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FINNISH FOREST RESEARCH INSTITUTE

MELA2009

Reference Manual (2nd edition)

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Preface

MELA2009 Reference Manual (2nd edition) is the documentation of the updated MELA Version 2009. MELA2009 Reference Manual (2nd edition) is published electronically only and made available for public in Internet.

Hannu Hirvelä, Kari Härkönen, Visa Redsven, Olli Salminen and Markku Siitonen designed, programmed and documented the new features of the software:

The new or changed features of the MELA2009 (released in November 2009)

- The energy wood harvesting alternatives either by collecting the logging residues (branches, tops and/or stumps) after the traditional commercial roundwood cuttings or as an independent energy wood cuttings has been installed. The time expenditure models concerning energy wood harvesting are based on mainly the studies of Laitila et al. (2004, 2007), Kärhä et al. (2004, 2006) and Heikkilä et al. (2005).
  In order to run energy wood harvesting alternatives the user has to make for each of them a new EVENT definition. Especially she/he must define the energy wood harvesting type using the first specific EVENT_CALL argument for cuttings. There are ten (0–9) specifications for each cutting method (1–6):
  - .0 or empty: only commercial roundwood cuttings (pulpwood and logs)
  - .1: branches (including partly foliage) and stem residues of felled trees from the commercial roundwood cuttings are hauled for energy wood
  - .2: stumps and roots (> 10 cm) of felled trees from the commercial roundwood cuttings are lifted for energy wood (branches and stem residues are left on the ground)
  - .3: branches (including partly foliage), stems, stumps and roots (> 10 cm) of felled trees from the commercial roundwood cuttings are hauled for energy wood
  - .4: integrated harvesting of roundwood and energy wood - energy wood is harvested using whole-tree method
  - .5: integrated harvesting of roundwood and energy wood - energy wood is harvested using partial tree method
  - .6: integrated harvesting of roundwood and energy wood - energy wood is harvested using trunk method
  - .7: pure energy wood harvesting using whole-tree method
  - .8: pure energy wood harvesting using partial tree method
  - .9: pure energy wood harvesting using trunk method

  Further there are four new parameters made for energy wood harvesting:
  ENERGYWOOD_LOGGING,
  ENERGYWOOD_LOGGING_COSTS,
  ENERGYWOOD_PRICES,
  ENERGYWOOD_USE_POINTS
  and the parameter SUBS_AND_TAXES has changed due to the energy wood harvesting (new arguments 17–19). The users are strongly recommended to apply the parameters

with own values, though the MELA can be run, of course, using the default values.

- The biomass models of Repola (2009a, 2009b) have been incorporated into the MELA besides of Marklund's (1988) models. The choice between Marklund's (1988) and Repola's (2009a, 2009b) models is made by using the new MELA2009 parameter BIOMASS_MODELS. Repola's models are defaults.
- Associating to the biomasses and energy wood harvesting the calculation of the carbon and heating values has been included. There are new parameters CARBON_PERCENTS and HEATING_VALUES for the calculations of carbon and heating values.

- The time expenditure models of Kuitto et al. (1994) concerning mechanized roundwood cuttings have been replaced partly with the models of Rajamäki et al. (1996) and Väkevä et al. (2001). The productivity figures of the work agreement 2008 (Metsäalan ... 2008) concerning manual logging work are also applied.
- The diameter distribution models of Siipilehto (2007,2009) have been made also available by the usage of the parameter DIAMETER_DISTRIBUTION.
- The reporting possibility of the collective variables in the stand management files (mpu type files) besides the MSD-, MSR- and c-variables has been added. See the changed parameter MPS_VARIABLES.
- Coordinates can be given in EUREF-FIN coordinate system. The default coordinate system in the MELA2009 is Finnish uniform coordinate (YKJ)system. If the user wants to apply the EUREF-FIN (ETRS-TM35FIN) coordinate system she/he must take into the use the new parameter YKJ_COORDINATES with the value 0.
- The syntax of the parameters LOG_VOLUME_CALIBRATION, DIAMETER_DISTRIBUTION, GROWTH_CALIBRATION and VOLUME_CALIBRATION has been changed: in the MELA2009 with these parameters values only for one region can be given (in MELA2007 there were 20 regions). If the user applies these parameters, each region must in the MELA2009 simulate separately.

Though the user does not make any changes between the MELA2009 and MELA2007 runs the results will, however, differ a little bit due to the updating of the time expenditure functions of logging. For example according to Väkevä et al. (2001) time expenditures of forest haulage in thinnings increased on average 7,6 % and decreased in final cuttings on average 4,8 % as compared to Kuitto et al. (1994). These changes are made at the system level and the user cannot affect on them.

The new data collection requests (i.e. new collective variables) with the FOREST_REPORT parameter have been extended to cover the new features of the MELA2009.There are several new collective variables for the reporting the energy wood, and for calculations of carbon stock and heating energy. The users are highly recommended to get familiar with these possibilities in order to get more out of their MELA analysis.

<u>The new and changed features of the MELA2009 2nd edition (released March, 2011)</u>

- The reporting possibility of the management report text records also originating from the simulation has been added. Management unit level information of simulation record

variables (MSR-variables), decision data record variables (MSD-variables), collective variables, and/or c-variables can be now provided also from MELASIM as has been possible previously from MELAOPT. The procedure and parameters are similar than in MELAOPT, but the results are reported from each aimulated management schedule and therefore the output can be very large. Of course, when using re-simulation only the chosen management schedules are reported.

- New arguments (6 and 7) for the LOGGING_COSTS-parameter. Argument 6 is for the organization costs and argument 7 for the machine transfer costs due to the tradiotional round wood logging.
- The calculation of the indicating percents (WP1-WP5) for a management units and the possibility printing out the used land values (LDV1-LDV5) have been inserted. Users should note that it is sensible to report the WP's and the LDV's only at the management unit level.
- New collective variables
  - state variables: G (basal area) and N (number of stems)
  - event variables: IV (growth), MR (natural mortality), DR (total drain), ORA, ORN OSR, OCA, OCY, (acreages of artificial and natural regeneration, soil preparation, clearing and tending), LRA, LSR, LCA, LCY (labor expenditure days of artificial regeneration, soil preparation, clearing and tending), WRA, WSR, WCA, WCY (costs of artificial regeneration, soil preparation, clearing and tending)
  - category variable: MC (cutting method)
- The stump lifting time expenditure models of Laitila et al. (2007) have been replaced with the new models of Laitila (2010).
- The costs and partly also the acreage (regeneration) of the non-commercial small wood removals in cuttings have been classified into the clearing work. The cost of planning and administration due to the energy wood logging have been added. Furthermore, there have been made some internal modifications concerning the deduction and execution of the energy wood logging alternatives.
- The list of the municipalities has been updated to reflect the situation on 1.1.2011 (see http://www.vaestorekisterikeskus.fi).

<u>The new and changed features of the MELA2009 2nd edition (released August, 2011)</u>

- The arguments (1-3) of the ENERGYWOOD_LOGGING –parameter have been changed to be given by tree species wise (8 tree species), thus the number of arguments has increased by 21 (3*7 new arguments) and the total number of arguments is 31 (the old one was 10). Arguments 1-8 are used to define by tree species the minimum diameter of a tree and arguments 9-16 define the maximum diameter of a tree valid for energy wood, and arguments 17-24 define the minimum stumpage diameter for stumps valid for lifting.
- The error which hampered thinning based on the number of stems of the energy wood logging has been fixed.

Joensuu and Vantaa, 22 August 2011

Editors

The short MELA history

Pre-history:

1968 The first Finnish computerised cutting budget based on operation research methods (Kilkki 1968): the solution of a forest level planning problem (income-oriented cutting budget) using linear programming.

1975 A long-term timber production model for large forest area using simulation controlled by decision rules (Kilkki & Pökälä 1975).

1975, 1976 Numerical simulation of treatment alternatives for stands for integrated stand and forest level optimisation using LP (Kilkki et. al. 1975, Kilkki & Siitonen 1976). The approach to delineate the stands falls into the Model I category of Johnson & Scheurman (1977) classification.

Version history:

MELA The first fully operational MELA version (Siitonen 1983).
General features:
- automated simulation
- distance independent treewise natural process models documented in Metsien hoidon ... (1985) and in Ojansuu et. al. (1991).
- stand and forest level solutions using the linear programming package MINOS (Murtagh & Saunders 1980) and since the late 1980's the JLP software (Lappi 1992). The inclusion of the JLP - designed especially for the MELA - made it possible to obtain more efficient solutions of large problems and constraints also for any overlapping subsets of stands, including hierarchical forestry units.

MELA96 MELA product and documentation as the MELA Handbook (Siitonen et. al. 1996).
MELA extensions for applying also stand level forest data.

MELA98 The new growth models of Hynynen et. al. (1999).

MELA99 Extended and more open user-control of parameters.
Time expenditure/productivity functions of Kuitto et. al. (1994), Rummukainen et. al. (1995) and Metsäpalkkarakenteen uudistaminen (1995).
New growth models also for peatlands and for birch on mineral soils (Hynynen et. al. 1999).
Revision of the MELA handbook (Siitonen et. al. 1999).

MELA2000 New extension features and the user's guide for extension parts (Kilpeläinen et. al. 2000).
New features (e.g. retained trees) for event definitions in simulation.
Revision of the MELA handbook (Siitonen et. al. 2001).

MELA2002 User-defined decision variables by using parametrised data collection requests (the FOREST_REPORT parameter) and reformulation of the management schedule (**msd** type) files.
New sawlog reduction model (Mehtätalo2002).
Tools for session monitoring and error detection.
A set of new models into extensions for initial data conversion of Maltamo & Kangas (1999), Maltamo et. al. (2002) and Nissinen (2002).
Currency change from FIM to EUR.
Reformulated MELA Reference manual (Redsven et. al. 2002).

MELA2004 New models for tree mortality (Jutras et. al. 2003, Nuutinen et. al. 2004) for peatlands and adjustments of growth models of Hynynen et. al. (2002).
The more facilitate use of transfer files.
Revision of the MELA reference manual (Redsven et. al. 2004).

MELA2005 Local (sub-period) extrema (Pmin, Pmax) and respective margins of decision variables.
Biomass estimates based on Marklund's (1988) models.
Net present values also based on stumpage prices.
Updated list of the municipalities reflecting the situation on 1.1.2005 (see www.vaestorekisterikeskus.fi).
Revision of the MELA reference manual (Redsven et. al. 2005).

MELA2007 The data collection requests with the FOREST_REPORT parameter are extended to cover the more versatile needs of the users.
The unit prices and unit costs can be given by periods (up to nine periods) which makes it possible for example to study the effects of price changes in the MELA analysis.
The subsidies and taxes are incorporated to MELA.
In MELAOPT there has been added a SUM_UP command for summing up results from several msc and msd type files into a one sum type report file.
The new (2006) Finnish silvicultural recommendations are installed as default values in MELA2007.
Updated list of the municipalities reflecting the situation on 1.1.2007 (see www.vaestorekisterikeskus.fi).
Revision of the MELA reference manual (2007).

Notation, conventions and layout

Layout

This manual is intended to be modular. A module covers a single item or subject. Each module contains even number of pages, so there can be empty pages between different modules. Chapter numbers are not used in the electronic version of this manual. References are mostly carried out with hyperlinks.

Typographic conventions

Following typographic conventions are used in this manual:

Example	Description
MELASET.PAR	The uppercase, bold text indicates file names.
SIMULATE	The uppercase, plain text indicates MELA commands, parameter names (see note 1) and symbol definitions.

Generic font in this manual is Times New Roman, common font size in chapters is 12.

Syntax descriptions

Syntax descriptions are shown in boxes:

```
SIMULATE application forestry_unit[,forestry_unit]
```

Example(s)	Description
SIMULATE	Obligatory component in **bold** font, also repeatable components.
{i}	Optional component in normal font. Notice that curly brackets here are the delimiter pair of expression.
[]	Repeatable component in normal or **bold** font in (nested) brackets.
<=> <=	Relational operator.
'string'	A (constant) character string given such as single quote.
string	A (user-supplied) character value.

Font in syntax descriptions is Courier New, font size 10.

Legends

Legends may follow syntax descriptions. Each legend corresponds to the certain component of the syntax. Component of the syntax is shown with the same font type and size as in syntax description.

Explanatory examples

Syntax descriptions may be directly followed by explanatory examples. Explanatory examples are in dotted boxes:

```
=1
=40<=80,>100,90
```

Explanatory examples are more indented than syntax descriptions. Font is `Courier New`, font size 10. See note 2.

Notes

1. Few MELA parameter names are shown in lowercase letters, and some parameter names are mixed with lowercase and uppercase letters.

2. Values in the explanatory examples are for demonstrative purposes. They should not be understood as default values.

OVERVIEW

Introduction

What is MELA?

MELA is a forestry model and an operational decision support system for solving such problems as (1) what are the production potentials of forests, and (2) how to manage forest stands in order to achieve the overall goals for forestry. In MELA, the management of forests is endogeneous, i.e. the decision when and how to cut an individual management unit is based on the user-defined goals and restrictions concerning the production or status of the whole forest area and domains in question over the planning period. The growth, felling regimes and the development of growing stock are the results of the analysis.

MELA consists of two parts: (1) an automated stand simulator based on individual trees and (2) the optimisation package based on linear programming, JLP (Lappi 1992).

MELA simulates a finite number of feasible and alternative management schedules (options) for the management units over the chosen calculation period automatically according to the given simulation instructions. Management schedules differ from each other, for example, in timing of management activities. After simulation MELA can be used to select from these options simultaneously both a production programme for the whole forest area and corresponding management schedules for the individual management units according to the optimisation problem (goals and restrictions) defined by the user.

Simulation of schedules for management units

The aim of the simulation is to produce a finite number of management schedules (or optional "yield tables") for each management unit. A management unit may represent one stand or a set of homogeneous stands with regard to the present stand characteristics and the expected future management and development. All the management schedules over the units represent the management and production possibilities of the whole forestry unit.

A management unit in MELA is described in the simulation by one or more sample plots, and the growing stock on the sample plots by simulation trees. The sample plots represent the spatial, tree species etc. variation within the management unit. The number of simulation trees may vary from one to the whole tree population of the management unit.

Sample plots and simulation trees have to be furnished with the site and tree variables necessary for further calculations. The main simulation variables for trees in the current simulator version are number of stems/ha (that each tree represents), tree species, diameter, height and age. These simulation variables are transformed into volumes, timber assortments and values etc. using respective general models.

The simulation trees may be actual measured trees or computed trees derived from stratum data using a conversion routine offered as a MELA extension.

The simulation of the management schedules for each management unit consists of states and events. The events are natural processes (e.g. ingrowth, growth and mortality of trees) and management activities (e.g. cuttings, silvicultural treatments, drainage of peatland, fertilisation, and changes in land use) simulated by the built-in basic event routines of the MELA simulator. The tasks of the basic event routines are to decide the feasibility of the basic events in each state of the management unit, to simulate the details of the basic events (such as logging costs), and to collect the summarised variables. Branching of the simulation is caused by several optional events in the same state. The event parameter of the MELA simulator makes it possible to define a set of optional events for each simulation application within the built-in event routines and their arguments.

The development of the growing stock is predicted using the simulation trees of the sample plots. A set of detailed models based on individual trees describing natural processes, human activities (or treatments), timber prices, costs, management instructions etc. is utilized. For example, the growth of the trees is predicted by using stem diameter and height increment models. Increment of diameter, for example, is a function of tree species, diameter and height of the tree, basal area of the stand, site type, geographical location, etc. (Hynynen et al. 2002, Ojansuu et al. 1991). Tables for volume and timber assortments are obtained from stem curve models as a function of tree species, diameter and height (Laasasenaho 1982). The value of the stems is calculated from timber assortments and unit prices. Respectively, the costs of logging and silviculture are calculated from unit prices and time expenditure models (Kuitto et al. 1994, Rummukainen et al. 1995) or from user-supplied time expenditure assumptions. The total figures of the sample plots and further of the management units are obtained as sums of the trees.

The development of the trees is predicted on the basis of the characteristics of each tree and the sample plot. The feasible treatments are selected on the basis of the average characteristics of the management units, but the simulation is carried out on each individual sample plot.

Only the expected values of the models are used in the simulation. The stochastic variation in natural processes, for example in the growth of the trees, has not been taken into account. However, the detailed and accurate initial description of the simulation objects and the processes and avoidance of improper aggregation are supposed to diminish possible biases.

The automated branching of the simulation is controlled by general decision rules and dedicated simulation instructions for each management unit. A large number of parameters is available to define application dependent options, for example, the length of the calculation period and the sub-periods, and the unit prices for each timber assortment. The choice of events for each application is provided by user-supplied event definitions. Using a MELA extension for the simulation instruction conversion also the standwise prescriptions given by the user can be translated for the MELA simulator.

Besides the simulation of ordinary management schedules, the pre-simulation option updates the growth of trees in the input data. A MELA extension is offered for the updating of stand data.

For the calculation of the net present value, the simulation of each management schedule continues after the calculation period until the end of the current rotation period.

