian rain forest is considered desirable because:

- it leads to an increase in economic value of the forest, and may therefore stimulate management aimed at sustained timber production;
- the present logging intensity in Cameroon is low and can presumably be somewhat increased if more species are used, without jeopardizing the functioning of the ecosystem;
- an increase in yield per hectare reduces costs of logging and silvicultural operations per unit product;
- diversification of timber production may lead to reduced exploitation pressure on highly valued timber species, to prevent that these species become rare or extinct and to allow the retention of good-quality trees for silvicultural or forest management purposes.

Harvesting more species implies that a market should be found for these species, and that these timbers should meet the requirements of timber consumers. These requirements cannot be generalized; they differ per end-use and also depend on local conditions (e.g. climate). It is therefore important that the suitability of tree species for specific end-uses is known, and the present study is to gather such information.

Selection of timbers used in the consuming countries is, besides price, availability, practical influence and fashion, usually based on their specific technological and physical properties.

These required properties are dictated by the intended end-uses. Marketing of timber by the producing countries would be helped enormously if producers were aware of specific end-use markets so that they could offer their products with a fair chance of success.
To date all efforts to promote the utilization of lesser-known and lesser-used species have been made with what could be offered at the production end in mind. Most of these efforts have not been very successful for various reasons.

More success could be expected if the approaches were based on the demand for specific properties for each defined end-use. This has been shown recently for the introduction of some species from Malaysia into the western European market. Therefore, the most important end-uses for western Europe have been analyzed and made available for practical use through this programme for exporters and other interested parties.

**Cameroonian lesser-known species added**

Thirty timber species and their properties were added to the existing MoreLKS database. These species were selected as follows:

- first, results of the national forest inventory and other surveys in Cameroon were studied to prepare a list of all timber species and their abundance. In case only vernacular names were used in the inventory, the botanical identity was verified;
- From this list, commercially well accepted species and other species already in the MoreLKS database or the Dutch practical timber guide were deleted;
- species which generally do not grow to timber size or which have other disqualifying features were also deleted, and so were a few species which are very important for the local population as source of non-timber products;
- from the remaining list, thirty species were chosen to be added to the database on the basis of available information on timber properties and common occurrence in Cameroon.

This procedure resulted in the following list (see next page):
<table>
<thead>
<tr>
<th>Trade name</th>
<th>Botanical name</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angloayeme</td>
<td>Albizia zygia</td>
<td>Mimosaceae</td>
</tr>
<tr>
<td>Saliyemo</td>
<td>Albizia adianthifolia</td>
<td>Mimosaceae</td>
</tr>
<tr>
<td>Aningre</td>
<td>Aningeria spp.</td>
<td>Sapotaceae</td>
</tr>
<tr>
<td>Akoung ele</td>
<td>Anthonotha cladantha (Macrolobium cladanthum)</td>
<td>Leguminosaceae</td>
</tr>
<tr>
<td>Awonog</td>
<td>Blighia welwitschii</td>
<td>Sapindaceae</td>
</tr>
<tr>
<td>Nom tonso</td>
<td>Cleistanthus polystachyus</td>
<td>Euphorbiaceae</td>
</tr>
<tr>
<td>Avom</td>
<td>Cleistopholis patens</td>
<td>Annonaceae</td>
</tr>
<tr>
<td>Ebe</td>
<td>Cordia platythyrsa</td>
<td>Boraginaceae</td>
</tr>
<tr>
<td>Nganga</td>
<td>Cynometra hankei</td>
<td>Caesalpiniaceae</td>
</tr>
<tr>
<td>Omang</td>
<td>Desbordesia glaucescens</td>
<td>Irvingiaceae</td>
</tr>
<tr>
<td>Eyoum P</td>
<td>Dialium dinklagei</td>
<td>Caesalpiniaceae</td>
</tr>
<tr>
<td>Eyoum G</td>
<td>Dialium spp.</td>
<td>Caesalpiniaceae</td>
</tr>
<tr>
<td>Moambe jaune</td>
<td>Enantia chlorantha</td>
<td>Annonaceae</td>
</tr>
<tr>
<td>Landa</td>
<td>Erythroxylum mannii</td>
<td>Erythroxylaceae</td>
</tr>
<tr>
<td>Mutondo</td>
<td>Funtumia africana</td>
<td>Apocynaceae</td>
</tr>
<tr>
<td>Mvanda</td>
<td>Hylodendron gabunense</td>
<td>Caesalpiniaceae</td>
</tr>
<tr>
<td>Andok ngoe</td>
<td>Irvingia grandifolia</td>
<td>Irvingiaceae</td>
</tr>
<tr>
<td>Abip ele</td>
<td>Keayodendron bridelioides</td>
<td>Euphorbiaceae</td>
</tr>
<tr>
<td>Kumbi</td>
<td>Lannea welwitschii</td>
<td>Anacardiaceae</td>
</tr>
<tr>
<td>Dibetou</td>
<td>Lovoa swynnetonii, L.trichilioides</td>
<td>Meliaceae</td>
</tr>
<tr>
<td>Oboto</td>
<td>Mammea africana</td>
<td>Clusiaceae</td>
</tr>
<tr>
<td>Bete</td>
<td>Mansonia altissima</td>
<td>Sterculiaceae</td>
</tr>
<tr>
<td>Assila omang</td>
<td>Maranthes inermis</td>
<td>Chrysobalanaceae</td>
</tr>
<tr>
<td>Zingana</td>
<td>Microberlinia bisuculata</td>
<td>Caesalpiniaceae</td>
</tr>
<tr>
<td>Bahia</td>
<td>Mitragyna (Hallea) ciliata</td>
<td>Rubiaceae</td>
</tr>
<tr>
<td>Nom atui</td>
<td>Newtonia spp.</td>
<td>Mimosaceae</td>
</tr>
<tr>
<td>Ozek</td>
<td>Odyendyea gabonesis</td>
<td>Simaroubaceae</td>
</tr>
<tr>
<td>Ebai bekwe</td>
<td>Pentaclethra eetveldeana</td>
<td>Mimosaceae</td>
</tr>
<tr>
<td>Sikon</td>
<td>Pyteleopsis hylodendron</td>
<td>Combretaceae</td>
</tr>
<tr>
<td>Ebebeng</td>
<td>Margaritaria discoidea (= Phyllanthus discoideus)</td>
<td>Euphorbiaceae</td>
</tr>
</tbody>
</table>

Unfortunately, the available information on timber properties of these 30 species is not always complete. As MoreLKS rated the absence of information as negative, a species may wrongly be rated as not suitable for some end-uses.
HARDWARE REQUIREMENTS

Introduction
The computer programme was intended to be used on low-end PCs. It is possible to run the programme without any problems on PCs from the last ten years. In order to use this programme you should have:

- An IBM-compatible computer with a hard disk (PC, XT, AT, PS/2 or true compatible) with 640 K RAM internal memory.
- The MS-DOS or PC-DOS operating system (version 2 or later).
- Floppies to make a back-up of both data and programme.

What may also be used
- A graphic display (preferably with a colour monitor)
- Printer

It is possible to run this programme on computers equipped with Microsoft Windows 3.1 and Windows 95/98, using a DOS-application box.

The programme will not operate properly on 256 Kb machines but these can be considered as being outdated.
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A QUICK TOUR AROUND

Introduction
This chapter will demonstrate what the output of this programme will be and what you need to do. First, you should have installed the programme on your computer. If this has not yet been done, then please do so now. We will -as an example- test the suitability of Teak (*Tectona grandis*) for windows and doors.

Start the programme
After switching on the computer and waiting for the prompt, select the proper directory, type MoreLKS and press RETURN. The programme shows a starting screen and, after pressing RETURN, will load information.

Select a database file
You will then be prompted to choose one of the existing files which contain information on the properties of timber species. Please select the ALL file from the files listed (using the ARROW keys and press RETURN). After the file is loaded, the main menu appears.

The main menu
Now, let’s see what the properties are for a species of -for instance - Teak (*Tectona grandis*). To do this we should go to the database section. Select the option "Change the properties Database" (with ARROW) and press RETURN. We are now in the Database section of the programme.

Database menu
We will now go to the option "View wood species" and select it by pressing RETURN.

View a timber species
On the screen we can see the species included in this data file. One of them is *Tectona grandis*. Select this species (by moving with the ARROW and pressing RETURN). If you wish, more species can be selected. The selected species are highlighted. Leave this menu by pressing F10.

Properties of *Tectona grandis*
On the screen you will see the properties of *Tectona grandis* (as far as these are necessary for the end-uses we have prepared). Press ESC to leave this screen and to go back to the Database menu or press F10 if more species were selected.

Suitability for the selected end-uses
To see whether a certain timber is suitable for one of the selected end-uses we need to go back to the Main menu. We can do this: select the option "Quit database manager" and press RETURN. The programme will display the main menu seen previously. Now select the option "Select and match properties with requirements" (by moving the ARROW) and press RETURN.
Selection menu
Please select the first option (the "Choose selection" option), which is already highlighted, and press RETURN.

Select species
Move from the species listed to Tectona grandis using the ARROW and select this species by pressing RETURN. If you wish, more species can be selected. The selected species are highlighted. Leave this menu by pressing F10.

Select end-uses
Here you can choose between the various end-uses. Please select windows and doors, by moving the ARROW and pressing RETURN to select. Leave this menu by pressing F10.

The evaluation display
The programme will now display the suitability of the first selected species for the first selected end-use. In this case the programme will show the suitability of Tectona grandis for doors. You can press F1 for help (use PGDN and PGUP to move through the help text and press ESC to leave help). Press RETURN to find out the suitability of the next selected end-use (in this example: doors), based on the end-use requirements and the properties of the timber.

The meaning of the evaluation display
The properties of the selected timber are compared with the end-use requirements of the selected end-use. This is done at two levels of acceptance: a preferable and (if the species does not meet all requirements) a minimum level.

The bars shown on the screen are the result of the comparison. Depending on your computer, you will see coloured or pattern-filled bars. The key for the colours and patterns are displayed at the bottom of the screen. The number above the bar indicates the property number (numbers and properties are shown by pressing F1). When a property does not meet the requirements for the current end-use, it will be displayed on the right of the screen under the heading "Properties not sufficient". Under the evaluation of the properties you will see three boxes which give the result of the screening.

The boxes
The first box (Result) shows the result of the screening. It has three possible outcomes:

- Meets requirements at the preferable level
- Meets requirements at the minimum level
- Does not meet requirements

The second box (Hint) gives an indication by a total add-up of a point system which takes into account the relevant properties for the selected end-use.

The third box (Practical evaluation) displays the overall result by taking the previous boxes into account.
The practical evaluation:
*Tectona grandis* is a "good species" for windows because:
  it "meets minimum requirements" (Result) and "might be very suitable" (Hint)

*Tectona grandis* is a "fairly good species" for doors because:
  it "meets minimum requirements" (Result) and "might be suitable" (Hint)

**How to leave the programme**
Keep pressing ESC until you reach the main menu.
Select the option "QUIT programme" and press RETURN twice.
USER's GUIDE

What is to be found
You can find the procedure you should follow to install the programme and prepare it for use.

