ForestCalc® *Inventory* **version 6**
© 1998–2012, ForestCalc Consulting Oy   **12.7.2012**
   Joensuu, Finland

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II

PARAMETERS AND TABLES

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This manual describes structure and content of database tables in the **ForestCalc Inventory** software. Please notice that some database fields may not be in use because they are reserved for the coming versions of this software. These cases are mentioned in this paper. For the complete list of references, please see Manual I.

CONTENT

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1. PROGRAM PARAMETERS

1.1. Parameter files and the default settings

There are two essential MS Access database files containing program parameters and models: **TreeparaInventory.mdb** and **Forestpara.mdb**. The first file contains information about local tree species and their models (functions), the second file includes codes and definitions for collected data: local administrative data (provinces, districts), plot variables and some tree variables. The user can edit these tables, if needed, in order to localize of this software.

> NOTICE!
>
> 1) **DO NOT** change database structure, names or data types.

Tree species codes: see **TreeparaInventory.mdb**, table TreeSpecies.

1.2. Equations in database

Volume functions, height curve functions and biomass models can be stored into the database. The equations are solved using an equation parser. The following rules should be observed:

- Operators are the common ones (+ - * / ^)
- Computing of raise to a power (^), use ALWAYS parenthesis.

  E.g. the software computes 2*2^3 $=>4^3=48$ (wrong), should be: 2*(2^3) $=>2*8=16$ (correct)
- Pi (3.1415..) is a constant, written as **PI**
- Check parentheses
- **The logical equations** can be entered into the field *Rules*. These equations give answer as TRUE or FALSE. For example, if a volume model requires that diameter exceeds five centimeters, write '(d>5)'. [1]Operands AND, OR, NOT can also be used. The computing is allowed, if the result of a logical equation is *True*. See the following examples:

      h<10
      AND(d>0,h>1.3)
      OR(d>20,h>10)
      NOT(d=0)

  The logical rules are not obligatory, thus the field **Rules** can also be left blank.

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[1] Currently logical rules work best with Timber prices & dimensions. Logical rules are not taken into account in computing of tree volumes if a species has just one volume equation. Read more about give more than one volume equation for species in chapter 1.3 (*Equation lists and the rules in computing of tree volume*).

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Code	Equation	ModelSource
2	0.022927 * (d ^ 1.91505) *(0.99146 ^ d) *(h ^ 2.82541) *((h - 1.3) ^ (-1.53547))	Laasasenaho 1982
3	0.011197 * (d ^ 2.10253)* (0.986 ^ d)* (h ^ 3.98519)* ((h - 1.3) ^ (-2.659))	Laasasenaho 1982
1	0.036089 * (d ^ 2.01395) * (0.99676 ^ d) *(h ^ 2.07025) *((h - 1.3) ^ (-1.07209))	Laasasenaho 1982

Figure 1. Volume equations in the database table.

The allowed variable names are

in all model types

d = diameter (cm),

h = height (m),

Hstump = stump height (m)

<u>and</u>

in bole volume models:

Hc = **Ht** = log height (bole height) (m)

V = **Vol** = single tree stem volume (m3)

in biomass equations:

V = **Vol** = single tree stem volume (m3)

Vlog = single tree log part volume (m3)

Vpulp = single tree pulp (pole) part volume (m3)

Vtop = single tree top waste volume (m3)

The previous variables are read from the result database.

DryWeight = density factor (kg/m3).

DryWeight *is set in **TreeParaInventory.mdb**, table TreeSpecies (but if **DryWeight** is missing or it is zero, then the value is taken from the table ProgramParameters, field Default_DensityFactor)*

The equation parser can solve the following mathematical functions:

LN(*Value*)	natural logarithm
LOG(*Value,Base*)	logarithm, *Base*>0
LOG10(*Value*)	10-base logarithm
EXP(*Value*)	e^{Value}
SQRT(*Value*)	square root. This is the same as (x^0.5).

The volume equations must yield the results in cubic meters (m^3). If your model gives result in liters (dm^3), add '/**1000**' to the end of the equation, and use parenthesis as applicable. New models can be written into the database **ForestPara** using MS Access.

There can be a constant value in the equation, if required. For example, there is a case in the biomass equation table that no leaf biomasses are computed for birch, hence the equation is set to a constant value of zero (see the next figure).

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2	7	EXP(13.37/U3*(d/(d+8))-6.3851)	
2	8	EXP(7.6283*(d/(d+12))-2.5706)	
3	1	EXP(8.1184*(d/(d+11))+0.9783*LN(h)-3.3045)	koivut
3	2	EXP(8.3019*(d/(d+14))+0.733*LN(h)-4.0778)	
3	3	EXP(10.2806*(d/(d+10))-3.3633)	
3	4	0	lehtiä ei lasketa koivulle
3	5	EXP(11.2872*(d/(d+30))-0.3081*h+2.6821*LN(h)-6.6237)	

1.3. Equation lists and the rules in computing of tree volume

One species can have more than one reference to the same volume equation table (see table *TreeSpecies*, fields *VolumeModel_d* etc).

>   An example. *Volume of Larix sibirica as function of DBH and total tree height*
>   *We want to add an unique volume model for small (height <10 m) Larix trees, but we want to use different function for taller trees (height ≥10 m). In this case, we write to the database **TreeparaInventory.mdb**, table **TreeSpecies** for Larix sibirica the list of equation codes (all applicable models). The timber volume of trees with height less than 10 meters can be computed using function number 4, and for the bigger trees using model number 2. Hence, the model list is of the form '**4,2**' (separator comma). We must also enter a logical rule into table **VolumeModel2** for model number 4, into field **Rules,** as follows: '**h<10**'.*
>   *When computing the result for a Larix tree, the rules are checked, starting from the first model in the list, and running down till logical rule gives TRUE or the field **Rules** is blank. In case that all queries are FALSE, the volume is computed using the last function on the list.*

Notice ! This method includes a risk that there may be a sharp distinction in level of results when changing from a volume model to another. Hence, **the user carries all the risks when applying this method**.