A selection of user-defined simulation variables and aggregated decision variables at the management unit level, and the simulation instructions of the management schedules are stored in files for the selection phase and further analyses. There are available approximately 1 000 conventional decision data variables for each sub-period, for example, volume, increment, drain and cutting removal by tree species and timber assortments, value, areas of different treatments and land categories, gross income, costs, net income, net present value discounted with different interest rates, etc. In addition, data collection requests can be used to generate additional decision data variables for the optimisation or for the compilation of reports.

Integrated selection of forest and stand level management programme

In the current version of MELA, linear programming is applied to select simultaneously forest (production program) and management unit level (management proposal) solutions.

JLP is used as the optimisation package of MELA because of its computing capacity, flexibility for the system integration and additional analysis tools offered besides the LP algorithm. "Built-in" constraints of JLP, for example area constraints and domains, reduce the memory needs of actual LP problems compared with general LP packages. Constraints for domains, easy constraint definitions, a control language, subroutine access allowing automated matrix and report generation pre-compiler for flexible generation of versions, etc. are available in JLP in addition to the large problems and the computational efficiency. The marginal analysis of the JLP solution (shadow prices, cost of increase, cost of decrease, etc., see Lappi 1992) gives useful information about the solution. For the details of the dedicated linear programming software (JLP) and the optimisation problem, see Lappi (1992).

The JLP software is embedded in the MELA optimisation module as a subroutine and controlled by MELA commands and MELA parameters. In the optional JLP mode, JLP commands are available for interactive use.

The optimisation problem is open in MELA. Actual JLP problems are given in user-supplied problem definition files. Any of the stored decision variables over the calculation period (hundreds in total) and their linear combinations are available as optional decision criteria (objective or constraints of the optimisation) both for the whole forestry unit and for the domains (any combinations of stands, overlapping if required, defined by the JLP c-variables of the management units). The decision variables describe the state and the development of forests, as well as forest production and its economy and efficiency over the whole calculation period. The optional decision variables make it possible to solve various planning problems

depending on the needs of the decision makers. Problems without an explicit utility function are solved through the iterative use of LP.

The size of the JLP problem is minimized by taking into the JLP memory only the variables referred in the optimisation problem. A JLP solution as such comprises, for example a summary of the decision variables for the domains referred in the problem definitions, a list of the management schedules selected in the JLP solution, and shadow prices for the constraints. In the MELA report, a summary of all stored decision variables is generated from the selected management schedules for monitoring the solution in details. A selection of results including the simulation instructions and a summary of stand level information from the selected management schedules are stored for further analysis and transfer to other programs.

MELA extensions

The MELA software can be used as a forest management planning module of stand information systems in state, private and industrial forestry. Forest data (stand and stratum data, prescriptions etc.) of the stand information systems are not directly compatible with the description of simulation units in the MELA simulator.

For example, in standwise forest inventory it is not typical to measure trees. In the MELA simulator, however, the development of the management units is predicted via simulation trees on sample plots according to the characteristics of each tree and its site. If no trees are measured, simulation trees have to be generated (computed) before the simulation.

In stand information systems step-by-step instructions how to manage a particular stand or how the stand is expected to be managed may be defined. In principle, the MELA simulator core can read instructions for sequences of activities if they are written in a binary file using definition language of built-in event routines. The use of binary files in different operating systems and environment is difficult. In addition, the translation between treatment codes of stand information system and MELA is required.

A common use of the MELA simulator in stand information systems is to update forest resource data. From the MELA simulator core the results can be stored in a binary file containing the information at sample plot and tree level. In stand information system, however, the information is usually stored at stand and tree stratum level.

To assist the integration of MELA and stand information systems a set of specific features is supplied for the interface development. Because the features do not belong to the core of MELA they are referred to as extensions.

The role of methods, assumptions, models and data

Relevant forest resource data together with forest development, management and economy models are also required to accomplish any analyses. When interpreting the results one should make the difference between the general simulation-optimisation principle being applied in

MELA and the actual data and models used in the analyses. Forest data and models have a great influence on the planning results and their relevance. The methods are based on the general assumption that the natural processes in forest stands - and consequently the development of forest resources - can be predicted, and the limited number of management schedules describes the future potentials of forests with sufficient accuracy and relevance concerning the decisions under consideration.

User Interface

Running MELA

MELASIM and MELAOPT are separate programs communicating with each others via MELA system files. MELASIM and MELAOPT programs are hereafter referred as MELA programs as properties common to both programs are introduced.

MELA programs are started according to the starting convention of the operating system used. For detailed instructions see installation guide delivered with MELA system. Command EXIT given as input line ends the execution of MELA programs

The MELA programs are controlled using commands and parameter definitions given on input lines. Some of the commands and parameters are common for both programs, but most of the commands and parameters are specific to either MELASIM or MELAOPT. In addition to commands and parameters MELAOPT needs problem definition file containing the description of the optimisation problem.

MELA programs can be run interactively or in batch mode. In interactive use, input lines are typed one by one. The MELA command INCLUDE makes it possible to include a set of input lines stored in a file, usually a **par** type file. The included files may contain any types of input lines, also nested INCLUDE commands.

In many cases, it is sensible to run the MELA programs in batch mode or in background if it is possible on the operating system. Especially this is recommended if actual data material is extensive (or simulation time is long) or if the problem definition is complicated.

Contact your system manager to find out if batch jobs are supported by your operating system and to get detailed instructions for using batch jobs.

When working with batch jobs, operating system commands and relevant MELA input lines redirected to MELA programs are stored in a operating system's command file. The command file is then submitted for execution using operating system commands. The output of the batch job is directed into a operating system dependent log file.

The command and include files can be edited with a text editor.

In addition to running the MELA sessions as batch jobs (if you are using a one-window terminal or equivalent) the sessions can be run in separate windows (if your operating system allows several simultaneous windows and tolerably fast multi-processing). MELA programs can be started simultaneously if memory allows. It is recommended to run MELASIM, MELAOPT and text editor each in separate windows. Since MELASIM generates MELA system files needed as input in MELAOPT, you must not start a new MELA step in one

window (for example, SOLVE in MELAOPT) before the successful completion of the previous one in another window (for example, SIMULATE in MELASIM).

Input Lines

The MELA programs have a command line user interface. There are three types of input lines:

- commands,
- parameter definitions (and their continuation lines), and
- comments.

MELA commands, parameter names, and command argument values (and consequently file names)

- can contain characters A-Z, numbers 0-9 and underline character ('_')
- must begin with a character (A - Z)
- must NOT contain national characters (such as Scandinavian Å, Ä and Ö)
- must be in UPPER CASE LETTERS (except user parameters)

Some operating systems may accept both case letters in file names.

The maximum length of an input line is 131 characters.

MELA comments, commands and parameter names begin at column 1 on an input line (notice the exception later) and must NOT contain extra spaces (character ' ') and tabs in the beginning of the input line. However, user defined parameter names (classifications, forestry_unit_LEVELS and forestry_unit_members) begin at column 2.

Instructions for using different kinds of input lines are introduced in the general descriptions of MELA commands and parameter definitions.

Comments and empty lines are omitted in the execution of input lines.

Comment lines begin with the character '*' at 1 st column. Comments may contain any characters. Comment lines must NOT contain extra spaces (character ' ') and tabs in the beginning of the input line.

Comments and empty lines may appear anywhere in parameter files or during a MELA session, including the continuation lines in parameter definitions. The number of comment lines is not restricted.

User Material

User-supplied initial data files (forest resource information) have to be compatible with the MELA software. MELA extensions for updating and for the conversion of initial data and stand simulation instructions are available for the interface development.

All the files related to a MELA session are assumed to be in the directory where the MELA program is started. The changes in this assumption have to be implemented using operating system level tools.

MELA text files can be read, printed or edited by the user, when necessary. Binary MELA system files cannot be edited and should not be tampered by the user.

Further Processing of MELA Results

The policy in the current MELA software is to provide results both in the form of table type reports directly for users and in the form of files for further processing by user programs or commercial software for creating tables, graphics, maps, etc. The reports and the files currently available are shortly introduced in this manual.

See also

MELASIM program
MELAOPT program
MELA extensions

MELA commands
MELA parameters

General MELA command EXIT
General MELA command INCLUDE
MELASIM command SIMULATE
MELAOPT command SOLVE

Parameter definition files (**par** type files)
Problem definition files (**mdl** type files)
Symbol definition file (SYMBOL.SYM file)

Session monitoring and troubleshooting

MELA Core

Program MELASIM

Functions

MELASIM is the stand management and development simulator of the MELA software.

The MELA simulation is based on user-supplied forest resource data. The details of the simulation are limited by the built-in routines and models, and controlled with a MELASIM commands, user-supplied MELA parameter values and specific simulation instructions. The simulation control is

- **either** automatic on the basis of general event definitions (see the EVENT parameter) valid for all management units

- **or** user-supplied when specific prescriptions are provided for each management unit separately.

Event definitions and other parameter values should be customized for each simulation application.

The MELASIM program is used, for example, for the following tasks:

- simulation of (optional) management schedules for the management units (or equivalent),
- updating of initial forest resource data, and
- re-simulation of the management schedules selected in a MELAOPT solution.

In addition, initial forest resource data can be updated as a separate task or as a part of the simulation of management schedules using the pre-simulation option of MELASIM (see the YEARS parameters).

The purpose of the simulation of optional management schedules is to generate feasible management alternatives of stands for the MELAOPT optimisation phase. The simulated management schedules are stored in **msd** and **msc** type files (see figure 1 in the Files section, management schedule files (**msd** type files) and the decision data record). In larger applications, the number of management schedules may become high and need a lot of disk storage. Therefore only decision data variables reguested using FOREST_REPORT parameter in the analysis are usually stored.

Sometimes there is a need to have more detailed information on those management schedules selected in optimisation. The purpose of the re-simulation is to restore the management schedules selected in a MELAOPT solution with sufficient details for presenting and storing the results. Event definitions and other parameter values (the OUTPUT and

FOREST_REPORT parameter excluded, see note 2) must be equal to the original simulation of management schedules. Re-simulation requires a simulation instruction file (a **sms** type file) from the MELAOPT solution, see the MELAOPT command REPORT SUMMARY.

Simulation parameters

Only some frequently used parameters are introduced here. For more information and additional parameters, see MELA parameters.

Notice that the simulation of management schedules is sensitive to all parameters. If exactly the same simulation results are required in different MELASIM applications, all simulation parameters **must** have exactly the same values.

General simulation instructions (the generic name of the parameter in Finnish is in brackets):

YEARS (VUODET)	- The YEARS parameter defines the calculation period and its sub-periods. The time period is expressed either in relative (default) or absolute terms.
OUTPUT (TULOSTUS)	- A collection of instructions, for example, for storing management schedules, printing forestry unit and management unit level summaries, and collecting sample plot data into files.
SIMULATION_CONTROL (SIMULOINNIN_OHJAUS)	- A collection of essential simulation control parameters.
LAND_VALUES (MAAN_ARVOT)	- The LAND_VALUES parameter defines land values for the calculation of the net present value of future revenues (NPV). Relevant land values should be defined for each application.
FOREST_REPORT (METSA_RAPORTTI)	- The FOREST_REPORT parameter defines the design, contents and layouts of MELA forest level summary reports (see **sum** type files). It may include data collection requests resulting collective variables available as decision data variables in the optimisation and in the compilation of reports.

Event definitions:

EVENT (TAPAHTUMA)	- Event definitions describe optional events available in the simulation of management schedules. Each occurrence of the EVENT parameter generates another alternative event for the automatic simulation. Specific (user-defined) event definitions are required for each different simulation application.
EVENT_DEFAULTS (TAPAHTUMA_OLETUS-ARVOT)	- Default values for optional items of the event definitions. Default values will be used instead of the missing event definition items.

Input file types for simulation

The input for MELASIM consists of initial forest resource data, simulation instructions and some obligatory system files.

Some typical input files:

rsd_type files rsu type files	- User-supplied initial forest resource data.
sms type files smu type files	- Standwise simulation instructions (for simulation of management proposals or re-simulation).
par type files	- MELA parameter values (including event definitions) specific to each application.
vol type files	- Stem volume and timber assortment tables (obligatory).

Output file types from simulation

The output files from MELASIM transfer simulation results directly for further processing in MELAOPT and to the user.

Some typical output files:

msc type files	- A description of the management schedule data in the respective **msd** type file.
msd type files	- Management schedule data. See note 1 and note 2.
sum type files	- Forest level summary (decision data) reports. In MELASIM, the generation of sum type files is controlled by the items (2) and (5) of the OUTPUT parameter and by instructions for the generation of summary reports. See note 3.

Computing capacity

The capacity of MELASIM depends on the program version being used. Some other limits and general recommendations are given here.

The maximum number of management units in one **rsd** type file is limited in each MELASIM version. If there are more management units, they can be organized into several **rsd** type files.

The maximum number of sample plots in each management unit can be controlled with the item (11) of the SIMULATION_CONTROL parameter. If the number of sample plots in the initial data exceeds the parameter value, extra sample plots constitute an additional management unit. As a result, confusions in further processing of results may occur.

The number of sample plots in one management unit should never exceed 100 sample plots assuming that the average number of simulation trees for each sample plot is 10.

The maximum number of simulation trees on a sample plot is limited to 500.

The maximum number of simulated management schedules for each management unit can be controlled with the item (8) of the SIMULATION_CONTROL parameter. If the maximum number is reached, the management schedule with natural processes is still simulated and the simulation is continued in the next management unit. However, confusions are likely to occur if limits of this kind are set.

The overall computing capacity for a single management unit is restricted by memory available for a management unit and for a management schedule. The amount of memory required is a function of the number of sample plots and sample trees in a management unit, the number of sub-periods and the number of optional events. The capacity of simulation memory should become critical only in extreme cases.

Sampling of stands over forest area, using moderate calculation periods and limiting the amount of feasible management schedules can be used to reduce computing if necessary.

If there are plenty of simulation periods and optional events, the number of management schedules can rise high. In the case of thousands or more of management units and hundreds of thousands management schedules, the disk capacity can become critical.

Limiting the amount of decision data variables stored from the simulation of alternative management options can be used to reduce the requirement for the disk space. Re-simulation can be used to produce more detailed information on selected management schedules, if necessary.

Notes

1. Management schedule (**msc** and **msd** type) files store and transfer selected decision variables from MELASIM to MELAOPT.

2. In re-simulation, the item (1) of the OUTPUT parameter should be set to '0'. Otherwise originally simulated management schedules will be lost.

3. The default naming of **sum** type files is different in MELASIM and MELAOPT. For details, see forest level summary report (**sum** type) files.

See also

MELA parameters
MELA files
Program MELAOPT

Program MELAOPT

Functions

MELAOPT is the integrated forest production and stand management optimiser module of MELA. On the basis of the user-supplied optimisation problem (objective and constraints), both the forest and stand level solutions are searched from the stand level management schedules. The forestry unit in question may consist of several members on several decision hierarchy levels. Constraints can be given both for the whole forestry unit and for its subsets.

JLP (Lappi 1992) is the LP solver module in MELAOPT. In addition to embedded JLP routines, MELAOPT consists of routines for reading initial data and problem definitions, transmitting them into the JLP routines and generating MELAOPT reports based on the JLP solutions.

MELAOPT performs the following tasks:

- solves JLP optimisation problems,
- generates different kinds of reports from the solution, and
- generates re-simulation instructions of the selected management schedules

The MELAOPT program can be run in two modes:

- MELAOPT mode (see the SOLVE command), and
- JLP mode (see the JLP command)

A typical analysis process consists of the following steps:

- selection of relevant decision variables,
- formulation of the optimisation problem at the forest level,
- selection of the forest and stand level solution (the SOLVE or JLP commands),
- generation of requested reports and files (the REPORT command), and
- analysis and evaluation of the results.

Optimisation parameters

Only some frequently used parameters are introduced here (the generic name of the parameter in Finnish in brackets):

C_VARIABLES (C_MUUTTUJAT)	- Names of the c variables stored in management unit records of initial data (**rsu** or **rsd** type) files.

INTEGERAPPROXIMATION (KOKONAISLUKURATKAISU)	- The presentation of the JLP solution, true optimum or integer approximation.
FOREST_REPORT (METSA_RAPORTTI)	- The FOREST_REPORT parameter defines the design, contents and layouts of MELA forest level summary reports (see sum type files).

Input file types for optimisation

The input for MELAOPT consists of materials such as initial forest resource data, management schedule data, optimisation problem definitions and some obligatory system files.

Some typical input files:

rsd type files	- User-supplied initial forest resource data.
msc type files	- The description of management schedule data in the respective **msd** type file.
msd type files	- Management schedule data. Notice that management schedule (**msc** and **msd)** files store and transfer the selected decision variables from MELASIM to MELAOPT.
par type file	- MELA parameter values.
mdl type files	- JLP problem definitions.

Output file types from optimisation

The output files from MELAOPT transfer optimisation results directly to the user and for further processing with user programs and with MELASIM (re-simulation).