There is a chapter on the help system, one on the menu system, one on entering timber species, one on the screening process and one on the set-up and utilities part of the programme.
Installation and set-up

Introduction
This chapter allows you to install the programme from the floppy disk onto your hard disk and prepare the programme for use.

Start the computer
Switch the computer on and wait until the prompt is displayed.

Make back-up of disk
You are advised to make back-up copies of the original programme disk before you use the programme. Keep the original disk in a safe place.
You can use the DOS command DISKCOPY to make a back-up of the programme.

Installing the programme onto your hard disk
To install the programme onto your hard disk:
-1 insert the floppy with the programme into disk drive A and close the drive door
-2 type A: and press RETURN
-3 type INSTALL and press RETURN

The programme will be copied onto a sub-directory MORELKS on your hard disk (if available). Also, a so-called batch file will be copied onto the root of your hard disk.

If you wish to install the programme onto another drive or directory, you should use the DOS-command COPY to copy all the programme files onto the drive and directory of your choice.

Set-up of programme
Depending on the graphic card of your computer the programme will use a black and white display (Hercules, CGA, EGA) or colour (VGA). In the set-up of the programme you can alter the settings. Screen colours can also be altered to your own liking.
Help system

Introduction
This chapter describes the help system and how to use it.

Context sensitive help
This programme will display context sensitive help in most cases. This means that you will obtain information on the particular part of the programme you are currently using. You will obtain information about the choices you can make and/or the keys which have a particular function.

Pressing F1 (the first function key on your keyboard) will display the help if available.

In many cases, the help information will be concise. However, the amount of information sometimes exceeds the space on the screen. In that case, you may move the cursor with the ARROW or PGDN to reach the extra information.

General help
The main menu offers the option "How to use the programme". This option can be used to obtain more general information (not context sensitive).

Keys in effect
F1 Will display context sensitive help if available.
ESC Leaves the help screen.
ARROW Moves the cursor.
HOME Moves the cursor to the beginning of the help text.
END Moves the cursor to the end of the help text.
PGUP Moves the cursor to the previous page of the help text (if available).
PGDN Moves the cursor to the next page of the help text (if available).
F5 Enlarges the help text to full screen (or back to the original size).
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Menu system

Introduction
This chapter will help you to become familiar with the menu system and what to do with the menus.

The two menu types
There are two different menu types: single selection and multiple selection. Single selection offers the possibility of selecting only one of the listed items. The main menu is an example of such a menu. Multiple selection makes it possible to select more than one of the listed items. The "Select the species" menu is an example of this.

Keys in effect

Move the cursor:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARROW UP</td>
<td>Moves the cursor one item up.</td>
</tr>
<tr>
<td>ARROW DOWN</td>
<td>Moves the cursor one item down.</td>
</tr>
<tr>
<td>HOME</td>
<td>Moves the cursor to the beginning of the item list.</td>
</tr>
<tr>
<td>END</td>
<td>Moves the cursor to the end of the item list.</td>
</tr>
<tr>
<td>PGUP</td>
<td>Moves the cursor to the previous page of the item list (if available).</td>
</tr>
<tr>
<td>PGDN</td>
<td>Moves the cursor to the next page of the item list (if available).</td>
</tr>
</tbody>
</table>

Select or deselect an item:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETURN</td>
<td>Selects the item.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Selects the item.</td>
</tr>
<tr>
<td>Alpha num. keys</td>
<td>Selects first item starting with that character ¹.</td>
</tr>
</tbody>
</table>

Leave the menu:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F10</td>
<td>Accept choice(s) made.</td>
</tr>
<tr>
<td>ESC</td>
<td>Cancel the current menu without accepting any choice.</td>
</tr>
</tbody>
</table>

Get help:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Will display a help text.</td>
</tr>
</tbody>
</table>

¹ This will not work in the menu for selecting species or uses.
Entering species

Introduction
This chapter describes how to include new species in the programme.

Active database file
Species in the selected data file can always be viewed, added or deleted. You can change the active database file using the "Make or Use other database file" option in the database menu. You will be prompted to select the file to be loaded. We suggest strongly that you do not add species to the existing files but make some species files of your own.

It is possible to modify properties of species but not of the species provided. If you wish to alter the properties of the species provided, you cannot do it straight away. You can make a copy of the information provided by viewing a species and then - possibly after selecting your new file- use the option "Use old values". The changes can then be made permanent.

Filling in the properties
To enter a new species:
- Type the botanical name of the species and press RETURN. It is possible to use the ALT key in combination with the digits on the numerical key path to get special characters such as ¥, á, ñ, ã, ã, ç, â, Ç, ë, etc. During the screening process, however, these characters might not be visible on the screen when in graphical mode on some graphical cards.
- If you wish, you can enter the source and the commercial name(s); you can also enter a special message concerning the wood.
- Select hardwood or softwood.
- Enter the properties by moving the cursor to the required property field and press RETURN to obtain a menu from which you can make a choice. However, there are two exceptions: the density and modulus of rupture require an ordinary number.
- The grain and the region field can accept more than one choice.

Saving the information
When the properties have been entered, the species can be saved by pressing F10. Note: if properties have not been entered, the programme will issue an error message: you should fill in these properties before saving.

Leaving the menu without saving the information
Press ESCape.
Keys in effect

Move the cursor:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAB</td>
<td>Move cursor to the next field.</td>
</tr>
<tr>
<td>ARROW UP</td>
<td>Moves the cursor one field up.</td>
</tr>
<tr>
<td>ARROW DOWN</td>
<td>Moves the cursor one field down.</td>
</tr>
<tr>
<td>HOME</td>
<td>Moves the cursor to the beginning of the screen.</td>
</tr>
<tr>
<td>END</td>
<td>Moves the cursor to the bottom of the screen.</td>
</tr>
<tr>
<td>RETURN</td>
<td>Activates a list to choose or goes to the next field.</td>
</tr>
<tr>
<td>ENTER</td>
<td>as RETURN.</td>
</tr>
</tbody>
</table>

Leave the menu:

- **F10**: Save the information.
- **ESC**: Leave the menu without saving.
- **F1**: Will display a help text, containing information on the currently active property field.

Changing species

The properties of species can be changed if the species concerned is not included in the original database. (see active database file).
Screening the species

Introduction
This chapter supplies information on the use of the selection menu.

Selecting the species and end-uses
The selection menu has three options for selecting the species and end-uses that you can screen.
- The "Choose selection" option allows you to choose from the total list with nothing pre-marked.
- The "Use or alter previous selection" option allows you to choose from the total list with the previous selection(s) pre-marked.
- The "Retrieve selection file" option allows you to load an earlier selection (previously saved) from disk. You can use this selection if you select the "Use or alter previous selection" option.

The evaluation display
Following the selection of at least one species and one end-use, the programme will display the suitability of the first selected species for the first selected end-use.

Note: This is based on the end-use requirements and on the properties of the timber, other -also important- factors are not (yet) evaluated in this programme.

The meaning of the evaluation display
The properties of the selected timber are compared with the end-use requirements of the selected end-use. This is done at two levels of acceptance: a preferable and (if the species does not meet all requirements) a minimum level. The bars, shown on the screen, are the result of the comparison. Depending on your computer and choices made in the setup menu, you will see coloured or pattern-filled bars. The key for the colours and patterns are displayed at the bottom of the screen. The number above the bar indicates the property number (numbers and properties are shown after pressing F1).

When a property does not meet the requirements it will be displayed on the right of the screen under the heading "Properties not sufficient" under the appropriate sub-heading (preferable or minimum level). Below the evaluation of the properties you will see three boxes which give the results of the screening process.

---

1 The selected species must at this time be present in the selected database file.
The boxes

The first box (Result) shows the result of the screening. It has three possible outcomes:

- Meets requirements at the preferable level
- Meets requirements at the minimum level
- Does not meet requirements

The second box (Hint) gives an indication by a total add-up of a point system which takes into account the relevant properties for the selected end-use.

The third box (Practical evaluation) displays the overall result by taking the previous boxes into account.

The properties

The properties screened for an end-use are not displayed as text, since the amount of space is too limited. Instead, a number is written on the screen denoting the corresponding property. If you wish to know the property for a certain number the following list will be helpful. (During the screening process this list is part of the context sensitive help).

<table>
<thead>
<tr>
<th>Number</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Natural durability</td>
</tr>
<tr>
<td>2</td>
<td>Density low</td>
</tr>
<tr>
<td>3</td>
<td>Density high</td>
</tr>
<tr>
<td>4</td>
<td>Modulus of rupture</td>
</tr>
<tr>
<td>5</td>
<td>Grain</td>
</tr>
<tr>
<td>6</td>
<td>Texture</td>
</tr>
<tr>
<td>7</td>
<td>Reaction wood</td>
</tr>
<tr>
<td>8</td>
<td>Shrinkage</td>
</tr>
<tr>
<td>9</td>
<td>Tendency to exude gum or resin</td>
</tr>
<tr>
<td>10</td>
<td>Tendency to corrode and stain metal</td>
</tr>
<tr>
<td>11</td>
<td>Staining of neighbouring materials</td>
</tr>
<tr>
<td>12</td>
<td>Tendency to splinter</td>
</tr>
<tr>
<td>13</td>
<td>Staining</td>
</tr>
<tr>
<td>14</td>
<td>Drying rate</td>
</tr>
<tr>
<td>15</td>
<td>Tendency to checking</td>
</tr>
<tr>
<td>16</td>
<td>Tendency to distortion</td>
</tr>
<tr>
<td>17</td>
<td>Blunting effect on tools</td>
</tr>
<tr>
<td>18</td>
<td>Machining</td>
</tr>
<tr>
<td>19</td>
<td>Nailing</td>
</tr>
<tr>
<td>20</td>
<td>Gluing</td>
</tr>
<tr>
<td>21</td>
<td>Effect of wood substances on finishing</td>
</tr>
<tr>
<td>22</td>
<td>Finishing</td>
</tr>
</tbody>
</table>

For further explanation of the properties refer to the section "Properties and End-uses".
User's Guide

Keys in effect:

General:
ESC Press ESCape to stop
BREAK stop the complete programme (a crude method).
F1 HELP: press function key 1 to get this text.

Movement through the selected species and end-uses:
HOME go to the first selected end-use and the first selected species
END go to the last selected end-use and the last selected species.
Left ARROW go to the previously selected species (with current end-use)
Right ARROW go to the next selected species
Up ARROW go to the previously selected end-use.
Down ARROW go to the next selected end-use
CTRL ARROW go six positions further in direction ARROW (so six species forwards or backwards)

Special:
TAB View or change the current species. This is a shortcut to the database part of this programme. Pressing ESCape will bring you back to the selection part. Pressing F10 will make the changes you have made permanent if allowed (See "Changing properties").