1.4. Tree class codes

Tree class codes are the following:

> 0 = other use (no log/bole and pulp/pole volumes computed)
> 1 = log/bole timber. **DEFAULT VALUE**
> 2 = pulp/pole wood (no log/bole volume computed)
> 3 = marked log/bole timber (to be removed in thinning)
> 4 = marked pulp/pole wood (to be removed in thinning)
> 5 = dead tree (no log and pulp/pole volumes computed, no increment computed)
> 6 = stump (no stem volumes computed, no increment computed, below-ground biomass computed)
> 7 = branch

In addition, in the result database the program uses the following tree class coding:

> 20 = seedlings
> 100 = all living trees
> 105 = living + dead trees

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Tree class codes are fixed in **ForestCalc Inventory** and you cannot edit them. If you do not give any tree class code for your tally and sample trees then the program uses TreeClass=**1** for all entered trees. This program can also compute results for living trees and dead trees separately, total standing stock and removal (based on stump diameters), and for each tree class.

Branches can be recorded separately using a special tree class code (7). Otherwise recorded branches are treated as trees. Branches are typical for trees growing on African *Miombo* lands. Commercial (log/bole) volume for a branch is computed only if the bole height is recorded. Branches are not counted into the total number of stems and into the basal area. A practical method to record branches is to give them a decimal value as **Tree number**. An example: the main stem gets tree number 3 and the first branch gets 3.1, and so on.

1.5. *TreeparaInventory.mdb*

Parameter tables

Format: MS Access2000

Table name	Table includes
• *ProgramParameters*	- working directory, language setting, currency unit etc.
• *ProgramForestparaFileDefinition*	- list of localized files to substitute **ForestPara.mdb**
• *TreeSpecies*	- species codes and names, model numbers and biomass factor
• *TreeSpeciesGroups*	- species group codes and names
• *InputRules*	- input data validation rules
• *VolumeModel1*	- volume models, V= f(DBH)
• *VolumeModel2*	- volume models, V= f(DBH,height) or V= f(DBH,H,Hstump)
• *BoleVolumeModels*	- bole volume model, VolBole= f(DBH,Hc), f(DBH,H), f(DBH) or f(V)
• *HeightModel*	- height models for regression, h= f(DBH)
• *HeightCurveForInventory*	- height models for inventory, h= f(DBH) (**not obligatory**)
• *TimberTable*	- timber assortment dimensions and prices
• *ResultGrouping*	- lower diameter and age class limits for the result sheets (from program version 5.5.5)
• *BiomassModel*	- biomass models
• BEF_Model	- model(s) for Biomass Expansion Factor (BEF) (from program version 6.4.0)
• *TaperCurveModels*	- taper curve parameters (*Variable form model* or *Sharma & Oderwald* dimensionally compatible model parameters)

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Table **ProgramParameters** includes general default values and it has the following fields:

ProgramParameters			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
(DefaultPath)	Text	Data folder. (Old versions)	In v. 4.2.2 default data folder shift to table *ProgramForestpara FileDefinition*
DefaultLanguage	Integer	Default language *The program works only with allowed languages. This is defined in the program license file.*	1=Finnish 2=English 3=German 4= Swedish 5= Russian 6= Indonesian 7= Portuguese 8= Spanish
DefaultCurrencyUnit	Text		Max 5 characters! E.g. Euro, $, INR, ZKW
DefaultSamplingMethod	Integer		1=stratified random sampling 2= stratified cluster sampling
DefaultTimberTable	Integer	Default timber dimension & price group in *TimberTable*	Default: 1 (so-called General)
DefaultIncPeriod	Integer	Increment period (past), years	Default: 5 years
DefaultMinRegressionObs	Integer	Minimum number of observation in computing regression models	Default: 3
DefaultVolCalcMethod	Integer	1=Volume models 2=Taper curves (Laasasenaho Finland) 3=Variable-form taper curves (from v. 4.8 up) 4=Sharma & Oderwald taper (from v. 5.4.2 up)	
DefaultHeightCalcMethod	Integer	1=median tree method (Veltheim) 2=median tree, model from database 3=Regression method, Näslund 4= Regression method, polynomic 5= Regression method, Michailoff	
DefaultSpeciesNames	Integer	1=Local names 2=Latin names	
PlotSizeWeight	Yes/No	Yes= Plot size is weight factor in calculation of results (only if plot types are rectangular)	
DefaultSettingsVisible	Yes/No	program startup	
DefaultOrgName1	Text (100)		*Not in use*
DefaultOrgName2	Text (100)		*Not in use*
StratumName1	Text (50)	Name of higher level strata	

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StratumName2	Text (50)	Name of lower level strata	
BambooCalculationAvailable	Yes/No		
DefaultBambooCode	Text (10)	Species code	
DefaultBiomassVariable	Integer	Default stem biomass *Variable* in table **BiomassModel** to be used in calculation of carbon stock	
Default_DensityFactor	Value	Default wood density. Used if a value is missing in **TreeSpecies** table	kg/m3
Default_BEF	Value	BEF= Biomass Expansion Factor	Conversion of stem biomass to total above ground biomass
Default_RootShootRatio	Value	Root to shoot ratio (value)	An allometric equation will be solved using equation parser
Default_CarbonConversionFactor	Value		
DefaultBiomassCalcMethod	Integer	0=calculation by using biomass equations and parameters by species (see **TreeSpecies** table) 1=calculation by using default wood density, BEF, Root/Shoot ratio and carbon factor for all species	
Default_BEF_CalcMethod	Integer	0=calculation by using BEF figures 1= calculation by using BEF equations, if available (see relation from Table **TreeSpecies**, field *Model_BEF* to table **BEF_Model**)	
PlantationInventory	Yes/No	Yes= program can show results by tree age classes, if plantation year has been given as a plot level variable	

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Table **ForestParaFileDefinition** includes a list of local parameter file names (usually by provinces) to substitute file **ForestPara.mdb**. This list pops up when the program starts.

ForestParaFileDefinition			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Number	Integer	Selection number in the program's selection box	*No double values!*
TitleInProgram	Text	Text to be seen in ForestCalc	
ForestParaFileName	Text	File name	
Information	Text	Additional information	*No use in ForestCalc*
DataFolder	Text	Default data folder for input data	*From v. 4.2.2*

Table **TreeSpecies** includes information about tree species, volume models and conversion factors.