Some common output files:

sol type files	- Forest level solution reports.
sch type files	- Management schedule (stand level solution) reports.
shp type files	- Shadow price reports.
mrg type files	- Cost of change reports.

sum type files	- Forest level summary (decision data) reports. In MELAOPT, **sum** type files are generated by request using instructions given by FOREST_REPORT parameter definition. Notice that default naming of **sum** type files is different in MELASIM and MELAOPT.
msc type files	- A description of forest level summary data in the corresponding **msd** type file
msd type files	- Forest level summary data for further processing.
mps type files	- Selected simulation and decision variables in binary files for further processing (for example, for transmission into user's forest database).
mpu type files	- Selected simulation and decision variables in text files for further processing (for example, for transmission into user's forest database).
sms type files	- Standwise simulation instructions for the transmission of the re-simulation instructions of the selected management schedules from MELAOPT to MELASIM

Computing capacity

MELAOPT versions in different sizes are available for computers with different capacity and for different types of applications.

MELAOPT memory requirements depend on following factors:

- number of management units,
- number of management schedules in management units,
- number of decision variables defined at the JLP 'xvar' section,
- number of constrains in a problem definition, and
- number of c variables in initial data.

See also

Program MELASIM
MELAOPT command SOLVE

MELAOPT command REPORT
MELAOPT command SUM_UP
MELAOPT command JLP
MELA parameters
MELA files

MELA Extensions

Extension for initial data conversion

Functions

The MELA extension for initial data conversion is a routine which can read in the initial forest data (stand, stratum and/or tree records) from a text file. The extension also collects simulation trees from theoretical distributions based on stand and stratum data if no measured trees are available and, thereafter, furnishes the trees representing a number of stems per hectare with other variables such as height and age necessary for predictions.

The conversion is implemented as a part of the simulation run.

Parameters

Only some frequently used parameters are introduced here (the generic name of the parameter in Finnish in brackets):

FOREST_DATA_FILES (METSAVARATIEDOT)	- The parameter FOREST_DATA_FILES controls the use of the initial data files (**rsd** and **rsu** type files) and the files with stand simulation instructions (**sms** and **smu** type files).
DIAMETER_DISTRIBUTION (LAPIMITTAJAKAUMA)	- The DIAMETER_DISTRIBUTION parameter defines the usage of alternative basal area diameter distributions. It can also be used to define the calibration of the predicted diameter distribution.
SMALL_TREE_DIAMETER_MODEL (LAPIMITTAJAKAUMAMALLI)	-The SMALL_TREE_DIAMETER_ MODEL parameter controls the choice of the diameter model used in the calculation of the diameter for the computed trees derived from the height distribution. The height distribution is used for tree strata where mean diameter is below 5 cm.

Input file types for initial data conversion

The input for the initial data conversion consists of materials such as initial stand data and, parameters and some obligatory system files.

Some typical input files:

rsu type files	- User-supplied stand data text file.
par type file	- MELA parameter values.

Output file types from initial data conversion

The result of conversion can be stored in a **rsd** type file to be used later in the optimisation, or in possible successive simulation runs as an input file.

rsd type files	- Initial forest resource.

See also

Program MELASIM
Stand data record
Stratum data record
Tree data record
FOREST_DATA_FILES parameter
DIAMETER_DISTRIBUTION parameter
SMALL_TREE_DIAMETER_MODEL parameter
MELA files

Extension for simulation instruction conversion

Functions

The MELA extension for simulation instruction conversion is a routine which can read in simulation instructions for management units from a text file. The extension can also translate the user-specific management prescriptions into the definitions applied in the simulation if the event code list is given by the user.

The conversion is implemented as a part of the simulation run.

Parameters

Only some frequently used parameters are introduced here (the generic name of the parameter in Finnish in brackets):

FOREST_DATA_FILES (METSAVARATIEDOT)	- The parameter FOREST_DATA_FILES controls the use of the initial data files (**rsd** and **rsu** type files) and the stand simulation instructions (**sms** and **smu** type) files.
SMU_VARIABLES (SMU_MUUTTUJAT)	- The parameter SMU_VARIABLES defines the variables of the stand simulation instruction record in the stand simulation instructions text (**smu** type) file for transferring management prescriptions to the MELA simulator.
SMU_YEAR_CODES (SMU_VUODET)	- The SMU_YEAR_CODES parameter converts the user-specific year codes of management prescriptions into the MELA event years.

Input file types for simulation instruction conversion

The input for the simulation instruction conversion consists of materials such as simulation instructions, parameters and some obligatory system files.

Some typical input files:

smu type files	- User-supplied stand simulation instruction text file.
par type file	- MELA parameter values.

Output file types from simulation instruction conversion

The result of conversion can be stored in a **sms** type file to be used in possible successive simulation runs as an input file.

sms type files	- Stand simulation instruction file.

See also

Program MELASIM
Stand simulation instruction record
FOREST_DATA_FILES parameter
SMU_VARIABLES parameter
SMU_EVENTS parameter
SMU_YEAR_CODES parameter
EVENT parameter
MELA files

Extension for updating of stand data

Functions

The MELA extension for updating of stand data is a routine which exports in a text file a set of tree stratum variables (SMT variables) calculated from the tree variables of simulation record.

It is also possible to incorporate simulation instructions into updating process. However, in those cases the simulation cannot be extended to calculate the estimates of future growth. Therefore, also the choice of SMT variables is limited. If the updating incorporates simulation instructions, the simulation for the estimate of future growth should be done separately.

The updating and the export of stratum data should be implemented as a separate simulation run. Pre-simulation is possible only if SMT variables are not exported.

Parameters

Only some frequently used parameters are introduced here (the generic name of the parameter in Finnish in brackets):

UPDATED_STAND_DATA_FILES (METSIKKOPALAUTE)	- The parameter controls the generation of **smt** type files. The files are reported only by request.
SMT_VARIABLES (SMT_MUUTTUJAT)	- The parameter SMT_VARIABLES defines the variables of the updated stratum data record to be stored into the **smt** type files.
SMT_WEIGHTS (SMT_PAINOT)	- The parameter SMT_WEIGHTS defines the weighting measure to be used during the calculation of the specific stand stratum variables.

Input file types for updating of stand data

The input for updating of stand data consists of materials such as initial data (**rsu** type file), simulation instructions (optional), parameters and some obligatory system files.

Some typical input files:

rsu type files	- User-supplied initial stand data text file.
par type file	- MELA parameter values.
vol type files	- Stem volume and timber assortment tables (obligatory).

Output file types from updating of stand data

The result of updating can be stored in a **smt** type file to be transferred to user programs.

smt type files	- Updated stand data text file.

Note

1. Extension for updating requires **rsu** type file as input.

See also

Program MELASIM
Simulation record
Updated stratum data record
UPDATED_STAND_FILE parameter
SMT_VARIABLES parameter
SMT_WEIGHTS parameter
MELA files

Hierarchical forestry units in MELA

Functions

The MELA programs possess capabilities to process hierarchical forestry units. The management units may belong to several hierarchical and overlapping categories or domains. It is also possible, for example, to set constraints to members of hierarchical forestry units in MELAOPT problem definitions and to use short references to hierarchy members in MELA commands.

There are two complementary ways to refer to the parts of forestry units in the MELA programs:

- MELA decision hierarchies, and
- JLP domains.

Both MELA decision hierarchies and JLP domains may appear simultaneously.

Notes

1. A MELA decision hierarchy in MELAOPT is, in fact, a specific application of the JLP domains.

See also

MELA decision hierarchy
JLP domain definitions
Program MELAOPT

MELA decision hierarchy

Functions

The forestry units may comprise several sub-units on several (organisation or decision) hierarchy levels.

MELA decision hierarchy definitions are used, for example, for following purposes:

- to refer with a short name in MELA commands to the individual members or all the members of hierarchical forestry units,
- to define constraints for the individual members of hierarchical forestry units in MELAOPT (or JLP) problems being solved, and
- to select report categories in MELAOPT commands.

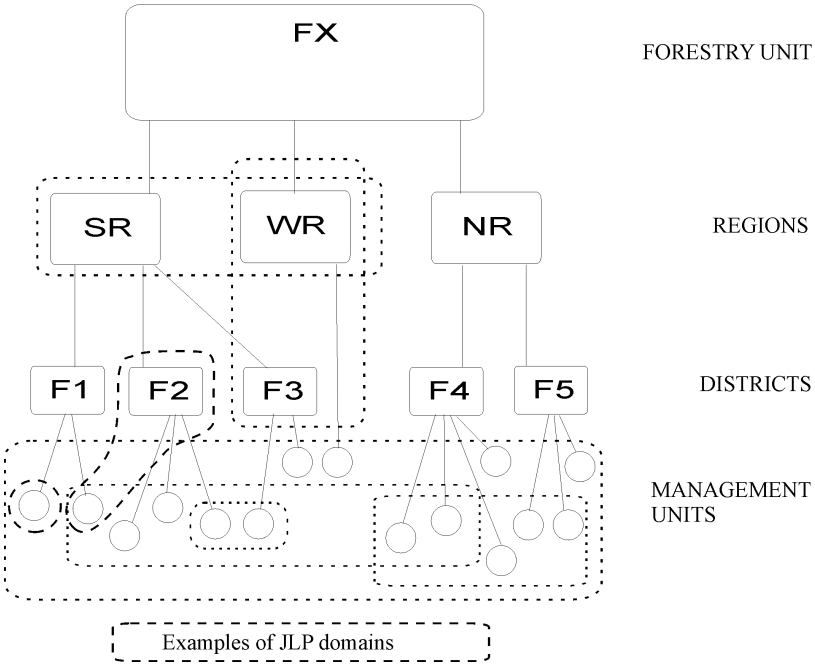

Figure 1: The hierarchical structure of the forestry unit FX and examples of JLP domains.

Actual MELA decision hierarchies are described in **par** type files (see example 1). Each decision hierarchy definition must contain two types of parameters:

- names of the decision hierarchy levels (see the forestry_unit_LEVELS parameter and FX, REGIONS and DISTRICTS in figure 1)

- members of each level in the decision hierarchy (REGION level members SR, WR, NR and DISTRICT level members F1, F2, F3, F4 and F5 in figure 1).

In principle, the number of hierarchy levels and their members in MELA is unlimited. However, the software and computing capacity may set limits to the number of hierarchy levels and members in practice.

Instructions

For further instructions, see the **forestry_unit** argument of the SIMULATE command and initial data files (**rsd** type files).

The reference to the actual decision hierarchy is selected in a MELA program session using the FORESTRY_UNIT parameter.

Notes

1. The name of the **par** type file containing the decision hierarchy definitions must equal to the name of the forestry unit described in the file. The decision hierarchy selection may appear during a MELA program session or in the **MELA_SET.PAR** file for the convenience, the default hierarchy reference should always be found in the **MELA_SET.PAR** file.

2. The names of decision hierarchy parameters (FX_LEVELS, FX, SR and NR in example 1) must begin at column 2 on input lines (if not, error exit will occur). See user parameters in the section Parameter definitions and the MELA parameters FORESTRY_UNIT, forestry_unit_LEVELS and forestry_unit_members.

3. The stands belonging to the smallest logical and physical decision unit should belong to the same lowest level member of the decision hierarchy and consequently to the same initial data (**rsd** type) file.

4. The names of the **rsd** type (and output) files belonging to the forestry unit are automatically generated from the lowest level members of the decision hierarchy described in the **forestry_unit.PAR** file, see example 1.

See also

JLP domain definitions
Initial parameter settings file (MELA_SET.PAR file)
Parameter definition files (**par** type files)
Initial data files (**rsd** type files)

Program MELAOPT
MELASIM command SIMULATE
FORESTRY_UNIT parameter
forestry_unit_LEVELS parameter
forestry_unit_members parameter

Examples

Example 1: A simple decision hierarchy definition.

```
* FX.PAR *

* Decision hierarchy levels of the forestry unit FX

 FX_LEVELS
#FX
#REGION
#DISTRICT

* The names of the members of each level
* in the decision hierarchy.

* Region level sub-units of FX

 FX
#SR Southern Region
#NR Northern Region
#WR Western Region

* District level sub-units of SR

 SR
#F1 District F1
#F2 District F2
#F3 District F3

* District level sub-units of NR

 NR
#F4 District F4
#F5 District F5

* Notice that WR has no lower level members.
```

JLP domain definitions

Functions

MELA management units can be grouped into categories or JLP domains. In principle, JLP domains are any subsets of management units.

JLP domains are used, for example, for the following purposes:

- to define constraints for groups of management units in MELAOPT (or JLP) problem definitions, and
- to select report categories in MELAOPT commands.

JLP domains are defined via logical statements in terms of the management unit variables (c variables in **rsd** type files) and the actual decision hierarchy.

c variables are provided in MELA in initial data files (**rsd** type files). Additional c variables can also be generated using JLP 'ctran' transformations (see Lappi 1992).

Domain definitions may appear, for example, in MELAOPT (JLP) problem definitions (see problem definition files (**mdl** type files)) and in report requests (see the MELAOPT command REPORT).

.

Notes

1. JLP domains may well be (in fact they usually are) overlapping.

See also

Management unit record (c variables in **rsd** type files)
Initial data files (**rsd** type files)
Problem definition files (**mdl** type files)
Decision hierarchy
Program MELAOPT
MELAOPT command REPORT

Tree selection routine

Functions

In MELA, there is a general routine to select trees in treatments, for example, to be removed in cuttings or to be saved for the reason of biodiversity. The stepwise tree selection procedure is controlled by selection instructions. Selection instructions make it possible to define several details of the tree selection for different kinds of treatments. The default values for selection instructions are built in the routines calling the tree selection, for example in cutting and pruning routines. In some cases, for example in thinnings, users can define also their own selection instructions via the EVENT_CALL item of the EVENT parameter in the user-supplied event definitions. The user-supplied selection instructions for each event override the built in defaults.

Tree selection procedure

Trees are selected separately on each sample plot of a management unit (see the simulation record) in the current MELA simulator. Selection instructions may be provided for one or several selection groups on a sample plot. The selection routine returns the number of stems selected for each tree of a sample plot to the calling routine for further processing.

The tree selection procedure on a sample plot proceeds by selection groups in the order of the actual selection instructions. In each selection group, the convergative iteration tries to reach the requested selection quantity (see specific EVENT_CALL arguments of the EVENT parameter for each basic event). The selection procedure stops immediately when the requested total quantity on the sample plot is reached, omitting the trees left in current selection group as well as the selection groups still left. If the selection routine fails to reach the requested quantity completely, a warning message is given and the current, more or less faulty selection is returned as a final result to the calling routine.

The selection priority of the trees in a selection group is determined by the selection factor (y) which depends on the value (x) of the actual priority variable in the priority function

$$y = ax + b$$

where **a** is the slope of the priority function, and **b** is determined iteratively by the selection routine on the basis of the requested selection quantity and the actual trees in the selection group. The value of slope in the priority function defines the selection principle, for example

Selection instructions

Selection instructions consist of

- overall selection range definitions for the whole sample plot, and
- a section for each different selection group on a sample plot.

The overall selection range is a set of trees which is determined by one or more overall selection criteria. If more than one criterion is given, the logical operator AND is applied between the given criteria. Furthermore, trees are selected from the overall selection range only.

Selection groups are sets of trees with their own selection instructions. Selection groups are defined via the tree variables of tree records, such as diameter, age, etc. The order of the groups in the selection instruction determines also the priority of the groups in the selection of the requested quantity.

- selection group definition (range variable and bounds), and
- selection parameters (priority variable, slope of the priority function and target proportion of overall quantity of trees to be left after selection).

For the overall quantity to be left, see specific EVENT_CALL arguments of the EVENT parameter for each basic event.

The selection instruction is a floating point vector having the following structure:

(1) number of following overall selection range criteria (i.e. groups of items (2) - (4))
parameters repeated for each overall selection range, items (2) - (4)

(2) index of the overall selection range variable in the tree record, see the tree variables of the simulation record.

(3) lower bound for the overall selection range variable (lower and upper bounds define the interval from which the trees are selected)

(4) upper bound for the overall selection range variable (lower and upper bounds define the interval from which the trees are selected)

(5) number of following selection groups
selection instructions repeated for each selection group, items (6) - (11)

(6) index of the range variable of the selection group, see the tree variables of the simulation record.
'0' trees in the overall selection range and still left untouched in the previous selection groups (for the last selection group only)

(7) lower bound for the range variable of the selection group
< 0 others than the absolute value of the lower bound are included in the selection process
> 0 all values between the lower and upper bound (excluding bounds) are included in the selection process

(8) upper bound for the range variable of the selection group
< 0 others than the absolute value of the upper bound are included in the selection process
> 0 all values between the lower and upper bound (excluding bounds) are included in the selection process

Notice the exceptional interpretations of the following item combinations:

(6)	(7)	(8)	
2	-1	1	refers to the dominant tree species and
2	-1	-1	others than the dominant tree species,

see the sample plot variable (32) of the simulation record.

(9) index of the priority variable in the tree record

(10) slope of the priority function

- < 0 trees with a lower value of the priority variable have a higher selection priority, for example, low thinnings. A low value means that the selection proceeds from the smallest values of the priority variable until the requested selection quantity is reached.
- = 0 all trees have equal priority (regardless the value of the selection variable)
- > 0 trees with a higher value of the priority variable have a higher selection priority, for example, high thinnings. A high value means that the selection proceeds from the highest values of the priority variable until the requested selection quantity is reached.