Note: If you try to reach beyond the selected range (for example before the first selected species, or after the last species) the programme will make a sound and display the currently active end-use and species.

Any other key will go to the next selected species, or -after the last species- to the next end-use with the first selected species. If this also was the last, the display will stop. (However: the keys: CAPSLOCK, CTRL, ALT, SCROLL LOCK and NUMLOCK have no effect. PRINT SCREEN will usually not work with your printer, except when you are in text mode).

Find the best case for the selection
The screening described above can be speeded up. The option "Find the most appropriate use for the selected species" will search and display the highest category of the practical evaluation. This is done for all selected species. It also gives the end-uses for that category.
System and utilities

Introduction
This chapter demonstrates how the installation and set-up menu can be used as well as the utilities menu.

Set-up and installation
In this menu you can change and save the screen-type and preferred colours. If you do not have a computer capable of displaying colours, then select the black and white option.
You can choose the graphic option: this only affects the display during the screening process.
To make presentations possible on simple laptops you can choose option Text. The display will then stay in the so-called "Text mode".

Utilities
In this menu you can copy the files with information on species. You can copy them to and from floppies using this menu. If a new version of the programme needs to be installed, you can use the option "install new version".
PROPERTIES AND END-USES

This chapter will give you extra information on the properties and the end-uses concerned.

Properties

A selection of properties relevant to the end-uses involved has been made. The data on species can be entered quite simply, choosing from predetermined classes. The properties used are described below and the classes can be found in appendix A.

Properties of the timber

General Wood Characteristics:
- Natural durability (1)
- Density (2,3)
- Modulus of rupture (4)
- Grain (5)
- Texture (6)
- Reaction Wood (7)
- Shrinkage (8)

Special Wood Characteristics:
- Tendency to exude gum or resin (9)
- Tendency to corrode and stain metal (10)
- Staining of neighbouring materials (11)
- Tendency to splinter (12)

Technological Properties:
- Staining (13)
- Drying rate (14)
- Tendency to checking (15)
- Tendency to distortion (16)
- Blunting effect on cutting tools (17)
- Machining (18)
- Nailing (19)
- Gluing (20)
- Effect of wood substances on finishing (21)
- Finishing (22)

The botanical name and region should be entered, as well as whether the timber is a hardwood or a softwood. Entering the source of information and trade names is optional.

Note: The numbers after the properties refer to the numbers shown on the screen in the reference section.
END-USE CRITERIA

Introduction
Criteria have been drawn up for the selection of timber for the mentioned end-uses. The current national requirements of the different western European countries have, if available, been taken into consideration as much as possible. Establishing criteria for end-use requirements took place in consultation with a number of institutes in the field of timber research and timber promotion. Also, some local end-use requirements have been drafted for the Cameroonian situation.

End-uses
The specific end-uses involved are:
- Windows (frames, sashes, sills etc)
- Solid panel doors (external)
- Cladding - external walls (weather boarding, bevel siding etc.)
- Solid wooden furniture parts (chair and table frames, upholstery framing, chair seats) and cabinet work (table tops, bases, legs etc.)
- Flooring for normal pedestrian traffic (less than 2000 persons per day) and flooring for heavy pedestrian traffic (more than 2000 persons per day) e.g. strip flooring, block flooring, parquetry.

The last four end-uses are also available for Cameroonian conditions.

The system
The system is based on the principle of screening a number of material-specific properties of timber against formulated end-use criteria, at two different quality levels. The result of a screening is expressed by the classification "acceptable" or "non-acceptable" for one of the two levels and furthermore by expressing the degree of suitability for the relevant specific end-use, based on the qualitative potential of a wood species. These parameters result in a final outcome concerning the suitability or non-suitability of a timber species for one of the specific end-uses involved.

The following pages consist of the criteria tables with their notes. The notes are numbered consecutively and are to be found on the following pages.

Note: The information on the following five pages has been taken from the TNO-report by P.B. Laming (1990):"SELECTION OF LESSER-KNOWN AND LESSER-USED TIMBER SPECIES FOR SPECIFIC END-USES BASED ON THE SYSTEM OF THE WOOD PROPERTY AND END-USE REQUIREMENTS", (HI 90.1066 600769504).
### Criteria for the selection of timber for the manufacture of windows (frames, sashes, sills, etc)

**TIMBER PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>PREFERABLE LEVELS</th>
<th>MINIMUM LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural durability of heartwood (1)</td>
<td>durable to very durable or moderately durable but capable to effective treatment (2)</td>
<td>perishable to non-durable but capable to effective treatment (2)</td>
</tr>
<tr>
<td>Density</td>
<td>softwood: 450 kg/m³ or more, hardwood: 500-450 kg/m³</td>
<td>softwood: 400 kg/m³ or more, hardwood: 450 kg/m³ or more</td>
</tr>
<tr>
<td>Grain</td>
<td>straight to moderately interlocked</td>
<td></td>
</tr>
<tr>
<td>Reaction wood</td>
<td>absent</td>
<td>no requirement</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>small, or medium</td>
<td>large</td>
</tr>
<tr>
<td>Tendency to erode gum or resin</td>
<td>absent after drying, slight after drying (3)</td>
<td></td>
</tr>
<tr>
<td>Tendency to corrode metals and staining in contact with metals</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Staining neighbouring materials</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Drying rate</td>
<td>rapid or moderate</td>
<td>rather slow or slow/very slow (4)</td>
</tr>
<tr>
<td>Tendency to checking during drying</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Tendency to distortion during drying</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Kneading</td>
<td>good, or satisfactory when tipped cutters are used and/or modified cutting angle</td>
<td></td>
</tr>
<tr>
<td>Blunting effect on cutting tools</td>
<td>slight to moderate, severe if tipped cutters are used</td>
<td></td>
</tr>
<tr>
<td>Gluing</td>
<td>good</td>
<td>satisfactory or good after pre-treatment or newly machined</td>
</tr>
<tr>
<td>Finishing (5)</td>
<td>good</td>
<td>satisfactory; if necessary after pre-treatment or newly machined</td>
</tr>
</tbody>
</table>

### Criteria for the selection of timber for the manufacture of solid panel doors (external)

**TIMBER PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>PREFERABLE LEVELS</th>
<th>MINIMUM LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural durability of heartwood (1)</td>
<td>durable to very durable or moderately durable but capable to effective treatment (2)</td>
<td>perishable to moderately durable but capable to effective treatment (2)</td>
</tr>
<tr>
<td>Density</td>
<td>softwood: 450 kg/m³ or more, hardwood: 500-450 kg/m³</td>
<td>softwood: 400 kg/m³ or more, hardwood: 450 kg/m³ or more</td>
</tr>
<tr>
<td>Grain</td>
<td>straight to moderately interlocked</td>
<td></td>
</tr>
<tr>
<td>Reaction wood</td>
<td>absent</td>
<td>no requirement</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>small, or medium</td>
<td>medium</td>
</tr>
<tr>
<td>Tendency to erode gum or resin</td>
<td>absent</td>
<td>intermittently after drying (3)</td>
</tr>
<tr>
<td>Tendency to corrode metals and staining in contact with metals</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Staining neighbouring materials</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Drying rate</td>
<td>rapid or moderate</td>
<td>rather slow or slow/very slow (4)</td>
</tr>
<tr>
<td>Tendency to checking during drying</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Tendency to distortion during drying</td>
<td>absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Kneading</td>
<td>good, or satisfactory when tipped cutters are used and/or modified cutting angle</td>
<td></td>
</tr>
<tr>
<td>Blunting effect on cutting tools</td>
<td>slight to moderate, severe if tipped cutters are used</td>
<td></td>
</tr>
<tr>
<td>Gluing</td>
<td>good</td>
<td>satisfactory or good after pre-treatment or newly machined</td>
</tr>
<tr>
<td>Finishing (5)</td>
<td>good</td>
<td>satisfactory; if necessary after pre-treatment or newly machined</td>
</tr>
</tbody>
</table>
### Criteria for the selection of timber for the manufacture of cladding - external walls (weather boarding, bevel siding, etc.)

<table>
<thead>
<tr>
<th>Timber Properties</th>
<th>Preferable Levels</th>
<th>Minor Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural durability of heartwood (1)</td>
<td>Durable to very durable or moderately durable but capable to effective treatment (2)</td>
<td>Perishable but capable to effective treatment (2)</td>
</tr>
<tr>
<td>Density (6)</td>
<td>Softwood: 350 kN/m3 or more Hardwood: 450 kN/m3 or more</td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td>Straight to moderately interlocked (7)</td>
<td></td>
</tr>
<tr>
<td>Reaction wood</td>
<td>Absent</td>
<td>No requirement</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>Small or medium</td>
<td>Large</td>
</tr>
<tr>
<td>Tendency to exude gum or resin</td>
<td>Absent</td>
<td>Slightly after drying (1)</td>
</tr>
<tr>
<td>Tendency to corrode metals and staining in contact with metals</td>
<td>Absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Staining neighbouring materials</td>
<td>Absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Tendency to checking during drying</td>
<td>Absent or controllable if present</td>
<td></td>
</tr>
<tr>
<td>Tendency to distortion during drying</td>
<td>Absent or controllable if present (7)</td>
<td></td>
</tr>
<tr>
<td>Machining</td>
<td>Good, or satisfactory when tipped cutters are used and/or modified cutting angle</td>
<td></td>
</tr>
<tr>
<td>Blunting effect on cutting tools</td>
<td>Slight</td>
<td>Moderate</td>
</tr>
<tr>
<td>Hallowing (8)</td>
<td>Good</td>
<td>Satisfactory, without precoring</td>
</tr>
<tr>
<td>Finishing (9)</td>
<td>Good</td>
<td>Satisfactory; if necessary after pre-treatment or newly machined</td>
</tr>
</tbody>
</table>

### Criteria for the selection of timber for the manufacture of solid wooden furniture parts (chair and table frames, upholstery framing, chair seats) and cabinet work (table tops, bases, legs, etc.)