TreeSpecies			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
SortOrder	Integer	Sorting order of species in program's dropdown lists	
Code	Text (10)	Species code	*No double values!*
Name	Text	Species name	
LatinName	Text	Species Latin name	
GroupCode	Text (10)	Species group code. Link to table **TreeSpeciesGroups**	
CspeciesList	Text (list)	List of compensating species (sample trees)	Separator comma (,) Blank: all species
ModelTaperCurve	Integer	Taper curve model code number	-> refers to table **taperCurveModels**, field *Code*
ModelBiomass	Integer	Biomass model code number	-> Table **BiomassModel**, field *Code*
ModelVolume_d	Text	Volume model code number	-> **VolumeModel1**
ModelVolume_d_h	Text	Volume model code number	-> **VolumeModel2**
TimberTableFileName	Text	Three alternative meaning: 1) File name for timber log and pulp percentages (Finland) [file name as text] 2) Form factor for bole volume [any decimal number between 0-1] 3) Code number in table **BoleVolumeModels** [integer number]	*Not obligatory, if no log and pulp/pole timber*
ModelTreeHeightCurve	Integer	Height curve code number in table **HeightCurveForInventory**	*Not in use at the moment. Give 1.*
DryWeight	Value	biomass conversion factor for the dry weight of stem	kg/m^3
BEF	Value	Biomass expansion factor (for computing Above ground biomass, Biomass_AG)	
Model_BEF	Integer	BEF model code number	-> Table **BEF_Model**, field *Code*
RootShootRatio	Value	Root to shoot ratio	Default =0.3
CarbonConversionFactor	Value	Tons/m3 (dry wood)	Default=0.5

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Table **TreeSpeciesGroups** includes information about species group codes and names. The user can later for example get results by species groups, and enter timber prices by species groups. **The maximum number of species groups is 20**. The results can also be seen by tree species groups.

TreeSpeciesGroups			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Text (10)		*No double values*
Name	Text	Group name	

Table **InputRules** includes data validation rules for data entry. See **Manual I** for more information about writing the input rules. This table contains a predefined order of records, so do not change it!

InputRules			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
DataNo	Integer		*No double values*
DataField	Text	Explanation	
FormMinimum	Value	Warning limit	(-1 = data not checked)
FormMaximum	Value	Warning limit	
ErrorMinimum	Value	Error limit	
ErrorMaximum	Value	Error limit	

Table **VolumeModel1** includes information about timber volume equations. The independent variable is diameter at 1.3 m above ground (**d**, in cm). For each species there is a link in table **TreeSpecies** (field *ModelVolume_d*) to field *Code* in this table.
Parameter values must be written into the equations. The table includes the following fields:

VolumeModel1			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Integer	Equation number	
Equation	Text (100)		
ModelSource	Text		*e.g. source of information*
Rules	Text	Logical rule	*Not obligatory*

Table **VolumeModel2** includes information of timber volume equations. The independent variables are diameter (**d**, in cm) and total tree height (**h**, in m). For each species there is a link in table **TreeSpecies** (field *ModelVolume_d_h*) to field *Code* in this table.
Parameter values must be written into the equations. The table includes the following fields:

VolumeModel2			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Integer	Equation number	
Equation	Text (200)		*See chapter 1.2*
ModelSource	Text		
Rules	Text	Logical rule	*Not obligatory*

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Table **BoleVolumeModel** includes information about bole volume equations. The independent variables can be among these: diameter (**d**, in cm), total tree height (**h**, in m), commercial tree height (**Hc**, m) or total tree timber volume (**V**, in m^3). The table **TreeSpecies** field *TimberTableFileName* contains the link into this table (i.e., model code number is given for each tree species).

Parameter values must be written into the equations. The table includes the following fields:

BoleVolumeModel			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Integer	Equation number	
Equation	Text (100)		*See chapter 1.2*
ModelSource	Text		
Rules	Text	Logical rule, based on DBH only. Variable name is '**d**'.	*Not obligatory*

Table **BiomassVariables** includes the title for the **biomass variable codes**. This table is **OPTIONAL**, and it has no usage in the Global Freeware version at the moment. It is used in Finland to compute results separately for tree components (i.e. stem, bark, leaves, needles, living and dead branches etc).

BiomassModel			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Variable	Integer		
Name	Text	Name of the model	
TreeClassList	Text	List of **TreeClass** codes, which are applicable for computing this variable.	*If this field in left blank, all tree classes are allowed*

Table **BiomassModel** includes information about **biomass equations**. See chapter 1.2 for the writing rules and variable names.

BiomassModel			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Integer	Equation number (for a group of models). Hence, there can more than one biomass variables computed for the trees.	There is a link from the table **TreeSpecies**, field **ModelBiomass** into this field.
Variable	Integer	Code links to the table **BiomassVariables,** field **Variable**	This field has no usage in the Global Freeware version at the moment.
Equation	Text (200)		*See chapter 1.2*
ModelSource	Text		
Rules	Text	Logical rule. Allowed variables are **d** and **h**	*Not obligatory*

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Table **BEF_Model** (optional) includes equations for computing **Biomass Expansion Factor** (BEF) as a function of tree's dimension(s). Allowed variables are as follows: DBH [d] and total tree height [h]. See chapter 1.2 for the writing rules and variable names in equations.

BEF_Model

FIELD	FORMAT	EXPLANATION	MORE INFO
Code	Integer	Equation number	There is a link from the table **TreeSpecies**, field **Model_BEF** into this field.
Equation	Text (100)		*See chapter 1.2*
ModelSource	Text	optional text about source of model	
Rules	Text	Logical rule. Allowed variables are **d** and **h**	*Not obligatory*

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Table **TaperCurveModels** (optional) includes information about **taper curve equations**. See chapter 1.2 for writing rules.