(11) target proportion of overall quantity to be left in the individual selection group. For the expression of the selection quantity, see specific EVENT_CALL arguments of the EVENT parameter for each basic event

- <= 1 refers to the target proportion to be left in the group in terms of the overall quantity to be left, for example 0.25
- > 1 refers to the aimed absolute quantity to be left in the group in the selection

The upper and lower bounds (items (7) and (8)) for the limiting variable for the selection group can be interpreted as the following combinations, see the exceptions of the selection instructions above and example 1:

combination	interpretation
lower bound > 0 and upper bound > 0	trees with the value of the limiting variable between lower and upper bounds, except the bounds themselves, constitute the selection group (from which the trees are selected)
lower bound < 0 and upper bound < 0	trees with the value of the limiting variable other than the absolute value of the lower or upper bound constitute the selection group
lower bound < 0 and upper bound > 0	trees with the value of the limiting variable less than upper bound, except the absolute value of the lower bound, constitute the selection group
lower bound > 0 and upper bound < 0	trees with the value of the limiting variable greater than lower bound, except the absolute value of the upper bound, constitute the selection group

Notes

1. All trees not included in the selection group definitions are excluded from the selection and left untouched.

2. The validity of any new applications of selection routine, for example, new event definitions, should be carefully tested with sufficient tree and sample plot material.

See also

EVENT parameter
Simulation record
Calls of basic event routines

Examples

Example 1: Interpretations of some bound values in the tree selection.

```
lower bound 2            upper bound 4
-------------++++++++++------------------------------
0     1     2     3     4     5     6     7     8     9

lower bound -2           upper bound -4
++++++++++++-++++++++++-++++++++++++++++++++++++++++++
0     1     2     3     4     5     6     7     8     9

lower bound -2           upper bound 4
++++++++++++-++++++++++------------------------------
0     1     2     3     4     5     6     7     8     9

lower bound 2            upper bound -4
-------------++++++++++-++++++++++++++++++++++++++++++
0     1     2     3     4     5     6     7     8     9

lower bound 2            upper bound 10
-------------++++++++++++++++++++++++++++++++++++++++++
0     1     2     3     4     5     6     7     8     9

lower bound 0            upper bound 4
-++++++++++++++++++++++++------------------------------
0     1     2     3     4     5     6     7     8     9
The character '-' on the explanation rows refers to
values outside of the selection range and '+' to
values included in the selection range.
```

A high absolute value of the slope (item (10) of selection instructions) generates more strict dependence of the selection priority on the value of the selection variable or, for example, different size trees have different selection priorities. A low absolute value of the slope means

less dependence on the selection variable, or all trees have almost the same selection priority. There are no universal rules of slope value for different treatments.

Example 2: A tree selection instruction with interpretation.

```
A selection instruction (items 1-23, cf. the EVENT_CALL arguments 16-38 in
example 1 in section "Calls of basic event routines"):

1 3 3 99 3 3 15 99 3 1 0 2 -1 -1 8 -0.5 0.2 0 0 0 8 -0.5 0

Interpretation of the items 1-23:

items value explanation

1     1     number of overall selection criteria

2-4         first overall selection criterion

      3     - overall selection range variable
      3     - lower bound for overall range variable
      99    - upper bound for overall range variable

            (trees with diameter 3-99 cm are
             included in the overall selection range)

5     3     number of selection groups

6-11        first selection group

      3     - range variable of selection group
      15    - lower bound for range variable
      99    - upper bound for range variable
      3     - priority variable
      1     - slope of priority variable
      0     - target proportion of quantity to be left

            (trees with diameter 15-99 cm starting
             from bigger ones in terms of diameter,
             all trees in group can be selected)

12-17       second selection group

      2     - range variable of selection group
     -1     - lower bound for range variable
     -1     - upper bound for range variable
      8     - priority variable
     -0.5   - slope of priority variable
      0.2   - target proportion of quantity to be left

            (trees other than dominant tree species can be
             selected, starting from trees with smallest stems
             volume. Amount to be left int his group is up to
             20 % of overall quantity to be left, in terms of
             event specific selection quantity)

18-23       third selection group

      0     - range variable of selection group
      0     - lower bound for range variable
```

```
      0     - upper bound for range variable
      8     - priority variable
     -0.5   - slope of priority variable
      0     - target proportion of quantity to be left

            (all trees in overall selection range left
             untouched in previous groups starting from
             smaller ones, all trees in group can be selected)
```

Example 3: Default tree selection instructions for cuttings and tending of young stands.

```
Basic event routine (identification number)

 default selection instruction
_____________________________________________________________________

Thinning based on basal area instructions (2.1)

 2 3 6 99 17 -99 1 2 2 -1 -1 8 -0.5 0 0 0 0 8 -0.5 0

Clear cutting (2.2)

 2 3 6 99 17 -99 1 1 0 0 0 8 0 0

Thinning based on number of stems instructions (2.3)

 2 0 3 99 17 -99 1 3 3 15 99 3 1 0 2 -1 -1 8 -0.5 0 0 0 0 8 -0.5 0

Over story removal (2.4)

 2 3 7 99 17 -99 1 1 14 0.5 2.5 8 3 0

Seed tree cutting (2.5)

 2 3 6 99 17 -99 1 2 2 1.5 10 4 0 0 0 0 0 4 -5 50

Shelterwood cutting (2.6)
 2 3 6 99 17 -99 1 2 2 -2 999 4 0 0 0 0 0 4 -5 0

Tending of young stands (3)

 2 3 0 18 17 -99 1 2 2 -1 -1 8 -0.5 0 0 0 0 8 -0.5 0
```

When user-supplied tree selection instructions are not given (see specific EVENT_CALL arguments of the EVENT parameter for each basic event), built-in default selection instructions in example 3 are used.

MELA COMMANDS

General information about MELA commands

MELA command types

MELA commands are used to perform desired actions during MELA sessions. Commands can be used in a free order and they are executed one by one in the order provided.

The two types of MELA commands are
- general commands which are common to all MELA programs, and
- program (MELASIM or MELAOPT) specific MELA commands.

General syntax of the MELA commands

```
command/option=option_value [/option=option_value]
                            argument_value[ argument_value]
```

All input to the MELA programs must be given in upper case letters, except commands in the MELAOPT programs JLP mode. JLP commands must be given in lower case letters.

Arguments

command	A valid MELA command name.
option	An option name. An option is a parameter with only one value.
option_value	A relevant numeric or character value depending on the option (parameter) type.
argument_value	A character string separated by spaces from the command name and the other arguments. Each argument has a position dependent interpretation.

See also

Program specific MELA commands:

MELASIM:

SIMULATE

MELAOPT:

SOLVE

SUM_UP

REPORT
JLP

General MELA commands:

EXIT
INCLUDE
RECALL
SHOW

MELA parameters

MELASIM Commands

SIMULATE

Name

SIMULATE

Name in Finnish

SIMULOI

Description

MELASIM command SIMULATE simulates feasible management schedules for the management units of the forestry unit(s).

Syntax

General syntax of the SIMULATE command is

```
SIMULATE application forestry_unit[,forestry_unit] instructions
```

or

```
SIMULATE application forestry_unit instructions sub_unit
```

Arguments

`application`	A name of the **par** type file containing application or context dependent MELASIM parameters. The MELA command INCLUDE can be used to read parameters from other files. For example, the **application** value 'MS' refers to the **MS.PAR** file. **The simulation of management schedules is sensitive to all parameters.** If exactly the same simulation results are required in different MELASIM applications, all simulation parameters **must** have exactly the same values. See Program MELASIM for a general set of simulation parameters and General Information about MELA parameters for the definition of application or context dependent parameters.
`forestry_unit`	A reference to the forest resource data (**rsd** or **rsu** type files) of the forestry unit.

The value of **forestry_unit** can be

- a reference to the decision hierarchy description for **forestry_unit** in a **par** type file (for details, see the description of **par** type files, the FORESTRY_UNIT and forestry_unit_LEVELS parameters and the decision hierarchy). The names of **rsd** type files belonging to **forestry_unit** are automatically generated from the lowest level members of the decision hierarchy described in the **forestry_unit.PAR** file. See note 1 and note 2.

- a name of the **rsd** type file containing forest resource data of the whole forestry unit. For example, if **FX.PAR** and decision hierarchy definitions are absent, the value FX refers directly to the **FX.RSD** file. See note 3.

`instructions` A reference to the standwise simulation instructions (**sms** or **smu** type files) of the forestry unit.

The value of **instructions** can be

- the value of the **proposals** component in a name of the **sms** type file containing user-supplied management proposals for individual management units, **only in the simulation of user-supplied management proposals**.

- a name of the MELAOPT optimisation **problem** (an **mdl** type file), **only in the re-simulation** of the management schedules selected in a MELAOPT solution. See note 4.

`sub_unit` A name of the individual member in the decision hierarchy of the forestry unit. A **sub-unit** argument is used **only in the case of re-simulation** of the management schedules selected in a MELAOPT solution **for one individual member** of the decision hierarchy, **instead of the whole forestry unit**.

Notes

1. The reference to the decision hierarchy description for each forestry unit must be provided in a separate **par** type file.

2. The actual decision hierarchy is given with the FORESTRY_UNIT parameter before the SIMULATE command. If only one decision hierarchy is used, the FORESTRY_UNIT parameter should be given in the **MELA_SET.PAR** file. For example, if the parameter description FORESTRY_UNIT#FX is found in **MELA_SET.PAR**, the decision hierarchy definitions of the **FX.PAR** file are automatically made available for the MELA session.

3. MELASIM output files are generated separately for each **rsd** type file of the forestry unit.

4. Re-simulation is possible only if the standwise simulation instruction (**sms** type) file from the MELAOPT solution is available. For the generation of **sms** type files, see the MELAOPT command REPORT SUMMARY

See also

MELASIM program
MELA decision hierarchy
FORESTRY_UNIT parameter
forestry_unit_LEVELS parameter
FORESTRY_REPORT parameter
Simulation parameters:
    General simulation instructions
    Event definitions
Input file types for simulation
Output file types from simulation
Notation, conventions and layout

Examples

Example 1: The simulation of alternative management schedules.

```
SIMULATE MS FX
```

Simulate forest management schedules for the stands according to the parameters given in the **MS.PAR** file. If **FX.PAR** exists, stand data come from **rsd** type files defined by the decision hierarchy in the **FX.PAR** file, otherwise from the **FX.RSD** file.

Example 2: The re-simulation of the selected management schedules.

```
SIMULATE MSR FX S2
```

Re-simulate the selected management schedules for the management units of the forestry unit FX on the basis of the MELAOPT problem defined in the **S2.MDL** file and collect the information requested in the **MSR.PAR** file.

In order to get consistent re-simulation results, the parameters in the **MSR.PAR** file have to be equal to the simulation of the original management schedules (except the OUTPUT parameter). Nevertheless, experiments with careful interpretation can be made by changing the re-simulation parameters.

In the re-simulation, the item (1) of the OUTPUT parameter should be set to '0'.
Otherwise originally simulated management schedules will be lost.

MELAOPT Commands

SOLVE

Name

SOLVE

Name in Finnish

RATKAISE

Description

MELAOPT command SOLVE finds a production program for the forestry unit and relevant management schedules for the management units in accordance with the user-supplied objective and constraints over time (for the present formulation of the MELA optimisation problem, see JLP User's Guide by Lappi 1992). Command SOLVE prints automatically a short forest level solution found for all the domains referred in the problem definition of the actual **mdl** type file (see the REPORT SOLUTION command).

Notice that the simulated management schedules define the search space in the MELAOPT optimisation. Solutions are found among the management schedules of the actual **msc** and **msd** files of the forestry unit only. It is necessary to simulate management schedules for each different application type separately.

Syntax

```
SOLVE problem forestry_unit[,forestry_unit]
```

Alternative syntax

```
SOLVE problem forestry_unit[&forestry_unit]
```

In the case of the comma (',') as a delimiter between forestry units, the problem is solved for each forestry unit separately.

The character ampersand ('&') as a delimiter between forestry units means that the problem is solved for all the forestry units together.

Arguments

problem — A name of the **mdl** type file containing the linear programming problem definition.

The linear programming problem is provided in the JLP problem definition language. JLP 'xvar' and 'prob' sections are needed at least. For further information about problem definitions, see JLP User's Guide in Lappi (1992) and the description of **mdl** type files.

For available decision data variables, see the MSD_VARIABLES and FOREST_REPORT parameters.

See note 1.

forestry_unit — A reference to the initial data (**rsd** type) files and the management schedule data (**msc** and **msd** type) files of the forestry unit.

The value of **forestry_unit** can be

- either a reference to the decision hierarchy description file of the forestry unit,
- or a name of the **rsd** type file containing initial data and of the **msc** and **msd** type files containing the management schedule data.

See note 2.

Notes

1. It is recommended to design in advance a number of relevant problem definitions (**mdl** type files) for common forest management problems. They can then be used for mapping the feasible solution space (or the limits of the production potentials) in the first phase of planning. In the second phase of planning, some or one of these solutions can probably serve as the starting point for defining the final production program.

2. A considerable time may be needed to read all initial data files (**rsd** type files) and management schedule files (**msc** and **msd** type files) of large forestry units.

See also

MELAOPT program
REPORT SOLUTION command
JLP command
Decision hierarchy

Optimisation parameters
Input file types for optimisation
Output file types from optimisation

Examples

Example 1: The selection of a production and management program for a single forestry unit.

```
SOLVE S2 FX
```

Solve the optimisation problem given in the **S2.MDL** file using the management schedules for the forestry unit FX.

If **FX.PAR** exists, initial data are obtained from **rsd** type files and management schedule data from **msc** and **msd** type files defined by the decision hierarchy in the **FX.PAR** file, otherwise from the **FX.RSD**, **FX.MSC** and **FX.MSD** files.

Example 2: The selection of a production and management program for two forestry units in one.

```
SOLVE S2 F1&F2
```

Solve the optimisation problem given in the **S2.MDL** file for the forestry units F1 and F2 together.

SUM_UP

Name

SUM_UP

Name in Finnish

SUMMAA

Description

MELAOPT command SUM_UP adds up content of one or several **msc** and **msd** type files into a **sum** type report file. The absolute prerequisite is that the used **msc** and **msd** type files generated either in optimisation or in re-simulation are fully compatible by their contents. The FOREST_REPORT parameter controls the contents of the processed **sum** type file. Notice that SUM_UP does not apply for JLP domain definitions.

Syntax

a) no hierachical forestry unit

```
SUM_UP application {>report}
```

Arguments

application	A name of the **par** type file containing the names of the **msc/msd** type files to be added up. The content of the 'application'.PAR is: 'application' #the title for the sum type report (optional) #the name of 1st msc/msd file without msc/msd extension ... #the name of n'th msc/msd file without msc/msd extension
>report	A name of the **sum** type report file (optional), if omitted the default will be 'application'.SUM. The output control character (>) belongs to ecplicitely defined report request.

b) using hierachical forestry unit

```
SUM_UP forestry_unit problem O/S {>report}
```

Arguments

forestry_unit	A name of the decision hierarchy description **par** type file, i.e forestry_unit.PAR defined by the FORESTRY_UNIT and forestry_unit_LEVELS parameters and the decision hierarchy definition.
problem	A name of the **mdl** type file
O/S	O or S depending if the **msc** and **msd** files are from the optimisation (O) or from the re-simulation (S)
>report	A name of the **sum** type report file (optional), if omitted the default will be 'forestry_unit_problem_O/S'.SUM. The output control character (>) belongs to ecplicitely defined report request.

Examples

Example 1: The summing using **par** type definition file TEST.PAR without hierarchical forestry unit. The sum type report file name will be TEST.SUM

```
SUM_UP TEST
```

The contents of the TEST.PAR file e.g.:

```
 TEST
#Sum of F1 and F2
#F1_F1_NPV_O
#F2_F2_NPV_O
```

Example 2: The summing using **par** type definition file TEST.PAR without hierarchical forestry unit. The sum type report file will be F1_F2_REPORT.OUT.

```
SUM_UP TEST >F1_F2_REPORT.OUT
```

If the extension OUT is omitted the report name will be F1_F2_REPORT.

Example 3: The summing using **par** type decision hierarchy definition file FX.PAR and according to the optimisation problem NPV.MDL generated **msc** and **msd** type files. The sum type report file will be FX_NPV_O.SUM.

```
SUM_UP FX NPV O
```

Example 4: The summing using **par** type decision hierarchy definition file FX.PAR and in the re-simulation generated **msc** and **msd** type files. The sum type report file will be FX.SUM.

```
SUM_UP FX NPV S >FX.SUM
```

REPORT

Name

REPORT

Name in Finnish

TULOSTA

Description

MELAOPT command REPORT generates requested reports and files from the MELAOPT solution for the whole forestry unit as well as its sub-units and other domains. There are available both forestry unit level and management unit (stand) level results.