<table>
<thead>
<tr>
<th>Timber Properties</th>
<th>Preferable Levels</th>
<th>Minor Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density (10)</td>
<td>Averaging not less than 550 kN/m³ and not more than 450 kN/m³</td>
<td>Averaging not less than 450 kN/m³ and not more than 350 kN/m³ (11)</td>
</tr>
<tr>
<td>Modulus of rupture</td>
<td>Not less than 40 kN/mm²</td>
<td>Not less than 35 kN/mm² (11)</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight</td>
<td>Moderately interlocked (12)</td>
</tr>
<tr>
<td>Reaction wood</td>
<td>Absent</td>
<td>No requirement</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>Small or medium</td>
<td>Large (13)</td>
</tr>
<tr>
<td>Tendency to exude gum or resin</td>
<td>Absent or slightly present after drying (14)</td>
<td>Moderately present after drying (15)</td>
</tr>
<tr>
<td>Tendency to splinter</td>
<td>Absent</td>
<td>Very little</td>
</tr>
<tr>
<td>Tendency to checking during drying</td>
<td>Absent or controllable if present (16)</td>
<td></td>
</tr>
<tr>
<td>Tendency to distortion during drying</td>
<td>Absent or controllable if present (17)</td>
<td></td>
</tr>
<tr>
<td>Blunting effect on cutting tools</td>
<td>Slight to moderate, or severe if tipped cutters are used.</td>
<td></td>
</tr>
<tr>
<td>Machining</td>
<td>Good or satisfactory if tipped cutters are used and/or modified cutting angle</td>
<td></td>
</tr>
<tr>
<td>Gluing</td>
<td>Good</td>
<td>Good, if necessary after pre-treatment or newly machined</td>
</tr>
<tr>
<td>Finishing</td>
<td>Good</td>
<td>Satisfactory; if necessary after pre-treatment or newly machined</td>
</tr>
<tr>
<td>Staining</td>
<td>Good and even</td>
<td>Satisfactory or controllable</td>
</tr>
<tr>
<td>Effect of wood substances on finishing</td>
<td>Absent</td>
<td>Controllable if present</td>
</tr>
</tbody>
</table>
### Criteria for the selection of timber for the manufacture of flooring (strip flooring, block flooring, parquetry)

<table>
<thead>
<tr>
<th>TIMBER PROPERTIES</th>
<th>PREFERABLE LEVELS</th>
<th>MINIMUM LEVELS</th>
</tr>
</thead>
</table>
| Density (18)      | for pedestrian normal traffic (19): softwood: not less than 600 kg/m³
|                   | hardwood: not less than 875 kg/m³|
| Grain (18)        | straight or slightly interlocked | moderately interlocked (19) |
| Reaction wood     | absent              | no requirement |
| Shrinkage         | small or medium (20) | large (22)     |
| Tendency to crede gum or resin | absent after drying | limited after drying (22) |
| Tendency to corrode metals and staining in contact with metals | absent or controllable if present |
| Staining neighbouring materials | usually not relevant |
| Tendency to checking during drying | absent or controllable if present |
| Tendency to distortion during drying | absent or controllable if present |
| Blunting effect on cutting tools | slight to moderate, or severe if tipped cutters are used |
| Gluing            | good, or satisfactory if tipped cutters are used and/or modified cutting angle |
| Staining          | good, without preboring | satisfactory, without preboring or difficult (23) |
| Gluing            | good               | satisfactory or good after pre-treatment or newly machined |
| Finishing         | good: after sanding a well-bonded and smooth coated surface must be obtainable by using an appropriate coating system | satisfactory; if necessary after pre-treatment or newly machined |
Notes referring to the properties-criteria tables on the previous pages.

1. Classifications refer to the natural durability of the heartwood in ground contact, all sapwood is excluded. The latter should be treated as perishable and usually permeable to preservatives. The levels set for durability and preservative treatment generally assume some form of applied finish.

2. For information on measures and rules for the necessity on wood preserving bound by the different national regulations and on acceptable wood preservatives and suitable treatment schedules, specifications dealing in more detail with preservative treatment must be consulted in the consuming countries.

3. Acceptability depends on finish to be used and visual standard required. Exudation varies within timbers affected as to quantity and between timbers as to form (over boards generally or in isolated places). Resinous timbers cause premature failure of surface coating. Exterior wood staining is the most appropriate treatment in this instance. Resin exudation is likely to become visible, especially on south elevations.

4. Not included below ‘Preferable Levels’ because of risk in commercial practice of inadequate even drying throughout thick cross-sections; with strict application of correct drying techniques, performance will equal that of more rapidly drying timbers.

5. Painting and other finishing processes. For exterior use, timbers with a very coarse texture are the least satisfactory for painting and varnishing. Exterior wood staining is the most appropriate treatment in this instance.

6. Density is not critical, but it affects resistance to indentation and nail-holding properties. Softwoods and hardwoods of appreciably higher density will be correspondingly more resistant to indentation. If nail-holding is in question, in general the density of hardwoods should be higher than that of softwoods for comparable holding properties.

7. May be particularly troublesome in sawn timber less than 22 mm thick. Tendency to cupping across width has been included under “distortion”, for this end-use. With timbers of good nail-holding properties and with fixings at frequent intervals, performance in situ may be satisfactory in thinner dimensions, but for the likelihood of air-dried timber not having been held long enough and resulting in unnecessary shrinkage or distortion in service.

8. Some of the timbers being ‘Difficult’ in nailing will accept small flooring nails if care is taken in application (e.g. Ipe). Many will be too hard, or split too easily or there may be neither practical experience nor information from standard tests. Since the nailing evaluation is based on 12-gauge nails applied perpendicular to the face, timbers marked as ‘Difficult’ should not necessarily be excluded for strip flooring or block flooring, but should not be specified without further evidence of suitability.

9. Painting and other finishing processes. For exterior use, timbers with a very coarse texture are the least satisfactory for painting and varnishing. Exterior wood staining is the most appropriate treatment in this instance.

10. Density is a general guide to strength and surface hardness. Reference should be made to remarks on the strength of timber in the introduction to this section where it will be seen that a particular level of density is ‘Preferable’ only as far as it contributes to, or necessary for, the strength of design as a whole.

11. An upper limit for density is not needed technically, but may be desirable when considering the effect of using very high density timbers on handling and transport of furniture, and bearing in mind that some timbers in this category may prove difficult to glue satisfactorily. For these reasons, timbers averaging over 950 kg/m³ have been excluded. Some timbers in the lower density category, require careful selection so as to exclude pieces with visible evidence of brittle heart and those of exceptionally light weight (often an indication of this defect) since the strength of such pieces is appreciably below average and they are liable to sudden fracture.

12. While all recommendations assume adequate selection within the species, eliminating the wavy-grained material or that with grain running off the edge is particularly important for long rails, joints and sawn-curved back legs.
This is not a major disadvantage (e.g. Oak has considerable tangential shrinkage), but much movement in service can contribute to failure of weak joints or of those subject to racking action.

No resinous timbers can be guaranteed not to show exudation after manufacture and coating, but those in this category, if selected to exclude obviously troublesome pieces, are usually satisfactory. With some, however, a good deal of gumming of cutters and sticking together of uncoated stacked parts may occur.

When considering stuff-over framing, it should be borne in mind that in service exudation could be severe near a source of heat and cause staining through covers at any point where in contact with the wood. May be unsuitable for show-wood parts.

This is only applicable to show-wood. Care in drying can overcome this problem in most timbers, especially when they are more than 50 mm thick; but fine checking which does not show with light coatings may give trouble under dark stains or ebonising.

Some timbers with a severe tendency to distort have been used with apparent success but should not be used without considering the need for extra care in drying, the possibility of reject parts, and the realization that inadequately dried parts (especially long lengths) are likely to distort after manufacture.

Density relates to general strength, hardness and quantitative loss of surface. Grain relates to quantitative loss and smoothness. Low level of one can be partly compensated by high level of another.

Normal pedestrian traffic: less than 2000 persons a day, heavy pedestrian traffic: more than 2000 persons a day.

Timbers with heavily interlocked grain or typically irregular grain are not recommended for strip flooring in rooms with normal pedestrian traffic, but can be satisfactory for block flooring. Timbers with heavily interlocked grain or irregular grain may be successfully applied for heavy pedestrian traffic.

For strip flooring particularly, those timbers which, meeting all other requirements have the smallest difference between radial and tangential shrinkage and small movement, are preferable. Small shrinkage only, if under-floor heating is used.

Where minimum humidity fluctuation is anticipated, timbers which, meeting all other requirements, are in the 'Large' shrinkage category (e.g. Jarrah, Keruing) may be satisfactory; but should not be specified without ensuring (1) that conditions will be suitable, (2) that adequate allowance is made for some cumulative movement of the floor and (3) that the timber is dried to, and retained at, a moisture content equal to average in-service conditions before, during and after installation.

Not suitable for very warm situations - nor with certain applied coating systems.

Some of the timbers being 'Difficult' in nailing will accept small flooring nails if care is taken in application (e.g. Ipe). Many will be too hard, or split too easily or there may be neither practical experience nor information from standard tests. Since the nailing evaluation is based on 12-gauge nails applied perpendicular to the face, timbers marked as 'Difficult' should not necessarily be excluded for strip flooring or block flooring, but should not be specified without further evidence of suitability.
REFERENCE GUIDE
The possible menu choices will be explained in detail in this section. Some information on printing, memory problems, file descriptions and possible errors will also be given.

Menus
All possible menus that can be used by the programme, will be shown. For more information and the various menu types and keys, please consult the chapter "menu system" of the user’s guide.

1 The opening screen

Selection and Introduction of lesser-known and lesser-used species for specific end-uses
Cameroonian version

Department of Forestry
J.E. Polman
M.A. Zijp

TNO Timber Research Institute
P.B. Laming
ONHDEF
T. Tongo Bokam

When starting the programme, an opening screen will be displayed. The programme will proceed if you press a key (SHIFT, CAPSLOCK, CTRL, ALT, PAUSE, however, have no effect). Which screen appears depends on the hardware (graphical card and/or monochrome monitor) and the selected language.
The "pick a database file"-menu

It is possible to load a number of species in the programme. Choose an existing file or press ESCape to create a new file.
You can make a choice by moving the highlighted (or coloured) bar to the one you want to load by using the arrow keys. When ready, press the RETURN key. The programme will load the selected file in memory.

If you want to create a new database file, press ESC. The programme will prompt you for a file name. Up to eight characters are permitted for this name. You should not add an extension as the extension (DBW) will be added automatically.

If you want to load a species file by default:
This is possible when you start the programme MORELKS with a command qualifier.
MORELKS FN
(For example, if you want to load the file ALL, you can type
MORELKS all
and you will not be prompted to select a file.)

3 The main menu

After a database file has been loaded, the main menu appears.
- "Installation and set-up" offers the opportunity to switch between text mode and graphical mode and to change colours in menus and windows (see menu 5). Here you can also set the default language.
- "Change the properties database" offers the possibility to view, change, delete and add species in the current active database (see menu 6).
- "Select and match properties with requirements" provides the possibility to
screen species for selected end-uses (see menu 7).

- "Utilities". Using this option you can copy files to your floppy disk (see menu 8).
- "Quit". You will leave the programme (after verification).

4 Getting help

Besides this manual, help is available from the programme in most cases. It is also possible in most cases to get context sensitive help.

For more information on the help system and how to use it, please consult the help system part in the user’s guide.
5 Installation and set-up

The set-up of the programme can be changed and saved using this option. Here are the choices:

- "Colour": You can select this option if your screen has the capability of displaying colours.
- "Black and white": you can select this option if the display of the matching is poorly visible (or not at all).
- "Graphics/VGA/EGA (enhanced)"; this will select the graphic option. The programme displays the matching graphical.
- "Hercules/Ega": this will select the graphic option for Hercules graphical cards. Matching will be displayed using 720*350 pixels (horizontal and vertical dots).
- "Text-mode": the programme will continue to use the 25 lines 80 columns and not switch to graphic display during the matching.
- "Change colours": you can change the colours of the windows on the screen, the menu, and more (see menu 9).
- "Change language": you can change the language of the programme, currently French and English.
- "Save options": the settings currently being used will be saved on disk. So, use this option to start the programme next time with the selected colours and language.
- "Quit": leave this menu and return to the previous one (main menu).