TaperCurveModels

FIELD	FORMAT	EXPLANATION	MORE INFO
Code	Integer	Equation number	There is a link from the table **TreeSpecies**, field **ModelTaperCurve** into this field.
TaperType	Value (Integer)	1= Variable form taper, 2= Sharma & Oderwald	
ModelSource	Text	Title of the model	
Parameter1	Value	1) Variable form taper: Alfa 2) Sharma&Oderwald: Beta	
Parameter2	Value	1) Variable f. taper: Gamma 2) Sharma: Gamma	
Parameter3	Value	Bark factor (1-Bark%)	
Parameter4	Value		*NOT IN USE*
StumpHeight	Text	Stump height	*Value (in meters) or an equation (with variable: 'd')*
Rules	Text	Logical rule. Allowed variables are **d**	*Not in use yet*

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Table **HeightModel** includes the height functions for regression analysis. Maximum number of models is ten. Tree height is computed using diameter (**d**) as an independent variable. The function has two parameters: A and B. The parameter values are not written into the formula, but they are written with letters **A** and **B**. Function must be written first in its linear form and it must be able to be solved by regression analysis. The form of the linear must be as follows:

$$Y\_dependent = \mathbf{A} + \mathbf{B} \times d$$

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The table includes the following fields:

HeightModel

FIELD	FORMAT	EXPLANATION	MORE INFO
Code	Integer	Equation number	
Equation	Text	Original function formula	
Y_dependent	Text	Linearized model's independent variable	
ModelSource	Text		*e.g. source of information*
Rules	Text	Logical rule	*Not in use, yet*

Timber dimensions and prices area in the table **TimberTable**. **The dimensions are only in use with the taper curves. Timber prices are in use with all methods**. The information is ordered in groups (=*TimberSource*) which can be different companies or regions, for instance. Each group must be adjusted one after another. When you enter your data about a new group, first write all log and then all pulp wood (or pole wood) dimensions and prices, finally other use wood price (fuel wood).

The table includes the following fields:

TimberTable

FIELD	FORMAT	EXPLANATION	MORE INFO
TimberCode	Integer	Id number	*No double values!*
TimberSource	Text	Group / Source	Rows in same group must be one after another in list
TimberName	Text	Name	*No use in program calculations*
TimberType	Integer	Timber code	0=other use timber 1=log timber 2=pulp timber
TimberQualityClass	Integer		*Not in use, yet*
Species	Text (list)	Species list or Species group code starting with '#', e.g. #1	*Separator comma (,). All species= asterix (*)*
MinUpperD	Value	Log's minimum diameter above bark (cm)	*Used in bucking with taper curves*
MinLenght	Value	Log's minimum length (m)	Used in bucking with Laasasenaho's taper (Finland)
MaxLenght	Value	Log's maximum length (m)	Used in bucking with Laasasenaho's taper (Finland)
ConstantDivisionValue	Value	Log's dimension share	*Used in bucking (Finland). In Finland usually 0.3 m for logs*
TimberValue	Value		*Per m3*
TimberValuePerTree	Value		*Per stem*
Rules	Text	Logical rule (variable can be	*This field can be*

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		diameter, **d**)	*blank*

Table **HeightCurveForInventory** includes ready made height curve equations, which can be used in the calculation of inventory results. The links to the models are given in the table **TreeSpecies,** field *ModelTreeHeightCurve*.

NOTICE. This table can **not** be left totally blank: there must at least one model, even though this model is not in use in inventory result computing. Hence we do recommend that there is always a default model number 1 in this table. The only independent variable in height curve model can be diameter (**d**).

Table includes the following fields:

HeightCurveForInventory			
KENTTÄ	**MUOTO**	**SELITE**	**TARKENNUS**
Code	Integer	Id number	*No double values!*
Equation	Text (100)		
ModelSource	Text (100)		*For instance model name or publisher*
Rules	Text	Logical rule	

Table *ResultGrouping* includes the following fields:

| *ResultGrouping*			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Count	Integer		Comes automatically, no use in program
DiameterLimits	Text (50)	Lower diameter limits of diameter classes for the inventory result sheet	Separator is semicolon (;)
AgeLimits	Text (50)	Lower tree age limits at the result sheet Format e.g. 4/ 0;5;10;15;20;25;30 where first value before '/' tells the index of **planting year** within *GeneralData* table's variable list (*PlotGeneral_x*). The planting year classes are defined in file **ForestParaInventory** as a plot level aggregated variable.	Separator is semicolon (;) In use in *Plantation version* only (see table *Program-Parameters,* field *PlantationInventory*).

The maintenance of this table is done easily through the program's main menu, command is *Settings*.

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1.6. *Forestpara.mdb*

> NOTICE!
> 1) The actual name of this file is given in **TreeParaInventory.mdb**, table *ForestParaFileDefinition*
> 2) There can be <u>more than one</u> this type of parameter file, e.g. one for each province. In this case, table *ForestParaFileDefinition* has a list of parameter file names. When the program starts, it asks to select the parameter file for a current province from a list.

The program uses MS Access2000 format database *Forestpara.mdb* for discrete class information. These tables are in use especially in Inventory result presentation. The database can include the following tables:
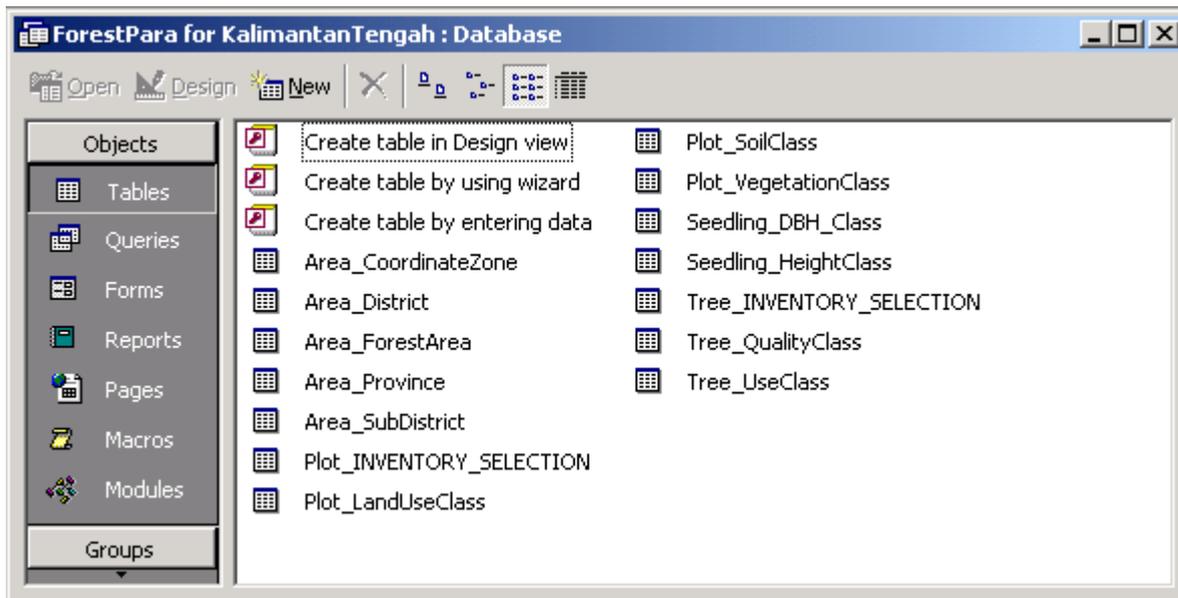
The tables are in four groups
1) Area_***   - predefined codes, names and areas (in ha) for inventory area
2) Plot_***   - aggregated plot data
3) Tree_***   - aggregated tree data
4) Seedling_***   - aggregated seedling data

The user can select which tables (plot and tree levels) are in use in the forest inventory. The selected table names are written into the following tables:
1) Plot_INVENTORY_SELECTION   - max. 10 variables
2) Tree_INVENTORY_SELECTION   - max. 5 variables

The user can create new variable tables with the help of MS Access.