Syntax

```
REPORT request_type {domain_definition:[,domain_definition:]}
```

REPORT command generates the requested reports from the MELAOPT solution after the SOLVE command.

See note 1 and note 2.

Arguments

request_type A report type, that can have following values (reports generic name in Finnish in brackets):

JLP_SOLUTION (JLP_RATKAISU)	- Print the last JLP solution on the terminal in the JLP style, see JLP User's Guide in Lappi (1992).
MARGINALS (RAJAHINNAT)	- Store the costs of decrease and increase for x variables from the last JLP solution in a **mrg** type report file For information about JLP marginal analysis, see JLP User's Guide in Lappi (1992).

Notice that the costs of decrease and increase for x variables are not calculated as a part of the standard solution in MELAOPT. That is why the generation of a MARGINAL report will usually take much time. See also **mdl** type files.

SCHEDULES (VALITUT) - Store a short list of the selected management schedules from the last JLP solution in a **sch** type report file.

SHADOW_PRICES (VARJOHINNAT) - Store shadow prices of the last JLP solution in a **shp** type report file.

For information about shadow prices, see JLP User's Guide in Lappi (1992).

SOLUTION (RATKAISU) - Store the last forest level solution for all the domains referred in the problem definition in a **sol** type report file directly from the last JLP solution. The variables of the report are determined at the 'xvar' section in a **mdl** type file.

SUMMARY (TAULUKKO) Store the summary of the last forest level solution in a **sum** type report file. The summary report is generated on the basis of the selected management schedules from management schedule (**msc** and **msd** type) files and the actual instructions for the generation of summary reports (FOREST_REPORT parameter).

The REPORT SUMMARY command also generates **mps**, **mpu**, **sms** and forest level **msc** and **msd** type files.

`domain_definition:` A logical statement in terms of c variables with the character colon (':') at the end of the statement, see JLP User's Guide in Lappi (1992). Domain definitions are valid for SOLUTION and SUMMARY requests only.

Specific domain definitions are:

`all:` the whole forestry unit or all the management units in the current JLP optimisation problem, and

`domains:` all domains referred in the preceding SOLUTION requests and in the current JLP problem definition.

The 'all:' and 'domains:' definitions may not appear as the components of the logical statements.

Logical statements consist of one or many relational expressions linked with logical operators:

Logical operator		Meaning
.and.	&	logical conjunction
.or.		logical disjunction
.not.		logical negation

Relational expressions consist of operands and values of operands separated with relational operators:

Relational operators		Meaning
.gt.	>	greater than
.lt.	<	less than
.ge.	>=	greater than or equal
.le.	<=	less than or equal
.eq.	=	equal
.ne.		not equal

Operands and values are linked in relational expressions in the following ways:

Operand	**Value of operand**
a name of the c variable in the last JLP problem solved	a valid value for the c variable
a name of the decision hierarchy level in the last JLP problem solved	a member of the decision hierarchy level
'data'	a value (or one of the values) for the argument **forestry_unit** in the last SOLVE command

See example 2 and example 3.

Notes

1. Domain definitions are valid for SOLUTION and SUMMARY requests only.

2. A SOLUTION type report is automatically generated after each successful SOLVE command for all domains referred in the problem definition.

3. If the 'domains:' definition appear in SOLUTION and SUMMARY requests, also the domains from SOLUTION requests are applied in SUMMARY reguests.

See also

MELAOPT program
MELAOPT command SOLVE
MELAOPT command JLP
Optimisation parameters
Input file types for optimisation
Initial data files (**rsd** type files)
Management unit records
C_VARIABLES parameter
Decision hierarchy
Output file types from optimisation
FOREST_REPORT parameter

Examples

Example 1: The generation of a MELAOPT solution report.

```
REPORT SOLUTION
```

Generate a SOLUTION type report for the whole forestry unit from the last JLP solution.

Example 2: The generation of a MELAOPT solution report for the domain defined by a simple relational expression.

```
SOLVE S2 F1&F2

REPORT SOLUTION data=F1:
```

Generate a SOLUTION type report for the domain 'data=F1:' from the last JLP solution.

Example 3: The generation of a MELAOPT summary report for the domain defined by a logical statement consisting of relational expressions.

```
C_VARIABLES#UNIT#AREA#SITE#CATEGORY#OWNER
SOLVE S2 FX
REPORT SOLUTION DISTRICT=F1.and.OWNER>2:
```

```
REPORT SUMMARY
```

Generate a SUMMARY type report for the domain 'DISTRICT=F1.and.OWNER>2:' from the last JLP solution. Notice that F1 is here a valid DISTRICT level member of the forestry unit FX and OWNER is a valid and accessible c variable of the forest resource data (see **rsd** type files, management unit records and the C_VARIABLES parameter).

RECALL

Name

RECALL

Name in Finnish

TOISTA

Description

RECALL command shows and re-executes the latest MELA command.

Syntax

```
RECALL
```

JLP

Name

JLP

Description

The MELAOPT command JLP without an argument turns the MELAOPT mode to the JLP mode, where all JLP commands and definitions are available, in addition to the management unit and management schedule data from MELA files. After the return from the JLP mode (the JLP command 'end'), the MELAOPT session continues.

If the MELAOPT command JLP is given with a JLP command as an argument, program control turns temporarily to the JLP mode. Program control automatically returns to the MELAOPT mode after the execution of the JLP command.

The JLP mode during a MELAOPT session makes it possible to utilize all JLP features with MELA data, for example, transformations ('ctran', 'dtran' and 'xtran' transformations) and additional domains for reporting (the JLP command 'show/domains'). For details, see Lappi (1992).

In the JLP mode, the same management unit data can be used (without reading the data for each problem again) for several subsequent JLP 'solve' commands and problems with the MELA decision variables introduced at the 'xvar' section of the last MELAOPT problem definition (**mdl** type) file.

See note 1.

Syntax

```
JLP
```

MELAOPT command JLP turns program from the MELAOPT mode to the JLP mode. See note 2.

```
JLP jlp_command
```

This command executes the JLP command in the JLP mode and returns immediately to the MELAOPT mode. See note 3.

Arguments

`jlp_command`	An individual JLP command to be executed in the JLP mode, see JLP User's Guide in Lappi (1992). JLP commands must be given in lower case letters. See note 4.

Notes

1. The JLP mode is recommended for users having previous experience in the use of JLP or needing JLP properties, that are not available in the MELAOPT mode.

2. Use the JLP command 'end' to return from the JLP mode to the MELAOPT mode.

3. In the JLP mode, the JLP command ‘mrep’ is used for the generation of the MELAOPT type reports, see the MELAOPT command REPORT and it’s arguments.

4. In the JLP mode, the commands must be given in lower case letters – in contrast to MELA commands which are given in upper case letters.

See also

MELAOPT program
MELAOPT command SOLVE
MELAOPT command REPORT
Input file types for optimisation
Output file types from optimisation

General MELA Commands

EXIT

Name

EXIT

Name in Finnish

LOPETA

Description

EXIT command finishes the MELA session and returns to the operating system level.

Syntax

```
EXIT
```

INCLUDE

Name

INCLUDE

Name in Finnish

LUE

Description

INCLUDE command specifies a text file containing input lines to the MELA programs. The commands are executed one by one in the sequential order.

Syntax

```
INCLUDE FILENAME.EXT
```

Arguments

FILENAME	A name of the file containing input lines (usually a **par** type file). The file may contain any type of MELA input lines. Nested INCLUDE commands are supported up to 5 levels.
EXT	A file name extension if other than **PAR**.

Notes

1. User must give file names always in upper case letters.

See also

MELA User interface
General information about MELA parameters

Examples

Example 1: An INCLUDE command.

```
* Get and process input lines from the
* MS_EVENT.PAR file in a MELA session.

INCLUDE MS_EVENT
```

SHOW

Name

SHOW

Name in Finnish

NAYTA

Description

SHOW command shows the requested information (available commands or parameter values) on the terminal.

Syntax

```
SHOW request_type
```

Arguments

request_type A type of the information requested which could be:

COMMANDS

Generic name in Finnish: **KOMENNOT**

Shows all the MELA commands available in the session. Only the list of commands is provided without further explanations. See example 1.

INTERPRETATION parameter_name

Generic name in Finnish: **TULKINTA**

Shows the interpreted values of the parameter. This request type is used, for example, to show the lowest level members of any hierarchy structure.

C_PARAMETER parameter_name

Generic name in Finnish: **C_PARAMETRI**

Shows the values of a character type parameter.

N_PARAMETER parameter_name

Generic name in Finnish: **N_PARAMETRI**

Shows the values of a numerical type parameter.

PARAMETERS

Generic name in Finnish: **PARAMETRIT**

Shows all the parameters and their values of the current session.

Examples

Example 1: A SHOW COMMANDS command

```
* Show available commands.
SHOW COMMANDS
```

Example 2: A SHOW N_PARAMETER command

```
* Show the values of the YEARS parameter.
SHOW N_PARAMETER YEARS
```

PARAMETERS

General information about MELA Parameters

Introduction

Functions

MELA parameter definitions transmit user-supplied optional information to the MELA programs and thus control the execution of the MELASIM and MELAOPT programs.

The two types of MELA parameters are

- common parameters applicable to all MELA programs, and,
- program (MELASIM or MELAOPT) specific MELA parameters.

Most of the MELA parameters have built-in default values but some parameters have to be defined for every single application. In addition, explicit parameter definitions are needed when the built-in defaults are to be substituted. Therefore, **the default values should never be used without checking their applicability** for the analysis and the geographical region in question.

All parameter definitions are stored in run-time memory to be retrieved by the MELA programs. Parameter definitions may appear in a free order during a MELA session. However, the parameter definitions must precede the MELA command applying parameter. Parameter definitions to MELA programs are supplied from parameter (**par** type) files (preferably) or from keyboard (not recommended or comfortable). MELA parameter files are text files which can be edited with a text editor.

The MELA command INCLUDE allows the nesting and the hierarchical organization of MELA parameter files. For example, the parameters may be grouped into sets belonging to the same context (e.g. economy parameters, event definitions etc.). If the user wants to share some parameter values in different sessions or applications the parameter values can be stored in a separate parameter file (module) which is included to the sessions or applications when applicable.

If the user wants to change parameter values, the safest way is to restart the MELA program with new parameter values. Therefore, only one SIMULATE command should be given in one MELASIM session. In MELAOPT the execution of SOLVE or JLP command removes parameter definitions given before the preceding SOLVE or JLP command.

Available MELA parameters

Parameters are divided into two categories by their origin:

1. **general parameters** of MELA (**system parameters)**, and

2. **parameters** declared by the user (**user parameters**).

Most of the MELA parameters are system parameters and their names are constants defined in the MELA programs. The names of the system parameters are always in upper case letters.

User parameters have user defined names. User-defined parts in the user parameter names are expressed in lower case letters. Current user parameters are classification, forestry_unit_LEVELS and forestry_unit_members.

The MELA parameters are presented here in alphabetical order. Most of the parameters are unchanged since the MELA Version 1996. In the MELA2009 version there is nine new and seven changed parameters.

In English:	**Generic names in Finnish:**
BASAL_AREA_INSTRUCTIONS	PPA_OHJE
BIOMASS_MODELS 2009	BIOMASSAMALLIT
BOUND_FOR_SUPPLEMENTARY_PLANTING	TAIMIKON_TAYDENNYSRAJA
BOUND_FOR_YOUNG_STAND_REGENERATION	TAIMIKON_UUDISTAMISRAJA
CARBON_PERCENTS 2009	HIILIPROSENTIT
classification &	luokittelu
C_VARIABLES %	C_MUUTTUJAT
COLLECTIVES 2009	KERATTAVAT
D_CLASSES_IN_REMOVAL	KERTYMAN_LPM_LUOKAT
DIAMETER_DISTRIBUTION *	LAPIMITTAJAKAUMA
DISCOUNT_RATES	LASKENTAKOROT
ENERGYWOOD_LOGGING 2009	ENERGIAPUUN_KORJUU
ENERGYWOOD_LOGGING_COSTS 2009	ENERGIAPUUN_KORJUUKUSTANNUKSET
ENERGYWOOD_PRICES 2009	ENERGIAPUUN_HINNAT
ENERGYWOOD_USE_POINTS 2009	ENERGIAPUUN_KAYTTOPAIKAT
EVENT *	TAPAHTUMA
EVENT_DEFAULTS	TAPAHTUMA_OLETUSARVOT
FEASIBLE_TREE_SPECIES	PUULAJIOHJE
FILE_NAMING &	TIEDOSTOT
FOREST_DATA_FILES	METSAVARATIEDOT
FOREST_REPORT &	METSARAPORTTI
FORESTRY_UNIT &	METSATALOUS_YKSIKKO
forestry_unit_LEVELS &	metsatalous_yksikko_TASOT
forestry_unit_members &	metsatalous_yksikko_jasenet
GROWTH_CALIBRATION *	KASVUN_TASOKORJAUS
H50_CALIBRATION	H50_KALIBROINTI
HEATING_VALUES 2009	LAMPOARVOT
INTEGERAPPROXIMATION %	KOKONAISLUKURATKAISU
LAND_VALUES	MAAN_ARVOT
LOG_VOLUME_CALIBRATION *	TUKKITILAVUUDEN_TASOKORJAUS
LOG_VOLUME_REDUCTION	TUKKIVAHENNYS
LOG_VOLUME_REDUCTION_MODEL	TUKKIVAHENNYSMALLI
LOGGING_COSTS	KORJUUKUSTANNUKSET
LOWEST_LEVEL	ALIN_TASO
MANAGEMENT_CATEGORY_GROUPS	KASITTELYLUOKAT
MANAGEMENT_UNIT_TYPE	LASKENTAYKSIKON_TARKENNE
MAX_REGENERATION_TIME	SALLITTU_UUDISTUMISAIKA
MAX_LENGTH_OF_FILENAME &	TIEDOSTONIMEN_PITUUS
MIN_NUMBER_OF_SEEDLINGS	MIN_VILJELYTIHEYS
MIN_NUMBER_OF_STEMS_AFTER_THINNING	MIN_RLUKU_HARV_JALKEEN
MIN_REGENERATION_AGE	MIN_UUDISTUSIKA
MIN_REGENERATION_DIAMETER	MIN_UUDISTUSLAPIMITTA

MPS_VARIABLES *	MPS_MUUTTUJAT
MPU_FORMAT	MPU_MUOTOILU
MSD_VARIABLES	MSD_MUUTTUJAT
MSR_VARIABLES	MSR_MUUTTUJAT
NUMBER_OF_SEED_TREES	SIEMENPUIDEN_MAARA
OUTPUT	TULOSTUS
PRINT_INPUT_LINES	SYOTTORIVIEN_TULOSTUS
RE_SIMULATION_INSTRUCTIONS	TOISTO_OHJE
ROADSIDE_LOG_PRICE_ADJUSTMENT	TIENVARSIHINNAN_JAREYSKORJAUS
ROADSIDE_PRICES	TIENVARSIHINNAT
SILVICULTURAL_COSTS	METSANHOITOKUSTANNUKSET
SIMULATION_CONTROL	SIMULOINNIN_OHJAUS
SMALL_TREE_DIAMETER_MODEL	LAPIMITTAJAKAUMAMALLI
SMT_VARIABLES	SMT_MUUTTUJAT
SMT_WEIGHTS	SMT_PAINOT
SMU_EVENTS	SMU_TPAHTUMAT
SMU_VARIABLES	SMU_MUUTTUJAT
SMU_YEAR_CODES	SMU_VUODET
STAND_MANAGEMENT_FILES %	LASKENTAYKSIKKOPALAUTE
STUMPAGE_PRICES	KANTOHINNAT
STUMPAGE_LOG_PRICE_ADJUSTMENT	KANTOHINNAN_JAREYSKORJAUS
SUBS_AND_TAXES	TUET_JA_VEROT
TIMBER_PRODUCTION_LAND	PUUNTUOTANNON_MAA
TIME_EXPENDITURE_IN_LOGGING	KORJUUN_AJANMENEKKI
UNUSED_GROWTH_ESTIMATES	KASVUMUISTI
UPDATED_STAND_DATA_FILES	METSIKKOPALAUTE
VOLUME_CALIBRATION *	TILAVUUDEN_TASOKORJAUS
YEARS	VUODET
YKJ_COORDINATES 2009	YKJ_KOORDINAATIT
YOUNG_STAND	NUORI_METSA

Notations:

2009	New MELA2009 parameter. This parameter is presented for first time in the MELA 2009 version
*	Changed MELA2009 parameter.
&	MELA parameter common to MELASIM and MELAOPT
%	MELAOPT specific parameter

Notes

1. Built-in default parameter values for non-obligatory parameters are applied when user-defined parameter values do not exist. For example, if the user has typing errors in the name of a parameter MELA just ignores the lines (without any complaints) and uses the default values.

2. It may sometimes be useful to define all the parameters of the session or application in the same parameter file, for example, if the parameters are controlled using a separate user interface.

3. The default values for economy models and related parameters are given as euros.

See also

General syntax of MELA parameters
Parameter definition files (**par** type files)
MELA commands
General MELA command INCLUDE
MELASIM command SIMULATE
MELAOPT command SOLVE

General syntax of MELA parameters

Type Numerical or character.