6 Change the properties database

With this menu, operations on the properties of species can be performed.
- "Add wood species". A form will appear (see menu 13). After completing this form successfully, the species will be added to the internal database (sorted) and saved on disk.
- "View wood species". The species, loaded in memory, can be viewed using this option. Selection of the species to be viewed will be done by displaying the list of species (see menu 11: select the species). Changing the properties is not possible with this option.
- "Change wood species". This operates in the same way as the previous option. However, changes can be made in the names, properties and other items of the selected species, as long as they do not concern the original database files provided.
- "Delete wood species". After having selected the species (using menu 11) to be deleted they will be deleted after verification. The species will be completely removed from memory and file.
- "Find wood species with specific properties". This option can be used to search the database for species meeting specific requirements (see menu 16).
- "Use old values". The information of the last display operation (add, view, or change) of a species will be displayed on a new form and can be used to add species to the database without typing duplicate information.
- "Save wood database on disk". The current wood database can be saved on hard disk (or floppy disk if you started the programme from a floppy disk). After adding, deleting and changing a species, this will be done automatically.
- "Make or Use another database". You can choose a database other than the one selected at the start of the programme. See menu 2: "Pick a database file with species for details".
- "Quit database manager". Leave this menu and return to the main menu).
With this menu, one can select the species one wants to screen and other related actions.

- The "Choose selection" option allows one to choose from the total list of species (see menu 11) with nothing pre-marked.
- The "Use or alter previous selection" option allows you to choose from the total list of species (see menu 11) with the previous selection(s) pre-marked.

Having selected the species, you can select the end-uses (see menu 12). The screening process will then start (see menu 14).

- The "Find the most appropriate use for the selected species"-option will process the marked species (by option one, two or four of this menu). The programme will search and screen the end-use(s). The best rating (defined as the practical evaluation) will be displayed. NOTE: Only western European end-uses are in effect. Other defined end-uses do not contain information to arrive at a practical evaluation.
- The "Retrieve selection file" option allows you to load an older selection\(^1\) (previously saved) from disk (see menu 15). You can use this selection if you select the "Use or alter previous selection" option.
- "Delete selection file(s)"; the available selection files will be listed. Using the cursor you can select a selection file to be deleted. The file will be deleted after verification.

\(^1\) The selected species must at this time be present in the selected database file.
"Save selection file": the marks of the selected species (as a result of option one or two) will be saved on disk for future retrieval. You will be prompted to provide a name. It will be saved with the extension SEL, after successfully entering the name.

8 Utilities

This menu makes it simple to store the database files on a floppy disk. It can also be helpful in updating the programme to a newer version.

- "Copy current wood database file to floppy": will copy the internal database file from the default drive to the floppy disk inserted in drive A.
- "Copy current wood database file from floppy": will copy the internal database file from the floppy disk inserted in drive A to the default directory.
- "Copy all wood database files to floppy": will copy all the files with extension DBW (and some others) from the inserted floppy in drive A to the default directory.
- "Copy all wood database files from floppy": the reverse of the previous option: it will copy all the files with extension DBW (and some others) from the inserted floppy in drive A to the default directory.
- "Install new version from floppy": This option cannot be used unless stated in a newer version of the programme.
- "Execute update command files": This option cannot be used unless stated in a newer version of the programme.
- "Show free memory": The amount of free available internal memory will be displayed.
- "Show wood database files": gives a list of the wood database files in the default directory.
- "Quit utilities" will leave this menu and return to the previous one (the main menu).
9 Change colours

You can change the colours (see menu 10) of the items mentioned in the menu:
- "Windows": the screen background on which for instance the text and the menu are displayed.
- "Menu": the screen colour of several menus in the programme.
- "Single database": all single menus to fill in the properties in the properties form.
- "Multiple database": All the multiple menus to fill in the properties in the properties form (grain and region).
- "Choose species": the menu colours of menu 11.
- "Choose end-uses": the menu colours of menu 12.
- "Help": the colours of the help text to be displayed. On certain laptops, the original colours do not provide a contrast between background and text colour.

10 Change colour

After selecting an item in the previous menu, you may choose the colour selection by moving the ARROW and pressing RETURN. First you will be prompted to choose the colour for the background and text, and then the colour for the frame surrounding the selected item.

11 Select the species

Press RETURN to switch between selected and not selected. This will affect the species which is coloured or highlighted by the cursor bar. If you want to find the botanical name for a commercial or trade name, press F5. After entering the name (or a part of it) the corresponding botanical name will be displayed, if it is present in the current database file.
Press ENTER to select the next species: useful for selecting a large number of adjacent species.

12 Select the end-uses

Press RETURN to switch between selected and not selected. This will affect the end-use which is coloured or highlighted by the cursor bar. Press ENTER to select the next end-use: useful for selecting a large number of adjacent end-uses.
The form displays the various properties which have to be filled in (except the commercial name, source and message). Pressing ESC will leave the form without change for the displayed species. F10 will save the information if all required data have been entered and the displayed species is not from the original database. To fill in a field, use the ARROW to go to that field and press RETURN to get a list of choices, except Modulus of rupture and Density that require digits.
Screening the species

For an explanation please refer to the appropriate section in the user's guide. Pressing ESC will bring you back to the "Select and match properties with requirements" menu.

Selection files

File name (.SEL):

F3.SEL KAMEROEN.SEL PROTO.SEL

ALL.SEL CTFT.SEL PRODCTRS.SEL
First enter a name to retrieve a selection-file. You may also press RETURN to get a list of available selection files to choose from (by moving the cursor bar to the desired selection file with the ARROW keys and pressing RETURN). The previously selected species will be omitted. An error will occur if the selected species are not present in the internal database. If this happens, you should load the appropriate database file in memory (so, go back to the Main menu, select the "Change the properties database" followed by "Make or Use another database").

### Finding species meeting with specific properties

To find species with specific properties this form can be used. The method (possible option "Normal" or "Fixed") will determine the search process. When "Normal" is selected, and - for example - the natural durability class "moderately durable" is selected, the search will accept all species which are moderately durable or better (more durable). "Fixed" will only search for moderately durable timbers.

![Wood database management system](image)
PRINTING

In the present version of this programme, emphasis is on displaying information on the screen. However, printing is possible but is not extended.

If you want to print the screening of a species for an end-use, this can be done by pressing PRINT SCREEN (if this does not work, try pressing SHIFT and PRINT SCREEN simultaneously).

If your printer produces output which does not fulfil your expectations:

→ Go to the Installation and Set-up option in the main window and select textmode.
→ Return to the matching section and try again.

It is also possible to get information directly printed. This is option 3 of the selection and matching menu: Find the best use for the selected species. To do this, press ALT P and select the appropriate option on (to printer and/or to log file). If you set "LOG File" to "on" then the information will be saved in a file named PROLOG.LOG. This ASCII text file can be printed later using the DOS command PRINT or can be imported into a word processor for formatting and printing.
Files and their description

The following files are present on the floppy disk(s).

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<tr>
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<th>Extension</th>
<th>Function</th>
</tr>
</thead>
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<td>MORELKS</td>
<td>EXE</td>
<td>The main programme</td>
</tr>
<tr>
<td>MENUCH3</td>
<td>FRA/ENG</td>
<td>Programme file (menu choices, status bar, language elements)</td>
</tr>
<tr>
<td>SETSCR1</td>
<td>SET</td>
<td>contains screen positions for VGA.</td>
</tr>
<tr>
<td>SETSCR2</td>
<td>SET</td>
<td>contains screen positions for Hercules e.a.</td>
</tr>
<tr>
<td>SETUPB</td>
<td>SET'</td>
<td>contains colour selections (for black and white).</td>
</tr>
<tr>
<td>SETUPC</td>
<td>SET'</td>
<td>contains colour selections.</td>
</tr>
<tr>
<td>ENG_HLP</td>
<td>DEF</td>
<td>Data definitions for the HELP system (in English).</td>
</tr>
<tr>
<td>FRA_HLP</td>
<td>DEF</td>
<td>Data definitions for the HELP system (in French).</td>
</tr>
<tr>
<td>ENG_HLP</td>
<td>HLP</td>
<td>Data for the HELP system in English.</td>
</tr>
<tr>
<td>FRA_HLP</td>
<td>HLP</td>
<td>Data for the HELP system in French.</td>
</tr>
<tr>
<td>ENG_OPN</td>
<td>HLP</td>
<td>Start-up explanation (in English).</td>
</tr>
<tr>
<td>FRA_OPN</td>
<td>HLP</td>
<td>Start-up explanation (in French).</td>
</tr>
<tr>
<td>ATT</td>
<td>BGI</td>
<td>Driver for ATT-400-line Graphics adapter.</td>
</tr>
<tr>
<td>CGA</td>
<td>BGI</td>
<td>Driver for Color Graphics Adapter.</td>
</tr>
<tr>
<td>HERC</td>
<td>BGI</td>
<td>Driver for Hercules Graphics Adapter.</td>
</tr>
<tr>
<td>IBM8514</td>
<td>BGI</td>
<td>Driver for IBM8514 Graphics Adapter.</td>
</tr>
<tr>
<td>PC3270</td>
<td>BGI</td>
<td>Driver for 3270-PC Graphics Adapter.</td>
</tr>
<tr>
<td>SANS</td>
<td>CHR</td>
<td>Stroked font definition.</td>
</tr>
<tr>
<td>LITT</td>
<td>CHR</td>
<td>Stroked font definition.</td>
</tr>
<tr>
<td>SETTING</td>
<td>DBA</td>
<td>The saved configuration (language, colour).</td>
</tr>
<tr>
<td>PROPVAL2</td>
<td>DBA</td>
<td>Files for the programme.</td>
</tr>
<tr>
<td>WOOD13</td>
<td>SCR</td>
<td>Definitions for screen handler.</td>
</tr>
<tr>
<td>DATVAR2</td>
<td>DBA</td>
<td>Numbers of variables.</td>
</tr>
<tr>
<td>NRSYM2</td>
<td>ENG/FRA</td>
<td>Text strings.</td>
</tr>
<tr>
<td>ENG_WEU</td>
<td>DBU</td>
<td>Definition of end-use requirements (English text).</td>
</tr>
<tr>
<td>FRA_WEU</td>
<td>DBU</td>
<td>Definition of end-use requirements (French text).</td>
</tr>
<tr>
<td>ALL</td>
<td>DBW**</td>
<td>100 well-known tropical timbers, 50 lesser-known species. submitted by producing countries, 120 lesser-known species. from former CTFT (now Cirad Forêt) from France (in English).</td>
</tr>
<tr>
<td>FRA_ALL</td>
<td>DBW**</td>
<td>ALL (see above) but in French.</td>
</tr>
<tr>
<td>AFRICA</td>
<td>DBW**</td>
<td>Only the African species from ALL.</td>
</tr>
<tr>
<td>AFRICAF</td>
<td>DBW**</td>
<td>Only the African species from FRA_ALL.</td>
</tr>
<tr>
<td>LKSF3</td>
<td>DBW**</td>
<td>The species added during the F3 project.</td>
</tr>
<tr>
<td>DEMO</td>
<td>SEL*</td>
<td>A number of selected species.</td>
</tr>
<tr>
<td>PROTO</td>
<td>SEL*</td>
<td>A number of selected species.</td>
</tr>
<tr>
<td>ALL</td>
<td>SEL*</td>
<td>A number of selected species.</td>
</tr>
<tr>
<td>AFRICA</td>
<td>SEL*</td>
<td>A number of selected species.</td>
</tr>
<tr>
<td>INSTALL</td>
<td>BAT</td>
<td>Batch file for installation.</td>
</tr>
<tr>
<td>MLKS</td>
<td>BAT</td>
<td>Batch file for installation.</td>
</tr>
</tbody>
</table>

The files marked with * can be modified by the user. In the present version of the programme, changes can be made by adding timber species in a file with the extension DBW (marked **). You can remove and add species. Changes can be made but only with species you added to the database.
You can also make, change or delete SEL files.
The preferred colours and other settings can be changed in the "installation and set-up" menu.