Tables of **Area_***** contains the following fields:

Area_			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Text (10)		*No double values*
Name	Text	Explanation	
Area	Value (double)	Area in ha	This field is not in table *Area_CoordinateZone*

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Table Plot_INVENTORY_SELECTION contains the list of plot level aggregated variables It includes the following fields:

Plot_INVENTORY_SELECTION			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
DataOrder	Integer	Sort order in program menus	*No double values, max 10*
TableName	Text	Table name (**Plot_**_Name_)	
TitleInProgram	Text	Title in program menus	

Table Tree_INVENTORY_SELECTION contains the list of tree level aggregated variables. It includes the following fields:

Tree_INVENTORY_SELECTION			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
DataOrder	Integer	Sort order in program menus	*No double values, max 5*
TableName	Text	Table name (**Tree_**_Name_)	
TitleInProgram	Text	Title in program menus	

Tables **Plot_***** and **Tree_***** contain the following fields:

Plot_ & Tree_			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Text (10)	Class code	*No double values. This can be a text or a number*
Name	Text	Class name	

Tables of the type **Seedling_DBH_Class** and **Seedling_HeightClass** include the following fields:

Seedling_DBH_Class & Seedling_HeightClass			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Code	Text (10)		*No double values*
Name	Text	Class name	
ClassMidValue	Value	Mean value of the class	

An example of inventory parameters in Zambia:

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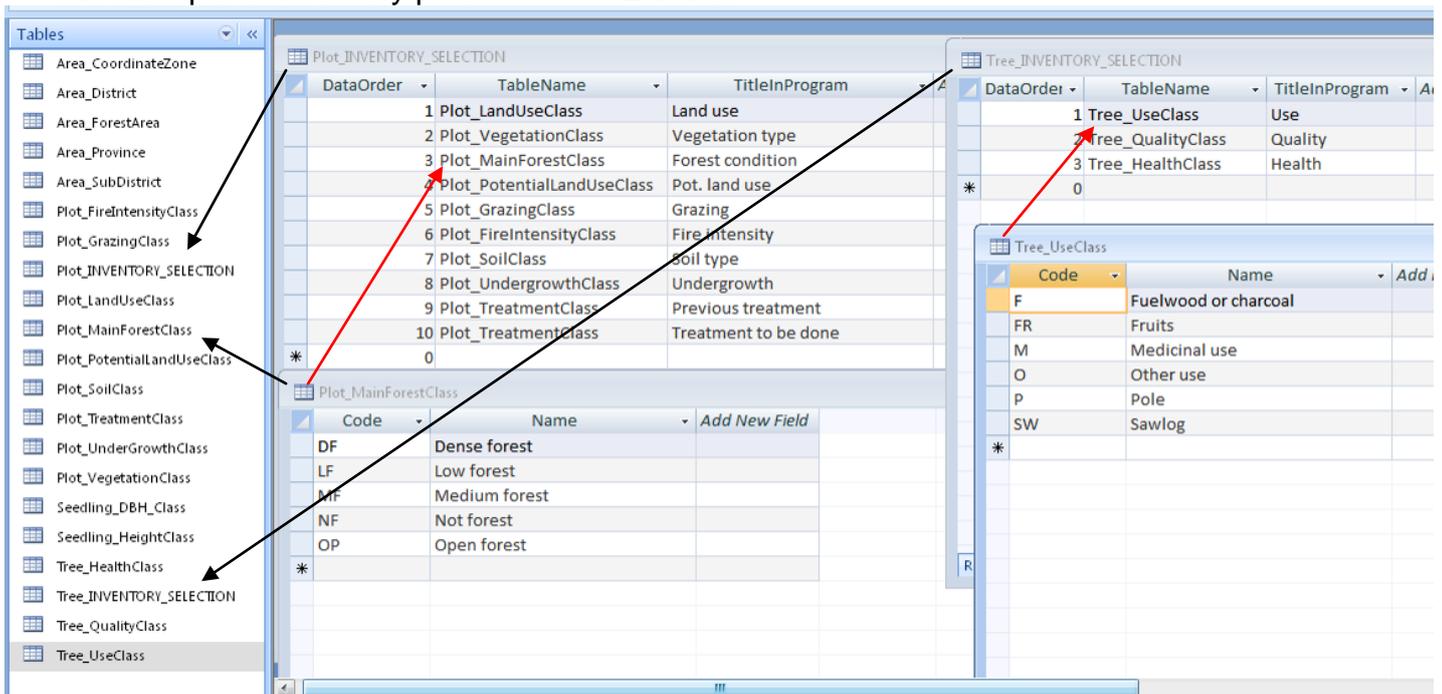
1.7. Timber percentage files

<div style="border:1px solid black; padding:10px">

NOTICE

These files are currently used in Finland only. However, this methodology can be adapted in other counties too. However, please look at definition of table **TreeSpecies**, field **_TimberTableFileName_**.

</div>

Timber percentages for log and pulp wood collaborate with volume functions read from the database, they do not work with taper curves. Timber percentages are saved in ASCII files in the program folder. The file name for each species is entered in the table **TreeSpecies**, field **_TimberTableFileName_** (without the folder name). This information is not obligatory if there are no log and pulp wood percentages for some species.