General syntax of numerical type parameter

```
PARAMETER_NAME numerical_value[ numerical_value]
```

PARAMETER_NAME A valid MELA parameter name.

numerical_value An integer or floating point value.

General syntax of character type parameter

```
PARAMETER_NAME #character_value[#character_value]
```

PARAMETER_NAME A valid MELA parameter name.

character_value A character string.

An individual parameter value must be given on one input line. The maximum length of an individual parameter value is 131 characters.

Parameter values belonging to the same parameter definition may appear on one or several adjacent input lines. There is no explicit continuation line sign. All input lines (excluding comments and empty lines) from the beginning of the parameter definition to the next valid command or parameter definition are continuation lines.

The continuation lines cannot begin with a character (A - Z) at column 1 or 2 in order to separate the continuation lines from commands and definitions. Continuation lines may contain extra spaces (character ' ') and tabs.

The syntaxes of system and user parameters are slightly different. The name of the system parameter begins with an upper case letter at column 1 on an input line, while user parameters begin at column 2 preceded by a space (character ' ').

Notes

1. If the user has typing errors in the name of a parameter MELA just ignores the lines and uses the default values.

2. The delimiter between values of numerical type parameters is a space (the character ' ').

3. The decimal point ('.') is used for floating-point values in numerical definitions.

4. The delimiter between values of character type parameters is the character '#'.

5. To separate visually system parameters, user parameters and continuation lines, it is recommended to begin the continuation lines of character type parameters with the delimiter '#' at column 1 (see example 2).

6. If the name of the user parameter begins at column 1, a warning message will be printed. However, the definition of the parameter is accepted.

See also

MELA parameters

Examples

Example 1: An example of a numerical parameter definition.

```
* The name of the system parameter begins at column 1.

YEARS 1 3 7 17 27

* or equivalently

YEARS

* After the parameter name there can be extra spaces or comments.

    1 3 7 17 27
```

Example 2: An example of a character parameter definition.

```
* The name of system parameters begins at column 1.
FORESTRY_UNIT#FX

* The name of user parameters begins at column 2.
 FX#SR#NR

*or equivalently
 FX
#SR
#NR
```

Parameter descriptions

BASAL_AREA_INSTRUCTIONS

Generic name in Finnish

PPA_OHJE

Functions

Parameter BASAL_AREA_INSTRUCTIONS defines the minimum basal area requirements before and after thinning. The parameter values can be also modified with the specific EVENT_CALL arguments of the EVENT parameter.

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

576

Default values

Example 1

Valid since

MELA99

Legend

```
(1) - (288) Minimum basal areas (m² per hectare) before thinning.

    Categories:
    • soil and peatland category: 2
      1 mineral soil
      2 peatland
    • forest site type category: 4 (see the sample plot variable (13
         of the initial data record)
      1 for values 1 and 2 of the sample plot variable (13)
      2 for value 3
      3 for value 4
      4 for values 5, 6, 7 and 8
    • tree species: 4
      1 pine
      2 spruce
      3 silver birch
      4 downy birch and other deciduous tree species
    • dominant height before thinning: 9 (10, 12, ..., 24, 26 m)
```

(289) - (576) Minimum basal areas (m2 per hectare) after thinning.

Categories: The same as for items (1) - (288)

Notes

1. The default values of the parameter have been changed in MELA2007.

See also

EVENT parameter
MIN_NUMBER_OF_STEMS_AFTER_THINNING parameter
Variables of simulation record

Examples

Example 1: A definition of the BASAL_AREA_INSTRUCTIONS parameter.

```
BASAL_AREA_INSTRUCTIONS
* Minimum basal area before thinning.
* Dominant height before thinning, m
*      10    12    14    16    18    20    22    24    26
* MINERAL SOIL
* FOREST SITE TYPE CATEGORY 1-2
* pine
     24.0  24.0  24.0  26.1  27.4  28.1  28.0  28.0  28.0
* spruce
     24.0  24.0  27.0  30.0  32.0  33.0  33.0  33.0  33.0
* silver birch
     16.0  16.0  16.9  18.9  19.8  20.7  20.7  20.7  20.7
* downy birch & other deciduous tree species
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
* FOREST SITE TYPE CATEGORY 3
     24.0  24.0  24.0  26.1  27.4  28.1  28.0  28.0  28.0
     24.0  24.0  24.0  26.1  27.4  28.1  28.0  28.0  28.0
     16.0  16.0  16.9  18.9  19.8  20.7  20.7  20.7  20.7
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
* FOREST SITE TYPE CATEGORY 4
     20.0  20.0  21.9  24.9  25.8  25.7  25.7  25.7  25.7
     24.0  24.0  24.0  26.1  27.4  28.1  28.0  28.0  28.0
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
* FOREST SITE TYPE CATEGORY 5-8
     18.0  18.0  18.9  21.9  22.8  22.7  22.7  22.7  22.7
     18.0  18.0  18.9  21.9  22.8  22.7  22.7  22.7  22.7
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9

* PEATLAND
* FOREST SITE TYPE CATEGORY 1-2
     21.0  21.0  24.5  26.7  27.7  28.3  28.4  28.4  28.4
     24.0  24.0  27.0  30.0  32.0  33.0  33.0  33.0  33.0
     16.0  16.0  16.9  18.9  19.8  20.7  20.7  20.7  20.7
     14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
```

```
* FOREST SITE TYPE CATEGORY 3
    21.0  21.0  24.5  26.7  27.7  28.3  28.4  28.4  28.4
    24.0  24.0  24.0  26.1  27.4  28.1  28.0  28.0  28.0
    16.0  16.0  16.9  18.9  19.8  20.7  20.7  20.7  20.7
    14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
* FOREST SITE TYPE CATEGORY 4
    19.5  19.5  23.2  25.2  26.1  26.4  26.4  26.4  26.4
    24.0  24.0  24.0  26.1  27.4  28.1  28.0  28.0  28.0
    14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
    14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
* FOREST SITE TYPE CATEGORY 5-8
    17.5  17.5  21.2  23.1  23.8  23.8  23.8  23.8  23.8
    17.5  17.5  21.2  23.1  23.8  23.8  23.8  23.8  23.8
    14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
    14.0  14.0  16.0  17.4  18.9  18.9  18.9  18.9  18.9
```

```
* Minimum basal area after thinning.
* Dominant height before thinning, m
*      10    12    14    16    18    20    22    24    26
* MINERAL SOIL
* FOREST SITE TYPE CATEGORY 1-2
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
    15.2  15.2  18.4  20.9  22.8  23.9  23.9  23.9  23.9
     8.5   8.5  10.9  12.7  14.1  15.0  15.0  15.0  15.0
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
* FOREST SITE TYPE CATEGORY 3
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
     8.5   8.5  10.9  12.7  14.1  15.0  15.0  15.0  15.0
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
* FOREST SITE TYPE CATEGORY 4
    14.2  14.2  15.9  17.0  17.6  17.9  18.1  18.1  18.1
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
* FOREST SITE TYPE CATEGORY 5-8
    12.0  12.0  14.1  15.5  16.1  16.1  16.1  16.1  16.1
    12.0  12.0  14.1  15.5  16.1  16.1  16.1  16.1  16.1
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4

* PEATLAND
* FOREST SITE TYPE CATEGORY 1-2
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
    15.2  15.2  18.4  20.9  22.8  23.9  23.9  23.9  23.9
     8.5   8.5  10.9  12.7  14.1  15.0  15.0  15.0  15.0
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
* FOREST SITE TYPE CATEGORY 3
    14.0  14.0  17.4  18.4  18.9  19.3  19.3  19.3  19.3
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
     8.5   8.5  10.9  12.7  14.1  15.0  15.0  15.0  15.0
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
* FOREST SITE TYPE CATEGORY 4
    13.2  13.2  16.3  17.3  17.8  18.0  18.0  18.0  18.0
    15.3  15.3  17.6  19.0  19.6  19.9  19.9  19.9  19.9
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
    10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
* FOREST SITE TYPE CATEGORY 5-8
    12.8  12.8  15.3  16.1  16.5  16.5  16.5  16.5  16.5
```

```
12.8  12.8  15.3  16.1  16.5  16.5  16.5  16.5  16.5
10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
10.4  10.4  11.7  12.7  13.4  13.4  13.4  13.4  13.4
```

Example describes the default values currently applied in MELA. The default values for mineral soils are based on the common thinning recommendations of the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006) for the Southern Finland. For peatlands the values of pine are based on the recommendations for peatlands Ruotsalainen 2007). For spruce and silver birch the same values as for mineral soils are used for site types 1−3, and for site types 4−8 the values of pine and downy birch are used for spruce and silver birch respectively.

BIOMASS_MODELS

Generic name in Finnish

BIOMASSAMALLIT

Functions

Parameter BIOMASS_MODELS is used to decide which set of biomass models is used when calculating biomass estimates in the simulation. There are two sets of biomass models available in the MELA system: models estimated by Repola (2009a, 2009b) and models estimated by Marklund (1988). Marklund's models were introduced in MELA2005 and are based on the data from Sweden. Repola's models are based on Finnish data and are introduced in MELA2009. Both sets of biomass models are based on tree species, breast height diameter and tree height as their input variables.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1

Default values 1

Valid since MELA2009

Legend

```
(1) Biomass models to be used:
    '1' Models by Repola (2009a, 2009b)
    '2' Models by Marklund (1988)
```

See also

Collectible variables

Examples

Example 1: Default value of the BIOMASS_MODELS parameter.

```
BIOMASS_MODELS 1
```

Biomass models of Repola (2009a, 2009b) are used.

BOUND_FOR_SUPPLEMENTARY_PLANTING

Generic name in Finnish

TAIMIKON_TAYDENNYSRAJA

Functions

Parameter BOUND_FOR_SUPPLEMENTARY_PLANTING defines the minimum seedling density (plants per hectare) of a stand feasible for further growing without supplementary planting. Below these densities the supplementary planting is executed with the most suitable tree species.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 16

Default values Example 1

Valid since MELA99

Legend

```
(1) - (16) Minimum number of seedlings (per hectare) of a stand feasible
     for further growing without supplementary planting.

     Categories:
     • forest site type category: 4 (see the sample plot variable (13) of
       the initial data record)
       1 for values 1 and 2 of the sample plot variable (13)
       2 for value 3
       3 for value 4
       4 for values 5, 6, 7 and 8
     • tree species: 4
       1 pine
       2 spruce
       3 silver birch and other deciduous tree species than downy birch
       4 downy birch
```

Notes

1. The BOUND_FOR_YOUNG_STAND_REGENERATION parameter implicitly defines the lower bound for feasible supplementary planting.

2. The default values of the parameter have been changed in MELA2002.

See also

BOUND_FOR_YOUNG_STAND_REGENERATION parameter
FEASIBLE_TREE_SPECIES parameter
MIN_NUMBER_OF_SEEDLINGS parameter
Variables of simulation record

Examples

Example 1: A definition of the BOUND_FOR_SUPPLEMENTARY_PLANTING parameter.

```
BOUND_FOR_SUPPLEMENTARY_PLANTING

* Tree species:
* (1) pine
* (2) spruce
* (3) silver birch and other deciduous tree species than downy birch
* (4) downy birch

*  (1)   (2)   (3)   (4)
* Forest site type category 1-2
  1500  1300  1200  1300
* Forest site type category 3
  1500  1300  1200  1300
* Forest site type category 4
  1500  1300  1200  1300
* Forest site type category 5-8
  1500  1300  1200  1300
```

The default values described in Example 1 are based on the Finnish recommendations of the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006). The default values are used for the temperature sum above 900 dd decreasing automatically about 15 % for each 100 dd below 900 dd. Notice that this mechanism does not work with the user-supplied parameter values.

BOUND_FOR_YOUNG_STAND_REGENERATION

Generic name in Finnish

TAIMIKON_UUDISTAMISRAJA

Functions

Parameter BOUND_FOR_YOUNG_STAND_REGENERATION defines the minimum seedling density (plants per hectare) of a stand feasible for further growing without immediate regeneration. However, supplementary planting can be a prerequisite for further growing. Below these densities the regeneration is executed.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 32

Default values Example 1

Valid since MELA99

Legend

```
(1) - (32) Minimum number of seedlings (per hectare) of a stand
           feasible for further growing without regeneration.

           Categories
           • tree species: 2
              1 coniferous tree species
              2 deciduous tree species
           • forest site type category: 4 (see the sample plot
             variable
              (13) of the initial data record)
              1 for values 1 and 2 of the sample plot variable (13)
              2 for value 3
              3 for value 4
              4 for values 5, 6, 7 and 8
           • height class: 4
              1 mean height     < 2,0 m
              2 mean height 2,0 - 2,99 m
              3 mean height 3,0 - 4,99 m
```

```
                4 mean height     ≥ 5,0 m
```

Notes

1. The parameter implicitly defines also the lower bound for feasible supplementary planting.

See also

BOUND_FOR_SUPPLEMENTARY_PLANTING parameter
MIN_NUMBER_OF_SEEDLINGS parameter
Variables of simulation record

Examples

Example 1: A definition of the BOUND_FOR_YOUNG_STAND_REGENERATION parameter.

```
BOUND_FOR_YOUNG_STAND_REGENERATION

* Coniferous tree species
* Forest site type category 1-2
* Height class:
* < 2  2-3  3-5  ≥ 5 m
  600  600  600  600
* Forest site type category 3
  600  600  600  600
* Forest site type category 4
  600  600  600  600
* Forest site type category 5-8
  500  500  500  500

* Deciduous tree species
  600  600  600  600
  600  600  600  600
  600  600  600  600
  500  500  500  500
```

The default values are based on the Finnish recommendations for Southern Finland by the Forestry Centre Tapio (Hyvän metsänhoidon ... 2006).

CARBON_PERCENTS

Generic name in Finnish

HIILIPROSENTIT

Functions

This parameter is used to give carbon percents for the biomass estimates (dry matter) in the simulation. Default value for the carbon fraction of biomass is 50 % and it is based on the guidelines of United Nation's Intergovernmental Panel on Climate Change (Good Practice Guidance for Land Use, Land-Use Change and Forestry, 2003) for calculating the carbon stock and the change on carbon stock in living biomass in forest land.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 28

Default values Example 1

Valid since MELA2009

Legend

```
(1) - (28) Carbon percents for the biomass estimates (dry matter) in the
    simulation.
    Categories:
    • Biomass components of a tree: 7 (stem wood, stem bark, living
    branches, foliage, dead branches, stump, roots)
    • tree species categories: 4 (pine, spruce, birch, deciduous trees
    other than birch)
```

Examples

Example 1: A Definition of the CARBON_PERCENTS parameter.

```
CARBON_PERCENTS
* carbon percents for scots pine
         50.0    50.0    50.0    50.0    50.0    50.0    50.0
* carbon percents for norway spruce
         50.0    50.0    50.0    50.0    50.0    50.0    50.0
* carbon percents for birch
         50.0    50.0    50.0    50.0    50.0    50.0    50.0
* carbon percents for deciduous trees other than birch
         50.0    50.0    50.0    50.0    50.0    50.0    50.0
```

classification

Generic name in Finnish

luokittelu

Functions

Classification Parameter parameter describes category definitions for category variables used in the data collection requests of the FOREST_REPORT parameter.

Origin	User parameter
Program	**MELASIM, MELAOPT**
Type	Character (character items may contain also numerical parts)
Number of items	Optional
Default values	None
Valid since	MELA2002

Syntax

```
name#item explanation[#item explanation]
```

```
  size#<10 small
 #=>10 large
```

`name`	Name of a classification parameter
`item`	Classification item
`explanation`	The short explanation of the category for the construction of verbal explanations for the respective collective variables.

A classification item can be either

- `*´ denoting all, or
- a relational expression (a list of single relations and ranges):

```
<=>c<=>c[,<=>c<=>c]
```

```
=1
1
=40<=80,>100,90
40<=80,>100,90
```

Notes

1. Design the categories of the classifications always with thought. The observations falling outside of the defined categories are just dropped from the respective distributions. Notice that additional outlier categories may serve as data range or model outcome check.

2. Category definitions must base on the existing values of category variables.

3. The number of classification items is not restricted and the items may well be overlapping, including intermediate and total sums. However, completely contiguous categories are faster to process than non-contiguous ones.

4. Sometimes a category variable may have several classifications with one or more similar classifications items. In those cases, if, for example, two data requests have same combination of collectible variable and category variable for which different classifications are defined, the explanation of the first matching classification item read by a MELA program is applied in both cases.

See also

FOREST_REPORT parameter
collective variables
relational expression
General syntax of MELA parameters

Examples

Example 1: Some definitions of classification parameters.

```
* tree species
 sp
#1,7   pine and resp.
#2     spruce
#3=4   birch
#5,6,8 other deciduous
#>0    total

* cutting method
 cm
```

```
#10,11  first thinning
#20,21  thinning
#25     over story removal
#27,28  seed tree cutting
#29     shelterwood cutting
#30     clear cutting
#10<=30 total

 cm1
#10,11  first thinning
#20,21  thinning
#25     over story removal
#10,11,20,21,25 intermediate cuttings
#27,28  seed tree cutting
#29     shelterwood cutting
#30     clear cutting
#27<=30 regeneration cuttings
#10<=30 total
```

A user supplied classification parameter *sp* defines the tree species categories to be used for data collection; *cm* is another classification parameter describing the categories of cutting methods using event identification number; *cm1* is also a classification parameter slightly different than *cm*.