Error-messages
These are a number of error messages that may occur.

1000 The arguments in ‘makewindow’ are illegal.
Check that
- the window number is in the range 1 .. 127
- StartRow + NoOfRows <= no. of rows on screen (usually 25 or 43)
- StartCol + NoOfCols <= no. of cols on screen (usually 80 or 120)
1001 The cursor values are illegal.
The Row and Column must be inside the actual window.
1002 Stack overflow.
1003 Heap overflow. Not enough memory.
1007 Heap overflow. Not enough memory.
1008 Arithmetic overflow in integer operation. The result cannot be stored in a 16-bit integer, which has a range of -32768 .. 32767.
1012 Attempt to assign output device to a file that is not in write mode.
1013 Failure in ‘system’ call.
‘system’ tried to load a programme too large for the available memory space, or which remained resident.
1014 Division by zero.
1015 Illegal window number An attempt to refer to a non-existing window was made.
1016 Maximum number of windows exceeded ( The maximum is 34).
1018 The file isn’t open.
1024 Error executing external programme. The external programme might be too large to be executed from the system or it could be an illegal EXE-file. Try to execute the external programme from the DOS shell to see what happens.
1027 Impossible to open file.
1028 Impossible to write file.
1030 Disk I/O error.
1031 Overflow in Expanded Memory System.
1071 File is not in read mode, or it is closed.
1072 Impossible to delete file.
1073 Impossible to rename file.
1074 Invalid arguments to the ‘date’-predicate.
The arguments should be three integers in the order day, month, year.
1101 Integer expected (during term reading).
1102 Double quote expected (during term reading)
1104 Single quote expected (during term reading).
1105 List start expected (during term reading).
1106 End of list expected (during term reading).
1107 Functor not found in domain (during term reading).
1108 ‘(’ expected (during term reading).
1109 ‘,’ or ‘)’ expected (during term reading).
2000 Not enough storage space for the text.
2001 Cannot execute a write operation.
It is difficult to establish the exact reason for this error, but more often than not it is caused by a full disk or an invalidated floppy drive. This latter condition may occur if several attempts have been made to write to a drive with no disk.
2002 Impossible to open:
The specified file does not exist or cannot be created.
2003 Impossible to erase: The specified file does not exist.
2004 Illegal disk : Illegal device or path.
2006 Cannot execute a read operation.
2007 Cannot execute a write operation to log file: This may be caused by the disk being full.
        The log file has been closed.
2009 Illegal path.
2010 Graphics equipment on this machine does not support the specified mode.
2011 Impossible to execute 'system'-predicate.
5100 The predicate is not supported in graphics mode.
5102 The hardware does not support the specified text mode.
6000 BGI graphics not installed.
6001 Graphics hardware not detected.
6002 Device driver file not found.
6003 Invalid device driver file.
6004 Not enough memory to load driver.
6005 Out of memory in scan fill.
6006 Out of memory in flood fill.
6007 Font file not found.
6008 Not enough memory to load font.
6009 Invalid graphics mode for selected driver.
6010 Graphics error.
6011 Graphics I/O error.
6012 Invalid font file.
6013 Invalid font number.
6014 Invalid device number.
Memory problem
The programme uses the internal memory of your computer. If the memory required is less than that available in your computer, an error will occur. It can occur as the programme is starting up. After the command to start the programme has been given it will give:

programme too big for memory
(or an equivalent phrase if another language was selected)

Also, it is possible that after the programme has been loaded in memory a problem will occur when loading some starting information. The programme will issue an error message and return to the operating system (DOS).

Also, when loading a data file with species it is possible that this may not fit in the memory.

If such a problem occurs, try the following options:

- Start the computer again but do not use memory resident programs.
- If memory problems start after selecting a species file: do not select the largest file (ALL or FRA_ALL) but try a smaller one. If the programme still gives a memory error: create a new file and check the memory. This can be done by choosing the "Utilities" option and the "Memory" option. The number displayed after "heap" should be above 50000 to load a hundred species.

In the other cases:

The programme requires computers with, preferably, a 640 Kb internal memory. With some drawbacks it is possible to use 512 Kb. If you have a computer with only 256 Kb then the programme will not work. Try to install more memory or use this programme on another (newer) computer.
REFERENCES

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APPENDIX A

Classification of properties and grades

Here the various properties used in the MoreLKS programme are listed with the grades used in the properties of species and/or end-use requirements.

1 Natural durability

- unknown
- perishable (class 5)
- perishable - non-durable (class 5/4)
- non-durable (class 4)
- non-durable - moderately durable (class 4/3)
- moderately durable (class 3)
- moderately durable - durable (class 3/2)
- durable (class 2)
- durable - very durable (class 2/1)
- very durable (class 1)

2 Density low

Density requires a number. In end-uses applies:

- very light < 300 kg/m²
- light 300 - 450 kg/m²
- medium light 450 - 650 kg/m²
- moderately heavy 650 - 800 kg/m²
- heavy 800 -1000 kg/m²
- very heavy > 1000 kg/m²

3 Density high

This is for species a copy of the density but in an end-use the maximum allowed density.

4 Modulus of rupture

This requires a number.

5 Grain

- unknown
- spiral
- wavy
- heavily interlocked
- moderately interlocked
- slightly interlocked
- straight

(a combination of the above mentioned is possible)

6 Texture
6 Texture
- unknown
- coarse
- moderately coarse
- moderately fine
- fine

7 Reaction wood
- unknown
- severe
- medium
- slight
- absent

8 Shrinkage
- unknown
- large
- medium
- small

9 Tendency to exude gum/resin
- unknown
- very serious
- serious
- moderate
- very little / slight
- absent

10 Tendency to corrode and stain metal
- unknown
- present and not controllable
- present but controllable
- absent

11 Staining of neighbouring materials
- unknown
- present and not controllable
- present but controllable
- absent

12 Tendency to splinter
- unknown
- serious
- very little / slight
- absent
13 Staining

- unknown
- difficult
- satisfactory or good after pre-treatment or newly machined
- good and even

14 Drying rate

- unknown
- very slow
- slow
- rather slow
- fairly rapid
- rapid

15 Tendency to checking

- unknown
- serious
- moderate
- slight
- absent

16 Tendency to distortion

- unknown
- serious
- moderate
- slight
- absent

17 Blunting effect on tools

- unknown
- severe if tipped cutters are used
- fairly severe
- moderate
- slight

18 Machining

- unknown
- difficult
- satisfactory when tipped cutters are used and/or modified cutting angle
- good

19 Nailing

- unknown
- difficult
- satisfactory: without pre-boring
- good: without pre-boring
20 Gluing

- unknown
- difficult
- satisfactory or good after pre-treatment or newly machined
- good

21 Effect of wood substances on finishing

- unknown
- serious
- present but controllable
- absent

22 Finishing

- unknown
- difficult
- satisfactory or good after pre-treatment or newly machined
- good

23 Hardwood (Yes or no)

- Hard
- Soft
APPENDIX B

Botanical names and trade names present in ALL.DBW (and FRA_ALL.DBW), supplemented with the names in LKSF3.DBW. These are included with an asterisk (*). Species not presumed to be present in Africa are listed in appendix C.

A
Afzelia africana
Afzelia bipindensis, A.pachyloba
Albizia adianthifolia *
Albizia ferruginae
Albizia zygia *
Alstonia boonei
Amphimas ferrugineus, A.pterocarpoides
Aningeria robusta *
Anthonotha cladantha
 (= Macrolobium cladanthum) *
Antiaris africana; A.welwitschii
Antiaris toxicaria
Antrocaryon spp.
Aucoumea klaineana
Autronella congolensis

Afzelia, Doussié
Afzelia, Doussié, Apa
Mepepe, Bangbaye, Saliyemo
Albizia, latandza
Ouochi, Angloayeme
Emien
Lati
Aningre, Abam
Akoung ele
Antiaris, Ako, Bonkonko
Ako
Onzabili
Gaboon, Okoume
Mukulungu

B
Baikiaea plurijuga
Beilschmiedia spp.
Berlinia bracteosa, B.confusa, B.grandiflora
Berlinia spp.
Blighia welwitschii *
Brachylaena hutchinsii
Brachystegia cynometroides, B.leonensis
Brachystegia laurentii
Brachystegia nigerica

‘Rhodesian teak’, Mukusi
Kanda
Ebiara
Berlinia, Ebiara
Avonog
Muhuhu
Naga
Bomanga
Okwen, Naga

C
Canarium schweinfurthii
Casearia bridelberges *
Ceiba pentandra
Celtis spp.
Chlorophora excelsa; Chl.regia
Cleistanthus polystachus *
Cleistopholis patens *
Coelocaryon preussii
Copaifera duckei, C.reticulata
Copaifera mildbraedii, C.salikounda

Canarium, Aiélé
see Keayodendron brideloiides
Fuma
Celtis d’Afrique
Iroko, Kambala, Odum, Mvule
Nom tonso
Sobu, Avom
Ekoune
Copaiba
Etimoe
Copaifera mildbraedii, C. salikounda
Cordia plathythyrسا *
Cylcodiscus gabunensis
Cynometra alexandri
Cynometra hankei *

D
Dacryodes igaganga
Dacryodes normandii
Dacryodes pubescens, D. heterotrycha
Dacryodes spp.
Daniella ogea, D. spp.
Daniellia spp.
Desbordesia glaucescens *
Dialium dinklagei *
Dialium spp *
Didelotia africana, D. idae, D. letouzeyi
Distemonanthus benthamianus