Log and pulp wood percentages are entered for each diameter-height pair in a matrix form, as integer values. The file has the following structure:

> **A comment row** begins with the exclamation mark (!). Comment can also be written at the end of any row. An example:

```
! Table 1, Taulukko 1: Manty / Scots pine
! This file contains log tree table, unit is %
```

The matrix limits are written as follows:
        D Minimum Maximum Range   - _diameter (cm)_
        H Minimum Maximum Range   - _tree height (m)_

For instance:
`D 4 50 1`   → Diameter runs from 4 cm up to 50 cm, with 1 cm intervals. The separator is space.

Percentages are listed after word `DATA` .

Diameter runs in rows, height in columns. Row starts with letter **A** or **B**. A means log percentage, B means pulp wood. Sum of these two numbers may not exceed 100. An example:

```
A  0  0  0  0 10 10 93 93 93 93 93 93 93 93 98 97 96 96 95 94 98 97
B 95 96 98 98 91 91  6  6  6  6  6  6  6  6  1  2  3  3  4  5  1  2
```

If you make new files or edit the existing files, check that number of rows and columns is correct. A practical way to edit these files is to open them with word processing software and change the page settings to _Landscape_ and font type to _Courier_.

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2. Data files

2.1. Input data

The input file includes measured data from the sample plots. The format is MS Access2000 and the file has the following tables:

- AreaData   - Inventory area information (metadata)
- Variables   - Description of plot type and measured variables
- GeneralData   - Plot data
- SampleTrees   - Tree data
- SubSampleData   - Seedling data
- StratumData   - Areas and names of strata
- LineData   - Transect line information

The structure is a copy of file **ModelInputData.mdb**. **Do not edit or delete this file!**
The database file name is of the form **FC_DataInput_x.mdb**, where **x** is the database number.

Table **AreaData** metadata of database. It includes the following fields:

AreaData			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Province	Text (30)	Province name or code	see codes in file **Forestpara.mdb**
District	Text (30)	District name or code	see codes in file **Forestpara.mdb**
Sub_District	Text (30)	Sub district name or code	see codes in file **Forestpara.mdb**
AreaName	Text (100)	Name for the inventory area	
CoordinateZone	Text (10)	Coordinate System or Zone code	see codes in file **Forestpara.mdb**
Information	Text (200)	Any additional information	

Table **Variables** includes the following fields:

Variables			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Plot	Text (20)	Plot number	
PlotType	Text (1)		1=rectangular 2=circular 3=concentric circle 4=relascope 5=nested rectangular
PermanentSamplePlot	True/False (Boolean)		Default=FALSE
VariableList	Text (list)		1=measured 0=not measured
TreesInGroups	True/False (Boolean)	Trees by diameter classes	*Not in use*
LocationMethod	Value	Tree locations (coordinates)	0=not measured 1=X,Y 2=azimuth, distance
PlotDirectionWithLine	True/False (Boolean)	Rectangular plot: left plot side azimuth in direction	*Not in use* Default= TRUE

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		with inventory line	
SeedlingNumber	True/False (Boolean)	Seedling subplot measured	Default=FALSE

Table **GeneralData** includes the following fields:

GeneralData

FIELD	FORMAT	EXPLANATION	MORE INFO
Plot	Text (20)	Plot number or code	
Stratum	Text (20)	Stratum code	
Plot_w	Value	Plot width or radius or relascope factor	
Plot_l	Value	Plot length	*(only if rectangular plot)*
SubPlot_w	Value	Sub plot width or radius	To be used with SEEDLING data
SubPlot_l	Value	Sub plot length (main side)	To be used with SEEDLING data *(only if rectangular subplot)*
MultiPlot	Text	Variable area plot	Separator semicolon (;)
MDay	Integer		
MMonth	Integer		
MYear	Integer		
Measurer	Text (50)		
PlotGeneral_1	Text (10)	Variables defined in FORESTPARA.MDB, table Plot_INVENTORY_SELECTION. (Maximum of 10 variables)	
PlotGeneral_2	Text (10)		
PlotGeneral_3	Text (10)		
PlotGeneral_4	Text (10)		
PlotGeneral_5	Text (10)		
PlotGeneral_6	Text (10)		
PlotGeneral_7	Text (10)		
PlotGeneral_8	Text (10)		
PlotGeneral_9	Text (10)		
PlotGeneral_10	Text (10)		
YearsFromCutting	Value		*Not in use*
Information	Text		
GPS_X	Value (Double)	Plot's X-coordinate	
GPS_Y	Value (Double)	Plot's Y-coordinate	
GPS_Z	Value (Double)	Plot's altitude	
PlotDirection	Value	Plot's azimuth (main side), *In North sector (degrees), only with rectangular plot*	*Not in use*
LineAzimuth	Value	Azimuth from previous plot (degrees)	
LineLength	Value	Distance from previous plot (m)	
LineLengthTotal	Value		
PlotWeight	Value	Weight for plot area in computing	Default= 1
PlotSlope	Value	Slope of the terrain, degrees	Default=0
PlotAspect	Value		*Not in use*
ImageFileName	Text (100)	Photo of sample plot	
EntryDate		Date when data entered Format YYYYMMDD	*From v. 5.5.5*

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EditDate		Date when data edited Format YYYYMMDD	*From v. 5.5.5*
EditTime		Last time when data entered or edited Format HH:MM	*From v. 5.5.5*
Editor		Editor's name	*From v. 5.5.5. In* **Plantation version** *only.*

Table **SampleTrees** includes the following fields:

SampleTrees

FIELD	FORMAT	EXPLANATION	MORE INFO
Plot	Text (20)	Plot number or code	
TreeNumber	Value		
Species	Text (10)		
TreeClass	Integer	*0 –7* *1= DEFAULT*	0=other use tree (no log and pulp) 1=log 2=pulp, staying 3=log, to be cut in the next harvesting 4=pulp, to be cut in the next harvesting 5=dead tree 6=stumpage 7=branch
D	Value	Diameter at the breast height, DBH (cm)	
H	Value	Total tree height (m)	
Bark	Value	(mm)	Sum from two sides (at 1.3 m)
D0	Value	Diameter at ground level or at stumpage height (cm)	
Hstump	Value	Stump height (m)	
Hc	Value	Crown height (m) or Bole height (m)	
Age	Value	(years)	
Ir	Value	Radius increment (mm)	*)*
Ih	Value	Height increment (m)	*)*
NumberOfTrees	Integer	Number of trees in diameter class	*Not in use*
X_Coord	Value	Tree's X-coordinate on the plot (m) OR azimuth angle (degrees)	*Information depends on the plot type*
Y_Coord	Value	Tree's Y-coordinate on the plot (m) OR distance to plot's origo (m)	
TreeClassVariable_1	Text (10)	*Variables are defined in FORESTPARA.MDB, table Tree_INVENTORY_SELECTION*	
TreeClassVariable_2	Text (10)		
TreeClassVariable_3	Text (10)		
TreeClassVariable_4	Text (10)		
TreeClassVariable_5	Text (10)		