COLLECTIVES

Generic name in Finnish

KERATTAVAT

Functions

Parameter COLLECTIVES expresses in MELASIM the collective variables to be stored in management schedule files (**msc** and **msd** type files) for further processing by MELAOPT. The defined collective variables are stored automatically for all the sub-periods defined by the YEARS parameter.

Collective variables should be selected according to actual decision problems and reporting needs.

Origin

System parameter

Program

MELASIM

Type

Character (character items may contain also numerical parts)

Number of items

Optional, max. 500

Default values

None

Valid since

MELA2009

Syntax

```
#collective[#collective]
```

#	The delimiter of MELA character parameter items.
collective	Name of the collective variable or data collection request.

Notes

1. Only categorical definitions are allowed, not references to a classification.

See also

Collective variables
MPS_VARIABLES parameter
YEARS parameter
Management schedule files (**msc** and **msd** type files)

Examples

Example 1: Example of the COLLECTIVES parameter definition.

```
COLLECTIVES
#P
#P[s=1,7]
#V[s=1,7][d>20]
#Pmax(RC,RC,node)
```

Four collective variables are defined with COLLECTIVES parameter. First is collectible variable P (roadside price value) without any category definition. Next is also collectible variable P, but now with one category definition (tree species code). Third one is collectible variable V (volume of growing stock) with two category definitions (tree species code and diameter at 1.3 m height). Fourth is reference to Pmax function for local margin.

C_VARIABLES

Generic name in Finnish

C_MUUTTUJAT

Functions

Parameter C_VARIABLES defines the names (character strings) of the c variables stored in management unit records of **rsd/rsu** type files. In MELASIM and MELAOPT c variables can be stored in to management report text records (**mpu** files), in MELAOPT also in to management report records (**mps** files). In MELAOPT c variables are management unit level classifications used to define JLP domains.

Origin System parameter

Program **MELASIM, MELAOPT**

Type Character

Number of items Optional, max. 100

Default values None

Valid since MELA96, changed MELA2009 2nd ed.

Legend

```
(1) - (n) Names (character strings) of the c variables in a management
          unit record.
```

Notes

1. User is responsible for the compatibility of the c variables in management unit records and the values of the C_VARIABLES parameter.

See also

JLP domains
Management unit record
Management unit text record
Stand management files (**mps** and **mpu** type files)

Examples

Example 1: A definition of the C_VARIABLES parameter.

```
C_VARIABLES#SITE#AGE#OWNER
```

There are three c variables in management unit records and the names of these variables are "SITE", "AGE" and "OWNER". The delimiter between the values of the character type parameters is '#'.

D_CLASSES_IN_REMOVAL

Generic name in Finnish

KERTYMAN_LPM_LUOKAT

Functions

Parameter D_CLASSES_IN_REMOVAL defines the diameter classes of cutting removal when collecting the variables (121) - (180) of the decision data variables (MSD variables).

Origin System parameter

Program MELASIM

Type Numerical

Number of items 4

Default values 10.4999 20.4999 30.4999 99.9999

Valid since MELA96

Legend

```
(1) - (4) Upper limits (cm) for diameter classes of cutting removal
          when collecting the decision data record variables (121) -
          (180).
```

Notes

1. The diameter classification of cutting removal is based on the diameter of the individual trees being cut.

2. The diameter classes are collected during the simulation in MELASIM. The diameter classes cannot be changed afterwards in MELAOPT. User is responsible for checking the compatibility of the explanations in the instructions for the generation of summary reports and the values of the D_CLASSES_IN_REMOVAL parameter.

3. Using classification parameter it is possible to define more detailed diameter classes for cutting removal or for other collective variables independently from the parameter D_CLASSES_IN_REMOVAL.

See also

Decision data variables (MSD variables)
collective variables
classification parameter
FOREST_REPORT parameter

Examples

Example 1: A definition of the D_CLASSES_IN_REMOVAL parameter.

```
D_CLASSES_IN_REMOVAL 20.4999 30.4999 40.4999 99.9999
```

The cutting removal will be divided in four diameter classes (0 - 20.4999 cm, 20.5 - 30.4999 cm, 30.5 - 40.4999 cm and 40.5 - 99.9999 cm) when collecting the decision variables data (121) - (180).

DIAMETER_DISTRIBUTION

Generic name in Finnish

LAPIMITTAJAKAUMA

Functions

Parameter DIAMETER_DISTRIBUTION defines the usage of alternative basal area diameter distribution models. The user can choose among three groups of specieswise basal area diameter distribution models:

- Weibull distribution models (Mykkänen 1986, Kilkki et al. 1989) (default)
- Percentile based basal area diameter distribution models (Kangas & Maltamo 2000)
- Johnson's SB distribution models (Siipilehto1999)
- Johnson's SB distribution models (Siipilehto 2007, 2009)

The last three model groups can apply measured stem numbers.

The DIAMETER_DISTRIBUTION parameter also defines the calibration of the predicted diameter distribution of pine. The measured stand characteristics which can be utilised in calibration are stem number.

Origin System parameter

Program **MELASIM/**extensions

Type Numerical

Number of items 4

Default values 0 0 0 0

Valid since MELA2002, changed in MELA2009

Legend

```
(1) Basal area diameter distribution models for pine
'0' Weibull
'1' Percentile
'2' Johnson's SB (Siipilehto 1999)
'3' Johnson's SB (Siipilehto 2007, 2009)
(2) Basal area diameter distribution models for spruce
'0' Weibull
'1' Percentile
```

```
'2' Johnson's SB (Siipilehto 1999)
'3' Johnson’s SB (Siipilehto 2007, 2009)
(3) Basal area diameter distribution models for birch
'0' Weibull
'1' Percentile
'2' Johnson's SB (Siipilehto 1999)
'3' Johnson’s SB (Siipilehto 2007, 2009)
(4) Calibration of the diameter distribution of pine
'0' No calibration
'1' Calibration with linear optimisation
```

Examples

Example 1: A definition of the DIAMETER_DISTRIBUTION parameter

```
DIAMETER_DISTRIBUTION 1 1 1 0
```

The use of the percentile based basal area diameter distribution models for all tree species are defined and the diameter distribution of pine is not calidistribution is not calibrated.

DISCOUNT_RATES

Generic name in Finnish

LASKENTAKOROT

Functions

Parameter DISCOUNT_RATES defines the optional discount rates applied in the calculation of the net present values.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 5

Default values 1.010 1.020 1.030 1.040 1.050

Valid since MELA96

Legend

```
(1) - (5) Discount rates
```

Notes

1. The discount rates applied in MELASIM cannot be changed in MELAOPT.
2. User has to take care of the compatibility of the discount rates and the land values.

See also

Decision data Variables (801) - (810)
Decision data Variables (951-960)
Net present value variable
Costs variable

Income/revenue/return variable
LAND_VALUES parameter

Examples

Example 1: A definition of the DISCOUNT_RATES parameter.

```
DISCOUNT_RATES 1.020 1.025 1.030 1.035 1.040
```

The discount rates for the calculation of net present values are 2.0, 2.5, 3.0, 3.5 and 4.0 per cent.

ENERGYWOOD_LOGGING

Generic name in Finnish

ENERGIAPUUN_KORJUU

Functions

Parameter ENERGYWOOD_LOGGING defines the basic parameter values needed in order to form energy wood procurement alternatives more or less exogenously in the MELA system. Thus with the sensible use of these values desirable alternatives can be forced in to the solution and the rise of fruitless alternatives can be restricted. However, the use of very strict values can also block efficient alternatives and hamper the endogenous choice i.e. the effects of the prices and costs on the choice.

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

31

Default values

4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0
9.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0
20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0
20.0 25.0 0.7 0.9 4.0 40.0 60.0

Valid since

MELA2009, changed MELA2009b 2nd ed

Legend

```
(1)-(8)    The minimum diameter at the breast hight by tree species (8)of a
tree
 suitable for energy wood in the integrated logging, cm.
 * category: tree species (see the tree variable (2) of the initial data
record)
(9)-(16)   The maximum diameter at the breast hight by tree species (8) of
a tree
 suitable for energy wood in the integrated logging, cm
```

```
 * category: tree species (see the tree variable (2) of the initial data
record)


(17-24)    The minimum diameter of a stump applicable for lifting, cm
 * category: tree species (see the tree variable (2) of the initial data
record)
(25)       The minimum harvested volume of energy wood in the integrated
logging,m³/ha
(26)       The maximum volume of roundwood (logs and pulwood) in integrated
logging,   m³/ha
(27)       The proportion of logging residues hauled from the stand, p/100
(29)       The proportion of lifted stumps applicable for lifting, p/100
(30)       The harvesting method for the logging residues
           '0' The most economic one of the '1'–'3'
           '1' Forwarding loose residues
           '2' Bundlings
           '3' Terrain chipping
           '4' Random choice between '1'-'3' using realized distribution
information
(30)       The minimum energy wood removal, m³/ha
(31)       Maximum truck transportation distance for energy wood, km
```

Notes

1. If the arguments (25)-(26), (30) or (31) do not actualize the treatment is disregarded

See also

ENERGYWOOD_LOGGING_COSTS
ENERGYWOOD_PRICES
EVENT_CALL

Initial data record variables (RSD variables)
Stand data text file variables (RSU variables)
Income/revenues/returns variable
Costs variable
Net present value variable

Examples

Example 1: A definition of the ENERGYWOOD_LOGGING parameter.

```
ENERGYWOOD_LOGGING
* tree species
*  1    2    3    4    5    6    7    8
  4.0  4.0  4.0  4.0  4.0  4.0  4.0  4.0
  9.0  9.0  9.0  9.0  9.0 99.0  9.0 99.0
 25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0
```

```
*
 20.0 40.0 0.7 0.85 1 20.0 60.0
```

For Scotch pine (1), Norway spruce (2), silver (3) and downy birch (4), aspen (5) and other coniferous species (7) the trees with diameter 4–9 cm and for alder (6) and other deciduous tree species (8) trees with diameter 4-99 cm are suitable for energy wood in the integrated energywood and roundwood logging and felled trees below 4 cm are left on the ground as logging residue and felled trees above 9 or 99 cm are purchased for pulpwood or logs. Trees having the stump diameter of 25 cm or more can be lifted. Stands having more than 20 m³ removal of energy wood and less than 40 m³ removal of logs or pulpwood are suitable for the integrated harvesting. 70 % of logging residues (branches, stems) are hauled from the stand as energy wood and 85 % of stumps having stump diameter ≥25 cm are lifted. The energy wood is forwarded as loose residues. The over all minimum removal of energy wood is 20 m³/ha and maximum long-distance transportation is 60 km.

ENERGYWOOD_LOGGING_COSTS

Generic name in Finnish

ENERGIAPUUN_KORJUUKUSTANNUKSET

Functions

Parameter ENERGYWOOD_LOGGING_COSTS defines the unit costs (€/hour or €/m³) for the whole energy wood procurement chain. This parameter is provided by the sub-periods corresponding to the YEARS parameter. The number of the given sub-periods can be 1 to 9. If the first given sub-period is 'k', the default values are used for the sub-periods 1 to k-1 and for the sub-periods beyond the k, the values of the k are used until the next given sub-period.

The costs are used together with the prices in the calculation of net revenues and net present values, consequently determining the preference and the priority of management operations in the analysis from the economic point of view. The consistency of prices and costs is of great importance, besides the general cost level.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 15 for each given sub-period, the maximum number of sub-periods is 9 and the maximum number of given items 135

Default values 1 85.0 25.0 85.0 60.0 70.0 60.0 87.0 120.0 1.7 0.3 1.3 63.0 75.0 53.0

Valid since MELA2009

Legend

```
(1)  The ordinal number of the sub-period.
(2)  Mechanized energy wood felling with harvester, €/hour
(3)  Manual energy wood felling, €/hour
(4)  Mechanized energy wood harvesting with harwarder, €/hour
(5)  Energy wood forest haulage with forwarder, €/hour
(6)  Bundler (baling the logging residues), €/hour
```

```
(7)  Stump lifting with excavators, €/hour
(8) Terrain chipper, €/hour
(9)  Mobile chippers at the road-side landing, €/hour
(10)Fixed stationary crusher, €/m³
(11) Compensation of felling logging residues in to the piles, €/m³
(12) Organisation costs, €/m³
(13) Machine transfer/entry costs, €/stand
(14) Long-distance transport costs with trucks, €/hour
(15) Costs of loading and unloadning of trucks, €/hour
```

See also

ENERGYWOOD_PRICES
ENERGYWOOD_LOGGING
YEARS parameter
EVENT_CALL
SUBS_AND_TAXES

Income/revenues/returns variable
Costs variable
Net present value variable

Examples

Example 1: A definition of the ENERGYWOOD_LOGGING_COSTS parameter.

```
ENERGYWOOD_LOGGING_COSTS
 2 88.0 26.0 88.0 62.0 72.0 62.0 90.0 124.0 2.0 0.0 1.0 65.0 77.0 55.0
 5 90.0 27.0 90.0 64.0 74.0 64.0 92.0 127.0 2.0 0.0 1.0 67.0 80.0 56.0
```

For the 1st sub-period the default values are used, for the sub-periods 2−4 the values of the given sub-period 2 are used and for the 5th and the subsequent sub-periods the values of the sub-period 5 are applied.

ENERGYWOOD_PRICES

Generic name in Finnish

ENERGIAPUUN_HINNAT

Functions

Parameter ENERGYWOOD_PRICES defines the prices for logging residues, for stems and for stumps and tallest (> 10 cm) roots used as energy wood both at the "stumpage" and at the road-side. "Stumpage" prices are used to calculate the value of energy wood (revenues) at the stand without taking the costs into account. With the road-side prices the average logging costs are included at the prices.

The parameter is provided by the sub-periods corresponding to the YEARS parameter. The number of the given sub-periods can be 1 to 9. If the first given sub-period is 'k', the default values are used for the sub-periods 1 to k-1 and for the sub-periods beyond the k, the values of the k are used until the next given sub-period.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	7 for each given sub-period, the maximum number of sub-periods is 9 and the maximum number of given items 63
Default values	Example 1
Valid since	MELA2009

Legend

(1)	The ordinal number of the sub-period.
(2)	Energy wood stumpage price for logging residues (€/m³)
(3)	Energy wood stumpage price for roundwood (€/m³)
(4)	Energy wood stumpage price for stumps and roots (€/m³)
(5)	Energy wood road-side price for logging residues (€/m³)
(6)	Energy wood road-side price for roundwood (€/m³)
(7)	Energy wood road-side price for stumps and roots (€/m³)

.

See also

ENERGYWOOD_LOGGING_COSTS
ENERGYWOOD_LOGGING
EVENT_CALL
SUBS_AND_TAXES
YEARS parameter

Income/revenues/returns variable
Costs variable
Net present value variable
Value variable
Tree species variable

Examples

Example 1: A definition of the ENERGYWOOD_PRICES parameter.

```
ENERGYWOOD_PRICES
 1
* at the stumpage
 2.5 5.0 1.5
* at the road-side
 5.5 18.0 5.5
 5
```

For the sub-periods 1−4, the values of the given sub-period 1 are used, and for the 5th and the subsequent sub-periods the values of sub-period 5 are applied.

ENERGYWOOD_USE_POINTS

Generic name in Finnish

ENERGIAPUUN_KAYTTOPAIKAT

Functions

With the parameter ENERGYWOOD_USE_POINTS the user can define the locations of facilities where she/he likes to transport the wood meant for the energy production. The parameter is used for determining the distance between the stand and the nearest facility in order to calculate transportation costs. The distance is determined as the shortest path (straight line) between two points and furthermore the distance is multiplied by a general curving coefficient (1,34). For the energy wood usage the distance from the stand to the end-use point is an important factor when calculating the profitability of energy wood usage.

The user can give at most 100 different locations defined by both north (X) and east (Y) coordinates. Finnish uniform coordinate system (YKJ) is the default coordinate system. If user applies EUREF-FIN (ETRS-TM35FIN) coordinate system then the parameter YKJ_COORDINATES with the value 0 must have been defined. By the default in MELA2009 there are 372 facility locations and the use of parameter ENERGYWOOD_USE_POINTS will neglect them all.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 2-200

Default values 372 locations

Valid since MELA2009

Legend

```
* First facility location
(1) North, X-coordinate, m
    Finnish uniform coordinate system (YKJ)or EUREF-FIN (ETRS-TM35FIN)
(2)  East, Y-coordinate, m
```

```
     Finnish uniform coordinate system (YKJ)or EUREF-FIN (ETRS-TM35FIN)
* Second facility location
(3)  X-coordinate
(4) Y-coordinate
...
*nth facility location
(2n-1) X-coordinate
(2n)   Y-coordinate
```

Notes

1. Coordinate system given in YKJ_COORDINATES parameter must been used with this parameter.

See also

ENERGYWOOD_LOGGING_COSTS
ENERGYWOOD_PRICES
EVENT_CALL
YKJ_COORDINATES

Income/revenues/returns variable
Costs variable
Net present value variable

Examples

Example 1: A definition of the ENERGYWOOD_USE_POINTS parameter.

```
ENERGYWOOD_USE_POINTS
6976161 3250345
6928161 3310345
6900161 3238345
6896161 3250345
6876161 3252345
6810161 3370345
6832161 3258345
6786161 3244345
6738161 3230345
6718161 3308345
6706161 3274345
```

In the example, 11 different facility locations are defined with 'pairs' of x and y-coordinates.