E
Enantia chlorantha *
Entandrophragma angolense
Entandrophragma cylindricum
Entandrophragma utile
Erythrophleum ivorense; E. guineense
Erythrophleum suavolensis, E. ivorense
Erythroxylum mannii *
Eucalyptus delegatensis

F
Fagara heitzii
Funtumia africana *

G
Gambeya albida
Gambeya spp.
Gilbertiodendron dewevrei
Gossweilerodendron balsamiferum
Guarea cedrata
Guibourtia arnoldiana
Guibourtia demeusei; G. tessmannii

H
Hallea ciliata, H. stipulosa
Heritiera utilis; H. densiflora
Hevea brasiliensis
Hevea spp.
Holoptelea grandis

I
Irvingia grandifolia *

Etimoe
Cordia d’afrique, Ebe
Okan
Muhimbi
Nganga, Ekop Nganga, Okomlo

Ossabel
Safoukala
Igaganga
Gommier
Ogea, Lonlaviol
Faro
Alep, Omang
Eyoum P, Koumbele, Mfang P
Eyoum G, Mfang G
Gombe
Ayan, Movingui

Moambe jaune, Mfo
Cedu nohor, Tiama
Sapele, Sapeli, Aboudikro
Utile, Sipo
Missanda, Tali
Tali
Landa
‘Tasmanian oak’, ‘Alpine ash’

Olon
Mutondo, Ele-ndamba

White star apple, Longhi
Longhi
Limba
Agba, Tola branca, Tola
Guarea, Bossé
Mutenye, Bengé
Bubinga, Kevazingo

Abura
Nyankom, Niangon
Rubberwood
Seringueira
Kekele

Andok ngoe, Zembila
J-K
Keayodendron bridelioides
(=Casearia brideloides) *
Khaya ivorensis; K.anthotheca
Klainedoxa gabonensis

L
Lannea welwitschii *
Lophira alata
Lovoa trichilioides *

M
Maesopsis emini
Mammea africana *
Maranthes inermis (= Parinari glabra) *
Microberlinia bisulcata *
Millettia laurentii
Mitragyna (Hallea) ciliata *
Monopetalanthus spp.
Morus mesozygia

N
Nauclea diderrichii
Nesogordonia papeverifera
Newtonia spp *

O
Ocotea usambarensis
Odyendyea gabonensis *
Olea hochstetteri
Oxystigma oxyphyllum

P
Paraberlinia bifoliolata
Parinari glabra *
Pentaclethra eetveldeana *
Pericopsis elata
Phyllanthus discoideus *
Piptadeniastrum africanum
Poga oleosa
Pteleopsis hylodendron *
Pterocarpus angolensis
Pterocarpus soyauxii
Pterocarpus soyauxii, P.osun, P.tinctorius
Pterygota spp.
Pycnanthus angolensis

Appendices

Abip ele
Mahogany, African; Khaya mahogany
Eveuss

Kumbi
Ekki, Azobé
Dibetou, Bibolo

Musizi
Oboto, Abotzok
Assila omang
Zingana, Zebra wood
Wengé
Bahia, Elolom
Andoung
Difou

Opepe, Kusia, Bilinga
Danta, Kotibé
Ossimiale, Nom atui

-East African campherwood’
Ozek
East African olive, Musheragi
Tchitola, Tola, Lolagbclo, Tola mafuta

Awoura
see Maranthes inermis
Ebai bekwe
Afromosia, Kokrodua
Ebeeng
Dahoma, Dabéma
Ovoga
Sikon, Osanga
Muninga, Mukwa
African padauk, Padauk, Camwood
Padouk
Koto
Ilomba
Q-R
Rhodognaphalon brevicuspe
Ricinodendron heudelotii

S
Scottellia chevalieri, S.coriacea, S.spp.
Scottellia coriacea
Sindoropsis letestui
Spathodea campanulata
Staudtia kamerunensis
Sterculia oblonga
Sterculia rhinopetala

T
Tectona grandis
Terminalia ivorensis
Terminalia superba
Testulea gabonensis
Tetraberlinia bifoliolata, T.tubmaniana, T.polyphylla
Triplochiton scleroxylon
Turraeanthus africanus

U-V-W-X-Y-Z

Kondroti
Erimado, Essessang
Akossika
Cdoko
Gheombi
African tulip
Niove
Eyong, Yellow sterculia
Lotofa
Teak
Idigbo, Framiré
Limba, Afara, Fraké
Izombé
Ekaba
Obeche, Wawa, Abachi, Ayous
Avodiré
APPENDIX C

Botanical names and trade names present in ALL.DBW (and FRA_ALL.DBW): Species not presumed to be present in Africa are listed here.

A
Alangium meyeri
Aldina heterophylla
Alexa grandiflora
Amburana cearensis; A.acreana
Andira coriacea, A.surinamensis
Andira spp.
Anisoptera spp.
Araucaria angustifolia
Artocarpus ovata
Aspidosperma peroba
Aspidosperma spp.

B
Bagassa guianensis; B.tiliaefolia
Balfourodendron riedelianum
Bertholletia excelsa
Bowdichia nitida; Diplotropis purpurea
Brosimum rubescens

C
Calophyllum brasiliense
Carallia spp.
Carapa guianensis; C.procera; C.spp.
Cariniana brasiliensis, C.integrifolia
Cariniana pyriformis
Caryocar glabrum, C.villosum
Castanopsis spp.
Casuarina equistifolia
Cedrela spp.
Cedrelinga catenaeformis
Celtis luzonica
Clarisia racemosa
Copaiifera multijuga
Couratari spp.
Couroupita spp.
Cratxylon arboreszens
Ctenolophon parvifolius

D
Dalbergia nigra
Dicorynia guianensis; D.paraeensis
Didymopanax morototoni; Schefflera paraensis
Dillenia philippinensis
Dinizia excelsa
Diplodiscus panicuatus
Diplotropis purpurea
Diplotropis spp.
Dipterocarpus spp.
Dipteryx spp.
Dryobalanops spp.

Putian
Macucu de paca
Melanciera
Amburana, Cerejeira
Angelina, Red cabbage wood
Andira
Mersawa
Pinheiro de Parana
Anubing
Peroba rosa
Araracanga

Santa Maria, Jacareuba
Meransi
Andiroba, Carapa, Crabwood, Krappa
Jequitiba
Abarco
Piquia
Berangan
Agoko
Cedro
Tonillo
Magabuyo
Guariuba
Copaiba
Tauri
Macacarecuia
Geronggang
Mertas

Rosewood, Rio rosewood, Jacandara
Basailocus, Angelique
Morototo
Katmon
Angelim pedra, Angelim vernelho
Baiobo
see Bowdichia nitida
Sucupira preta
Keruing, Yang, Dau, Gurjun, Apitong
Cumaru
Kapur
DIpteryx spp.
Dryobalanops spp.
Drypetes bordenii
Duabanga moluccana
Dyera costulata; D. lowii

E
Enterolobium contortisiliquum, E. cyclocarpum, E. maximum
Enterolobium schomburgkii
Eperua falcata; E. spp.
Eperua spp.
Erisma uncinatum
Euxylophora paraensis

F-G
Gmelina arborea
Gonystylus bancanus; G. spp.
Gonystylus macrophyllum
Goupia glabra

H
Heritiera simplicifolia; H. spp.
Heritiera sylvatica
Hura crepitans
Hymenaea spp.
Hymenolobium spp.

I
Intsia palembanica, I. bijuga
Irvingia malayana

J
Jacaranda copaia

K
Koompassia excelsa
Koompassia malaccensis
Koordersiodendron pinnatum

L
Lagerstroemia piriformis
Lagerstroemia speciosa
Letestua durissima

M
Mangifera altissima
Manilkara bidentata, M. spp.
Maquira coriacea
Marmaroxylon racemosum
Melia dubia
Mesua ferrea
Mezilaurus spp.
Michelia platyphylla
Mora spp.
Myristica philippensis

N
Cumaru
Kapur
Balikbikan
Loktob
Jelutong

Tamboril
Batbatra
Walaba, Walaba
Waliba
Quarubarana, Jatoby, Cambara
Pau amarello

Melina, Yemane, Gumari
Ramin, Melawis
Lanutan bagyo
Gupi, Kabukalli, Kopie, Cupiuba

Mengkulang, Kembang
Dungan
Açacu
Jatoba
Angelim

Merbau
Pauh kijang

Para-para

Manggis
Kempas
Amugis

Batitinian
Banaba
Congotali

Pahutan
Maçaranduba, Bolletrie
Muiratinga
Angelim rajado
Bagalunga
Penaga
Itauba
Tangilo
Mora
Duguan
Nectandra spp. / Ocotea spp.
Neobalanops heimii

Ochroma lagopus
Ocotea porosa
Ocotea rodiae
Ocotea rubra

Ocotea rubra
Octomeles sumatrena
Ormosia spp.

Palaquium spp.
Parashorea malaanonan; P. tomentella
Parashorea stellata, P. densiflora
Parkia spp.
Peltogyne pubescens, P. spp.
Peltogyne spp.
Pittosporum pentandrum
Planchonia spectabilis
Planchonia valida
Platonia insignis
Platymiscium ulei, P. pinnatum, P. trinitatis
Pometia pinanata
Pometia pinnata
Prioria copaifera
Protium spp.
Pseudosindora palustris
Pterocarpus dalbergioides
Pterocarpus indicus
Pterygota horsfieldii

Qualea albiflora, Q. dinizii
Qualea spp.

Sandoricum vidalii
Scleronema micranthum, S. praecox
Shorea bracteolata, S. spp.
Shorea faguetiana, S. spp.
Shorea guiso, S. kunstleri, S. ochrophloia, S. collina
Shorea negrosensis
Shorea pauciflora; S. spp.
Simarouba amara
Sterculia spp.
Sterculius elengatus
Swartziia spp.
Swietenia macrophylla
Swietenia macrophylla, S. humilis
Symphonia globulliera

Tabebuia serratifolia

Louro
Chengal

Balsa
Imbuia
Greenheart, Demerara greenheart
Red louro, Determa, Wane, Louro vermelho
Louro vermelho
Binuang
Tento

Nyatoh
White seraya; white lauan (in part)
Meranti gerutu, Gerutu gerutu
Faveira
Purpleheart
Amarante
Mamalis
Lamog
Putat
Bacuri
Macacauba
Malugai
Kasai, Matoa
Cativo
Breu
Sepetir
Andaman padauk, Padauk
Sena
Taluto
Impa

Quaruba, Kwarie
Mandioqueira

Malasantol
Cardeiro
White meranti, White lauan (in part)
Yellow meranti, Yellow seraya
Red balau, Red selangan batu
Dark red lauan, Red lauan
Dark red meranti, Nemesu
Marupa
Chicha
Tempinis
Coração de negro
American mahogany, Mogno
Mogno
Manil

Surinam greenheart, Ipé
Manual MoreLKS

Tabebuia spp.
Tarrietia javanica, T. simplicifolia
Tectona grandis
Terminalia copelandii
Tetragastris spp.
Tetramerista glabra
Tristaria decorticata

U-V
Virola spp.
Virola surinamensis; V. sebifera
Vochysia maxima; V. spp.
Vouacapoua americana

W
Walaceodendron celebicum

X-Y-Z
Xantophyllum excelsum

Ipe
Mengkulang
Teak
Lanipau
Sali
Punah
Malabayabas

Virola
Virola, Baboen, Ucuuba
Guaruba, Kwari, Yemeri
Acapu, Wacapou, Partridgewood

Banuyo

Bok-bok
APPENDIX D

Timber species: Trade names of African timber species. The added species are included in bold typeface.