*) Increment period in years is read from the database *TreeparaInventory.mdb*: table **ProgramParameters**, field *DefaultIncPeriod* (the default value is 5 years)

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Table **SubSampleData** contains the following fields:

SubSampleData			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Plot	Text (20)	Plot number or code	
SeedlingNumber	Value	Observation number	
Species	Text (10)	Species code	
NumberOfCases	Integer	Number of cases	
DiameterClass	Text (10)	Class code, see *FORESTPARA.MDB,* table **Seedling_HeightClass**	
HeightClass	Text (10)	Class code, see *FORESTPARA.MDB,* table **Seedling_HeightClass**	

Table **StratumData** contains the following fields:

StratumData			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
ReportArea	Text (100)	Reporting area, where strata are located. Can be left blank.	e.g. "Forest area"
Stratum	Text (20)	Stratum code	PRIMARY STRATUM CODE
StratumNumber	Value (Double)	Stratum Id as number	Needed e.g in ArcGIS Geodatabase linkage
Area	Value		*In hectares*
Information	Text (100)	Stratum name	

Table **HeightSampleTrees_Kenya** contains (dominant height) sample trees in Kenyan version of the program. The table contains the following fields:

HeightSampleTrees_Kenya			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Plot	Text (20)		
TreeNumber	Value		
Species	Text		
D	Value	Diameter (DBH)	cm
H	Value	Height	m

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Table **LineData** contains the following fields:

LineData			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
LineNumber	Long integer		
Stratum	Text (20)	Stratum code	*=Forest area*
GPS_X	Value (Double)	Starting point X-coordinate	
GPS_Y	Value (Double)	Starting point Y-coordinate	
GPS_Z	Value (Double)	Starting point altitude	
FirstPlotNumber	Text (20)		
LineAzimuth	Value		In degrees
LineLength	Value		In meters
LineLengthTotal	Value		In meters, *NOT IN USE*
Information	Text	Additional text about line	

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2.2. Result data

The result file contains computed results of the sample plots. The file format is MS Access2000 and the database has the following tables:

- SpeciesModel — model parameters
- NumTreeResult — tally tree dimensions
- NumTreeResultPast — tally tree dimensions at the beginning of growing period
- NumTreeBiomass — tally tree biomasses (/hectare)
- SpeciesResult — results for species and tree classes
- PlotResult
- SeedlingResult
- StratumResult — results for strata

The structure is a copy of file **ModelResultData.mdb**. **Do not edit or delete this file!**
Database file is of the form **FC_DataResult_x.mdb**, where **x** is the database number.

Notice: *InvArea* (unit is hectare) in table **PlotResult** means plot's proportion of the total inventory area.

Table **SpeciesModel** includes models' parameters and the meaning of each field can be read from field headers. One detail: in field **HeightModelNumber** the number refer to the following models:

0 = tree height was given, not estimated
1 = model from the height model table (parameter file *TreeparaInventory*, Table *HeightCurveForInventory*).
2 = Veltheim model (in Finnish version only)
3 = regression (Näslund)
4 = regression (polynomic model)
5 = regression (Schumacher model)

Table **NumTreeResult** contains information of tree dimensions at the time of measurements. The table has the following fields:

NumTreeResult			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Count	AutoNumber	Automatic ID	
Plot	Text (20)	Plot code	
TreeNumber	Value		
Species	Text (10)		
TreeClass	Value		
D	Value	(cm)	
H	Value	(m)	
Bark	Value	(mm)	
D0	Value	(cm)	
Hstump	Value	Stump height (m)	
Hc	Value	(m)	
Age	Value	(years)	
Ir	Value	Diameter increment (mm)	In 1 year
Ih	Value	Height increment (dm)	In 1year
BA	Value	Basal area	m^2/ha
Stocking	Value		Trees/ha
VolTree	Value	Stem volume (m^3/ha)	
VolLog	Value	Log volume (m^3/ha)	
VolPulp	Value	Pulp timber volume (m^3/ha)	
VolOther	Value	Other timber volume (m^3/ha)	
ValueTree	Value		(UNITS /ha)
ValueLog	Value	Log value	(UNITS /ha)
ValuePulp	Value	Pulp timber value	(UNITS /ha)
ValueOther	Value	Other timber value	(UNITS /ha)

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Table **NumTreeResultPast** includes information of the trees *n* years ago from the measuring date (Default: 5 years. This parameter is given in *TreeparaInventory.mdb*, table *ProgramParameters*). There are data in this table only if increments are measured. The first fields are the same as in table *NumTreeResult*, with the following extra fields:

NumTreeResultPast			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
(... see table NumTreeResult)			
VolIncTree	Value	Tree volume increment (m^3/ha)	Annual
VolIncLog	Value	Log timber change (m^3/ha)	Annual
VolIncPulp	Value	Pulp timber change (m^3/ha)	Annual
VolIncOther	Value	Other use timber change (m^3/ha)	Annual
ValueIncTree	Value	Value increment (UNITS/ha)	Annual
ValueIncLog	Value	Log timber value change	Annual
ValueIncPulp	Value	Pulp timber value change	Annual
ValueIncOther	Value	Other use timber value change	Annual

Table **NumTreeBiomass** includes tree biomass results. Table includes the following fields:

NumTreeBiomass			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
TreeID	Value	Refers to the field **Count** in the table **NumTreeResult**	
Plot	Text (20)		
TreeNumber	Value		
Variable	Value	See **TreeparaInventory**, table **BiomassVariables**	
Result	Value		*Unit / hectare*

Table **SpeciesResult** includes summary information computed by species and tree classes. This table includes summary information of the whole plot too: if field *Species* is equal to '*' and *TreeClass* is equal to **100,** it means that this row includes information of all species (='*') which are alive (=100). On the other hand, if field *Species* is equal to '*' and *TreeClass* is equal to **5**, this row has information of all the dead trees on the sample plot.