A
Abam
Abip ele
Abotzok
Aboudikro
Abura
Afara
African mahogany
African padauk
African tulip
Afrormosia
Afzelia
Afzelia
Agba
Aïlé
Ako
Ako
Akossika
Albizia
Alep
Amugis
Andok ngoe
Andoung
Angoayeme
Aningre
Antiaris
Apa
Afzelia
Afzelia
Aningeria robusta
Bingodendron bridelioides (= Casearia bridelioides)
Mammea africana
Entandrophragma cylindricum
Hallea ciliata, H. stipulosa
Terminalia superba
Khaya ivorensis; K. anthotheca
Pterocarpus soyauxii
Spathodea campanulata
Pericopsis elata
Afzelia bipindensis, A. pachyloba
Afzelia africana
Goss weilerodendron balsamiferum
Canarium schweinfurthii
Antiaris toxicaria
Antiaris africana; A. welwitschii
Scottellia chevalieri, S. coriacea, S. spp.
Albizia ferruginae
Desbordesia glaucescens
Koordersiodendron pinnatum
Irvingia grandifolia
Monopetalanthus spp.
Albizia zygia
Aningeria robusta
Antiaris africana; A. welwitschii
Afzelia bipindensis, A. pachyloba
Maranthes inermis (= Parinari glabra)
Turraeanthus africanus
Cleistopholis patens
Blighia welwitschii
Paraberlinia bifoliolata
Distemonanthus benthamianus
Triplochiton scleroxylon
Lophira alata

B
Bahia
Bangbaye
Bengé
Berlinia
Bété
Bibolo
Bilinga
Mitragyna (Hallea) ciliata
Albizia adianthifolia
Guibourtia arnoldiana
Berlinia spp.
Mansonokia altissima
Lovoa trichilioides
Nauclea diderrichii
<table>
<thead>
<tr>
<th>A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bomanga</td>
<td>Brachystegia laurentii</td>
</tr>
<tr>
<td>Bonkonko</td>
<td>Antiaris africana; A. welwitschii</td>
</tr>
<tr>
<td>Bossé</td>
<td>Guarea cedrata</td>
</tr>
<tr>
<td>Bubinga</td>
<td>Guibourtia demeusei; G. tessmannii</td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Camwood</td>
<td>Pterocarpus soyauxii</td>
</tr>
<tr>
<td>Canarium</td>
<td>Canarium schweinfurthii</td>
</tr>
<tr>
<td>Celtis d’Afrique</td>
<td>Celtis spp.</td>
</tr>
<tr>
<td>Congotali</td>
<td>Letestua durissima</td>
</tr>
<tr>
<td>Corail</td>
<td>Pterocarpus soyauxii</td>
</tr>
<tr>
<td>Cordia d’afrique</td>
<td>Cordia platthythysa</td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Dabéma</td>
<td>Piptadeniastrum africanum</td>
</tr>
<tr>
<td>Dahoma</td>
<td>Piptadeniastrum africanum</td>
</tr>
<tr>
<td>Danta</td>
<td>Nesogordonia papaverifera</td>
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<td>Dibetou</td>
<td>Lovoa trichilioides</td>
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<td>Difou</td>
<td>Morus mesozygia</td>
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<tr>
<td>Doussié</td>
<td>Afzelia bipindensis, A. pachyloba</td>
</tr>
<tr>
<td>Doussié</td>
<td>Afzelia africana</td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>East African olive</td>
<td>Olea hochstetteri</td>
</tr>
<tr>
<td>East African campherwood</td>
<td>Ocotea usambarensis</td>
</tr>
<tr>
<td>Ebai bekwe</td>
<td>Pentacanthra eetveldeana</td>
</tr>
<tr>
<td>Ebe</td>
<td>Cordia platthythysa</td>
</tr>
<tr>
<td>Ebebeng</td>
<td>Phyllanthus discoideus</td>
</tr>
<tr>
<td>Ebiara</td>
<td>Berlinia spp.</td>
</tr>
<tr>
<td>Ebiara</td>
<td>Berlinia bracteosa, B. confusa, B. grandiflora</td>
</tr>
<tr>
<td>Ekaba</td>
<td>Tetraberlinia bifoliota, T. tubmaniana, T. polyphylla</td>
</tr>
<tr>
<td>Ekk</td>
<td>Lophira alata</td>
</tr>
<tr>
<td>Ekop Nganga</td>
<td>Cynometra hankei</td>
</tr>
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<td>Coelocaryon preussii</td>
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<tr>
<td>Erimado</td>
<td>Ricinodendron heudelotii</td>
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<td>Essessang</td>
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<tr>
<td>Etimoe</td>
<td>Copaifera mildbraedii, C. salikounda</td>
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<tr>
<td>Eveuss</td>
<td>Klainedoxa gabonensis</td>
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<tr>
<td>Eyong</td>
<td>Sterculia oblonga</td>
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<tr>
<td>Eyoum P</td>
<td>Dialium dinklagei</td>
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<tr>
<td>Eyoum G</td>
<td>Dialium spp.</td>
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<tr>
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<tr>
<td>Fraké</td>
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<tr>
<td>Framiré</td>
<td>Terminalia ivorensis</td>
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<td>Fuma</td>
<td>Ceiba pentandra</td>
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G
Gaboon
Gedu nohor
Gheombi
Gombe
Gommier
Guarea

Aucoumea klaineana
Entandrophragma angolense
Sindoropsis letestui
Didelotia africana, D.idae, D.letouzeyi
Dacryodes spp.
Guarea cedrata

H
Ilatandza
Idigbo
Igaganga
Ilomba
Iroko
Izombé

Albizia ferruginae
Terminalia ivorensis
Dacryodes pubescens, D.heterotrycha
Pycnanthus angolensis
Chlorophora excelsa; Chl.regia
Testulea gabonensis

I-J-K
Kambala
Kanda
Kekele
Kevazingo
Khaya mahogany
Kokrodua
Kondroti
Koumbele
Kotibé
Koto
Kumbi
Kusia

Chlorophora excelsa; Chl.regia
Beilschmiedia spp.
Holoptelea grandis
Guibouria demeusei; G.tessmannii
Khaya ivorensis; K.anthotheca
Pericopsis elata
Rhodognaphalon brevicuspe
Dialium dinklagei
Nesogordonia papaverifera
Pterygota spp.
Lannea welwitschii
Nauclea diderrichii

L
Landa
Latì
Limba
Limbalí
Lolagbolo
Longhi
Lonlaviol
Lotofa

Erythroxylum mannii
Amphimas ferrugineus, A.pterocarpoides
Terminalia superba
Gilbertiodendron dewevrei
Oxystigma oxyphylum
Gambeya spp.
Gambeya albida
Daniella ogea, D.spp.
Sterculia rhinopetala

M
Mansonia
Mepepe
Mfang G
Mfang P
Mfo
Missanda
Moambe jaune

Mansonìa altissima
Albizia adianthifolia
Dialium ssp
Dialium dinklagei
Enantia chlorantha
Erythrophleum ivorensê; E.guineense
Enantia chlorantha

69
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<th>Mora spp.</th>
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<td>Olea hochstetteri</td>
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<td>Musizi</td>
<td>Maesopsis emini</td>
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<td>Funtumia africana</td>
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<td>Mvule</td>
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<td>Nganga</td>
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<td>Staudtia kamerunensis</td>
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<td>Mansonia altissima</td>
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<td>Oboto</td>
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<td>Poga oleosa</td>
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<td>Baikiaea plurijuga</td>
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<td>Rubberwood</td>
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<tr>
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<td>Tiama</td>
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<td>Tola</td>
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<td>Oxystigma oxyphyllum</td>
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<td>White star apple</td>
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<thead>
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<td>Sterculia oblonga</td>
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<td>Zembila</td>
<td>Irvingia grandifolia</td>
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<tr>
<td>Zebra wood</td>
<td>Microberlinia bisuculata</td>
</tr>
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APPENDIX E
Condensed results from African species screened for specific western European end-uses.

**Resulting classifications**
The result of the property/requirement screening is primarily expressed by "acceptable" or "not-acceptable" classifications for one of the two levels. These parameters result in a final outcome concerning the suitability or non-suitability of a timber species for one of the specific end-uses. A refinement in the procedure is included to differentiate the final result of the screening and ranking procedure by producing a "practical evaluation" in functional and practical terms of interpretation (such as "a perfect species", "a good species", "an unacceptable species", etc).
Cameroonian species that have been added are marked with an asterisk.

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>best rating for the end-use(s)</th>
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<tbody>
<tr>
<td><em>Alzelia africana</em></td>
<td>good window-frames</td>
</tr>
<tr>
<td>*Alzelia bipindensis, A.pachyloba</td>
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</tr>
<tr>
<td>Albizia adianthifolia</td>
<td>good window-frames</td>
</tr>
<tr>
<td>Albizia ferruginea</td>
<td>good window-frames</td>
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<tr>
<td>Albizia zygia</td>
<td>good window-frames</td>
</tr>
<tr>
<td>Alstonia boonei</td>
<td>good window-frames</td>
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<td>Autronella congolensis</td>
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<td>Baikiaea plurijuga</td>
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</tr>
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<td>Berlinia bracteosa, B.confusa, B.grandiflora</td>
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</tr>
<tr>
<td>Berlinia spp.</td>
<td>doubtful/unsuitable window-frames and doors and cladding and furniture and light flooring and heavy flooring</td>
</tr>
<tr>
<td><em>Blighia welwitschii</em></td>
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<tr>
<td>Brachystegia aculeotricha, B.leonensis</td>
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</tbody>
</table>

Blighia welwitschii — *A perfect species*.

*Brachylaena hutchinsii* — *A good species*.

*Antiaris toxicaria* — *An unacceptable species*. 

 Condensed results from African species screened for specific western European end-uses.
<table>
<thead>
<tr>
<th>Species</th>
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<th>Use Cases</th>
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<td><strong>Guibourtia demeusei</strong>, <strong>G. tessmannii</strong></td>
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<td><strong>Poga oleosa</strong></td>
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<td><strong>Microberlinia bisulcata</strong></td>
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<tr>
<td>Turraeanthus africanus</td>
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**Appendices**

- Window-frames and doors and furniture and light flooring and heavy flooring
- Window-frames and cladding and furniture and light flooring
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