The table includes the following fields:

SpeciesResult			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Plot	Text (20)	Plot code	* = all species in the stratum
Species	Text (10)		* = all species in the plot
TreeClass	Value		100= all living trees, see Tree Class codes
TallyTreeCases	Value	Number of tally trees on the plot	NOT IN USE
SampleTreeCases	Value	Number of sample trees on the plot	

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Stocking	Value		Trees/ha
D_min	Value	Minimum diameter (cm)	
D_max	Value	Maximum diameter (cm)	
D_med	Value	Median diameter (cm)	
D_weighted	Value	Weighted mean diameter (cm). Weight factor is tree basal area.	
D_std	Value		Standard deviation
H_min	Value	Height dimension..	
H_max	Value		
H_med	Value		
H_weighted	Value		
H_std	Value		
V_increment	Value	Volume increment	/ha (annually)
Age_min	Value	Age ..	
Age_max	Value		
Age_weighted	Value		
BasalArea	Value		/ha
TotalVolume	Value		/ha
TotalVolumeLog	Value		/ha
TotalVolumePulp	Value		/ha
TotalVolumeOther	Value		/ha
TotalValue	Value		/ha
TotalValueLog	Value		/ha
TotalValuePulp	Value		/ha
TotalValueOther	Value		/ha
Value_increment	Value		UNITS/ha (annual)
Volume_min	Value	Minimum stem volume	
Volume_max	Value	Maximum stem volume	
Volume_weighted	Value	Weighted mean volume. Weight factor is tree basal area.	
Biomass_Stem	Value		tons/ha
Biomass_AG	Value	Above ground	tons/ha
Biomass_BG	Value	Below ground	tons/ha
Biomass_Total	Value		tons/ha
Carbon_Stem	Value		tons/ha
Carbon_AG	Value	Above ground	tons/ha
Carbon_BG	Value	Below ground	tons/ha
Carbon_Total	Value		tons/ha

Table **PlotResult** includes results for the plots.

PlotResult			
FIELD	**FORMAT**	**EXPLANATION**	**MORE INFO**
Stratum	Text (20)		
Plot	Text (20)	Plot code	
PlotType	Text (1)	Plot type	See input data file, table *Variables*
Area	Value	Plot size (m^2)	If plot type is 1–3. For concentric plot: max. circle
Ddom	Value	Arithmetic mean of	

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		dominant trees DBH (cm)	
Hdom	Value	Dominant trees' (arithmetic) mean height (m)	
TimberSource	Text	Selected timber source in program menu	
InvArea	Value	Plot's proportion in the inventory area or stratum	*In hectares*
InvArea2ndSampling	Value	Plot's proportion of total inventory area or stratum	*In use in Zambia only.*
CalculationDate	Text		DDMMYYYY

Table *SeedlingResults* includes the following fields:

SeedlingResult

FIELD	FORMAT	EXPLANATION	MORE INFO
Plot	Text (20)	Plot code	
Area	Value	Plot area, m2	
Species	Text (10)	Species code	
Stocking	Value (double)	Number of seedlings per ha	
D_Mean	Value	Mean diameter (cm)	
H_Mean	Value	Mean height (m)	
TotalAmount	Value (double)	Volume or biomass	Not in use (Reserved for bamboo biomass calculation)

Table *StratumResults* includes the following fields:

StratumResult

FIELD	FORMAT	EXPLANATION	MORE INFO
Stratum	Text (20)	Stratum code	Stratum '-999' means results for inventory area (total area)
Area	Value (double)	Stratum area (ha)	
TreeClass	Integer	Tree class code: 100= all living trees 5 = all dead trees 105= living + dead trees 20 = seedling data (subplot data)	
PlotCount	Long Integer	Total number of plots in stratum	
Species	Text	Species code	
SpeciesName	Text		
Vol_Mean	Value	Mean volume (m3/ha)	
Vol_Std	Value	Standard deviation of volume (m3/ha)	*The formula for sample is applied*
Vol_SE	Value	Standard error (m3/ha)	
Vol_ConfLimit1	Value	Lower confidence limit (95%)	
Vol_ConfLimit2	Value	Upper confidence limit (95%)	
Vol_CoefVariation	Value	Coefficient of variation for total volume	
VolLog_Mean	Value	Mean log timber volume (m3/ha)	

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VolLog_Std	Value	Standard deviation of log timber volume (m3/ha)	*By formula of sample*
VolPulp_Mean	Value	Mean pulp timber volume (m3/ha)	
VolPulp_Std	Value	Standard deviation of pulp timber volume (m3/ha)	*By formula of sample*
VolOther_Mean	Value	Mean for other use timber volume (m3/ha)	
VolOther_Std	Value	Standard deviation of other use timber volume (m3/ha)	*By formula of sample*
V_increment	Value	Volume increment (m3/ha)	
Value_increment	Value	Value increment, /ha	
Stocking	Value	Number of trees/ha	
D_weighted	Value	Mean diameter, weighted by tree basal area	*If TreeClass=20 (seedlings), weight factor is density*
H_weighted	Value	Mean height, weighted by tree basal area	*If TreeClass=20 (seedlings), weight factor is density*
Age_weighted	Value	Mean age, weighted by tree basal area	
BasalArea	Value	Basal area (m2/ha)	
Value_Mean	Value	Value /ha	
ValueLog_Mean	Value		
ValuePulp_Mean	Value		
ValueOther_Mean	Value		
Biomass_Stem	Value		tons/ha
Biomass_AG	Value	Above ground	tons/ha
Biomass_BG	Value	Below ground	tons/ha
Biomass_Total	Value		tons/ha
Carbon_Stem	Value		tons/ha
Carbon_AG	Value	Above ground	tons/ha
Carbon_BG	Value	Below ground	tons/ha
Carbon_Total	Value		tons/ha
LevelName11	Text	Kenya: Province	
LevelName2	Text	Kenya: District	
LevelName3	Text	Kenya: Forest Station	
LevelName4	Text	Kenya: Block	
LevelName5	Text	Kenya: Compartment	
LevelName6	Text	Kenya: Subcompartment	
MeasurementDate	Number	in number because of easier SQL queries	YYYYMMDD
PlantingYear	Number	Kenya version	

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Copyright and liability

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