EVENT

Generic name in Finnish

TAPAHTUMA

Functions

Parameter EVENT defines optional events (natural processes and human activities) for the simulation of management schedules. The purpose of the simulation is to generate a set of different management options for stands over time for the selection of a forest level production and management program.

Each occurrence of the EVENT parameter generates one optional event for simulation. Every optional event has to be defined separately. The maximum number of event definitions is determined in the item (2) of the SIMULATION_CONTROL parameter.

Basic events with the basic event routines are the generic steps of the MELA simulation. The usage of the EVENT parameter makes it possible to provide set of optional events for each simulation application in the limits of the built-in basic event routines and their arguments in MELASIM. The same basic event routines can be referred several times in the same application with different parameter settings in order to generate slightly different management options, for example concerning thinnings (example 1).

The tasks of the basic event routines in the simulation are to

- decide the feasibility of the basic events in each state of the management unit,
- simulate the details of the basic events, and
- collect the summarized values of decision variables.

The basic event routines and the respective basic event groups in the current MELASIM version are:

- natural processes,
- cuttings,
- tending of young stands,
- artificial regeneration,
- clearing of regeneration area,
- soil preparation,
- drainage of peat lands,
- fertilization,
- pruning of pine, and
- changing the values of management unit variables.

The actual choice of optional events is generated using the EVENT parameter and event definitions. Besides the general event identification and event definition items, each

event definition contains one call or several calls of the basic event routines in accordance with the desired simulation actions.

The basic events and the calls of the basic event routines with their arguments are introduced in the section 'Calls of basic event routines'.

Origin System parameter

Program **MELASIM**

Type Character (character parts may also contain numerical parts)

Number of items Optional

Default values None

Valid since MELA96, changed MELA99

Syntax

Each occurrence of the EVENT parameter consists of three types of items:

- an event identification line (item (1)),
- up to seven optional event definition items (items (2) - (8)),
- one or more calls of the basic event routines (items (9) - (n)), and

An unlimited number of continuation "items" can follow each of the items (2) to (n) with prefix '#>>' as continuation indicator. Continuation items are for splitting EVENT definition items overriding the maximum length of input lines, i.e. 131 characters (example 2). Continuation items do not contain other than numerical values.

The items of the EVENT parameter are:

```
#event_identification characterisation
#EVENT_YEARS year[ year] repeat_interval
#EVENT_INTERVALS interval[ interval]
#EVENT_BRANCHING value[ value]
#COMPARABLE_EVENTS event_identification[ event_identification]
#FEASIBLE_PRECEDESSORS event_identification[ event_identification]
#FOREST_CATEGORIES feasibility_condition
#EVENT_PROBABILITY value[ value]
#EVENT_CALL argument_value[ argument_value]
#>> value[ value]
```

The event identification line (1) is a header of the event definition. Optional event definition items (2) - (8) control the simulation of events and describe the relationships

between events. Basic event calls (9) - (n) are references to the basic event routines equipped with application specific argument values.

The event identification line (1) and at least one basic event routine call (9) must appear in each event definition. Optional event definition items are required if they differ from the user-supplied default values given with the EVENT_DEFAULTS parameter. The COMPARABLE_EVENTS and FEASIBLE_PRECEDESSORS items are usually required for all event definitions.

Notes

1. User-supplied event definitions are always required for each simulation application.

2. The continuation items apply for the items (2) - (n) of the EVENT parameter only.

See also

event_identification item
EVENT_YEARS item
EVENT_INTERVALS item
EVENT_BRANCHING item
COMBARABLE_EVENTS item
FEASIBLE_PRECEDESSORS item
FOREST_CATEGORIES item
EVENT_PROBABILITY item
EVENT_CALL item
EVENT_DEFAULTS parameter
Item (2) of the SIMULATION_CONTROL parameter
Decision data Variables

Examples

Example 1: A definition of the EVENT parameter.

```
EVENT
* Event identification (10) and characterization in words
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS

* Optional event definition item (5)
#COMPARABLE_EVENTS 20 25 27 28 29 50

* Optional event definition item (6)
#FEASIBLE_PRECEDESSORS 70 71 99

* Optional event definition item (7)
#FOREST_CATEGORIES 3 30 0 -3.99999
```

```
* One basic event call
#EVENT_CALL 2 1 3 1 0 800 800 8 12 0 1500 1 0.5 0 0 0 0
```

A thinning based on number of stems is defined. The items (2) - (4) and (8) (EVENT_YEARS, EVENT_INTERVALS, EVENT_BRANCHING and EVENT_PROBABILITY) are defined in the EVENT_DEFAULTS parameter.

Example 2: The use of continuation items in the EVENT parameter.

```
EVENT
* Event identification line
#20 THINNING - BASAL AREA INSTRUCTIONS

* Optional event definition item (7)
#FOREST_CATEGORIES  3 30 0 -3.99999
#>>  3 12 1.0 4.0

* One basic event call
#EVENT_CALL 2 1  1 1 0 0 0 10 1.2 0 1.5 1 1 0 0 0 0
#>>  0.8 0.8 0.8 0.8 1 1 1 1 0 0
#>>  1 3 6 99 2 2 -1 -1 8 -0.5 0 0 0 0 8 -0.5 0
```

A thinning based on basal area instructions is designed with optional tree selection instructions in the EVENT_CALL item. The values of the FOREST_CATEGORIES and EVENT_CALL items are divided on several lines with continuation items.

EVENT – event_identification

Event identification line of the EVENT parameter

Item (1) of the EVENT parameter:

event_identification

Functions

The identification line of the EVENT parameter is the header of the event definition.

Syntax

```
#event_identification characterisation
```

event_identification An integer number to identify the event. The identification number must be unique for each event in the same application.

characterisation A character string describing the event in words.

Notes

1. There are formally no limits concerning the numbering of events, however the maximum number should be 999, for in some instances only tree digits are reserved for event identification number.

2. The event identification number for natural processes should always be the last one.

Examples

Example 1: A definition of the event identification.

```
EVENT
* Event identification (10) and characterization in words
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS

* Optional event definition item (5)
#COMPARABLE_EVENTS 20 25 27 28 29 50

* Optional event definition item (6)
#FEASIBLE_PRECEDESSORS 70 71 99
```

```
* Optional event definition item (7)
#FOREST_CATEGORIES 3 30 0 -3.99999

* One basic event call
#EVENT_CALL 2 1 3 1 0 800 800 8 12 0 1500 1 0.5 0 0 0 0
```

In the example the event identification number is ‘10’ and the rest of the line constitutes the characterization of the event: ‘FIRST THINNING – NUMBER OF STEMS/HA INSTRUCTIONS’.

EVENT – EVENT_YEARS

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (2) of the EVENT parameter:

EVENT_YEARS

Generic name in Finnish

TAPAHTUMAVUODET

Functions

Item EVENT_YEARS defines the relative years when the event can be simulated.

Syntax

```
#EVENT_YEARS year[ year] repeat_interval
```

year	A relative year when the event can be simulated, usually a year in the middle of the sub-period in question. The event years can be provided for the whole simulation period or any period when the event can be simulated. The events after the last year are simulated according to the repeat_interval argument. The sub-periods are defined by the YEARS parameter.
repeat_interval	A number of years between the event years after the last event year provided. This is the last argument of the EVENT_YEARS item.

Notes

1. The user is responsible for the compatibility of the EVENT_YEARS item and the YEARS parameter.

2. If an event should be simulated only for the selected sub-periods, the repetition can be omitted by providing a high value for the repeated interval.

3. If the item EVENT_YEARS is not provided the values of the parameter EVENT_DEFAULTS are used instead.

See also

event_identification item
EVENT_INTERVALS item
YEARS parameter
EVENT_DEFAULTS parameter
SMU_YEAR_CODES parameter

Examples

Example 1: A definition of the EVENT_YEARS item of the EVENT parameter.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#EVENT_YEARS 6 10
```

The event can be simulated with 10-year intervals beginning from the relative year 6, i.e. in the middle of each 10-year sub-period.

EVENT – EVENT_INTERVALS

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (3) of the EVENT parameter:

EVENT_INTERVALS

Generic name in Finnish

LYHIMMAT_TOTEUTUSVALIT

Functions

Item EVENT_INTERVALS defines the minimum intervals between the occurrences of the event and the comparable events in a management schedule.

Syntax

```
#EVENT_INTERVALS interval[ interval]
```

interval	A minimum time interval between the event and the comparable events in a management schedule. Minimum intervals are required for each event year defined by the EVENT_YEARS item. The last interval value is repeated as a minimum interval, if required.

Notes

1. If the item EVENT_INTERVALS is not provided the values of the parameter EVENT_DEFAULTS are used instead.

See also

EVENT_YEARS item
COMBARABLE_EVENTS item
EVENT_DEFAULTS parameter

Examples

Example 1: A definition of the EVENT_INTERVALS item of the EVENT parameter.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/ha INSTRUCTIONS
#EVENT_INTERVALS 10
```

The intervals between the occurrences of the event (first thinning) and the comparable events have to be at least 10 years for all event years provided.

EVENT – EVENT_BRANCHING

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (4) of the EVENT parameter:

EVENT_BRANCHING

Generic name in Finnish

HAARAUTUMINEN

Functions

Item EVENT_BRANCHING controls the branching of the simulation of management schedules. If branching is allowed, the event may have alternative events ("branches") in the same state, i.e. the event is optional in that state supposing it is feasible. If branching is denied, the event cannot have alternative events in the same state, i.e. the event is obligatory supposing it is feasible.

Syntax

```
#EVENT_BRANCHING value[ value]
```

value A branching control for each event year. The last value is repeated if further branching control is required. The branching control can have either the value '0' or the value '1'.

The value '0' of EVENT_BRANCHING denies alternative events. An event is obligatory in the event year and only that event is simulated if it is feasible. If all events are obligatory, only one management schedule will be as a result supposing that there are feasible events. The order of the event definition occurrences determinates the priority of the obligatory events in the simulation.

The value '1' of EVENT_BRANCHING allows alternative events in the event year. An optional event means that alternative events can be simulated in the same event year resulting to several alternative management schedules, assuming that several events are feasible in the event year.

Notes

1. Constraints in the optimisation should never be provided for decision variables originating from obligatory events in the simulation. In the case of example 1, no constraints should be given in the optimisation concerning first thinning.

2. If the item EVENT_BRANCHING is not provided the values of the parameter EVENT_DEFAULTS are used instead.

See also

COMBARABLE_EVENTS item
EVENT_DEFAULTS parameter

Examples

Example 1: A definition of the EVENT_BRANCHING item of the EVENT parameter

```
EVENT
#10 FIRTST THINNING - NUMBER OF STEMS/ha INSTRUCTIONS
#EVENT_BRANCHING 0
```

The event is simulated whenever feasible without any alternative events. Further, first thinning would always be chosen in the optimum solution, because it has no alternative management options.

EVENT – COMPARABLE_EVENTS

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (5) of the EVENT parameter:

COMPARABLE_EVENTS

Generic name in Finnish

VASTAAVAT_TAPAHTUMAT

Functions

Item COMPARABLE_EVENTS defines the mutually exclusive events that cannot be simulated in the same management schedule before the minimum time interval is fulfilled. The minimum intervals between comparable events are defined in the EVENT_INTERVALS item.

Syntax

```
#COMPARABLE_EVENTS event_identification[ event_identification]
```

event_identification The identification number of the event

Notes

1. If the item COMPARABLE_EVENTS is not provided the values of the parameter EVENT_DEFAULTS are used instead, which is not recommendable.

See also

event_identification item
EVENT_INTERVALS item
EVENT_DEFAULTS parameter

Examples

Example 1: A definition of the COMPARABLE_EVENTS of the EVENT parameter.

```
EVENT
#20 THINNING - BASED ON BASAL AREA INSTRUCTIONS
#COMPARABLE_EVENTS 10 20 25 28 29 50
#EVENT_INTERVALS 10
```

Comparable events for the basal area based thinning are the events 10, 25, 28, 29 and 50. The minimum interval between these events and basal area based thinning is 10 years as well as between subsequent basal area based thinnings.

EVENT – FEASIBLE_PRECEDESSORS

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (6) of the EVENT parameter:

FEASIBLE_PRECEDESSORS

Generic name in Finnish

SALLITUT_EDELTAJAT

Functions

The FEASIBLE_PRECEDESSORS item defines events that may immediately (i.e. in the same year) precede the event.

Syntax

```
#FEASIBLE_PRECEDESSORS event_identification[ event_identification]
```

event_identification The event identification number.

Notes

1. If the item FEASIBLE_PRECEDESSORS is not provided the values of the parameter EVENT_DEFAULTS are used instead, which is not recommendable.

See also

event_identification item
EVENT_DEFAULTS parameter

Examples

Example 1: A definition of the FEASIBLE_PRECEDESSORS item of the EVENT parameter.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#FEASIBLE_PRECEDESSORS 70 71 99
```

Events 70, 71 and 99 may immediately precede the first thinning.

EVENT – FOREST_CATEGORIES

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (7) of the EVENT parameter:

FOREST_CATEGORIES

Generic name in Finnish

METSIKKOEHDOT

Functions

Item FOREST_CATEGORIES defines the conditions of management units under which the event can be simulated. The conditions are expressed using the management unit variables of the simulation data.

Syntax

```
#FOREST_CATEGORIES feasibility_condition

feasibility_condition:

category_group[ 0 category_group]

category_group:

category_definition[ category_definition]

category_definition:

number variable value[ value]
```

'0'	The delimiter of category groups denoting the logical operator OR between adjacent category groups (see example 4).
number	The number of the following arguments (variable and value(s)) in the current category definition.
variable	A management unit variable in the simulation record.
value	A relevant value of the management unit variable for defining the feasibility of the event. The values with the sign '-' define the range from the previous value to the absolute value of the variable: example 1, example 2, example 3 and example 4.

The event is feasible and it can be simulated with regard to the FOREST_CATEGORIES item if the feasibility condition calculated from the actual management unit variables is TRUE.

The logical operator (expressed by the delimiter '0') between adjacent category groups is OR. If any of the category groups is TRUE, then the feasibility condition is TRUE.

The logical operator between the adjacent category definitions is AND. If any of the category definitions is FALSE, then the category group is FALSE. The delimiter between category definitions is the space character ' ' (example 3 and example 4).

The logical operator between adjacent values and/or ranges is OR. If any of the values or ranges is TRUE, then the category definition is TRUE.

Notes

1. If the item FOREST_CATEGORIES is not provided the values of the parameter EVENT_DEFAULTS are used instead, which is not recommendable.

2. The default value '0' of the FOREST_CATEGORIES item means that the event can be simulated for any of the forest management categories.

See also

Simulation record variables
EVENT_DEFAULTS parameter

Examples

Example 1: A definition of the FOREST_CATEGORIES item of the EVENT parameter, one category definition.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#FOREST_CATEGORIES 2 30 1
```

The event can be simulated if the value of the management unit variable (30) in the simulation record is equal to 1.

Example 2: A definition of the FOREST_CATEGORIES item of the EVENT parameter, a range type category definition.

```
EVENT
```

```
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#FOREST_CATEGORIES 3 30 0 -1.9999
```

The event can be simulated if the value of the management unit variable (30) in the simulation record is greater or equal to 0 and less or equal to 1.9999.

Example 3: A definition of the FOREST_CATEGORIES item of the EVENT parameter, two category definitions.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#FOREST_CATEGORIES 3 30 0 -1.9999 4 32 1 3 5
```

The event can be simulated if the value of the management unit variable (30) is greater or equal to 0 and less or equal to 1.9999 AND the value of the variable (32) is equal to 1, 3 or 5.

Example 4: A definition of the FOREST_CATEGORIES item of the EVENT parameter, two category groups.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#FOREST_CATEGORIES 3 30 0 -1.9999 4 32 1 3 5 0
#>>                3 30 0 -1.9999 3 36 0 -20.00
```

The event can be simulated if the value of the management unit variable (30) is greater or equal to 0 and less or equal to 1.9999 AND the value of the variable (32) is 1, 3 or 5 OR if the value of the variable (30) is greater or equal to 0 and less or equal to 1.9999 AND the value of variable (36) is greater or equal to 0 and less or equal to 20.00. The variable (30) etc. refers here to management unit variables in the simulation record. Notice the continuation item '#>>' of the FOREST_CATEGORIES item.

EVENT – EVENT_PROBABILITY

Optional event definition items (items (2) – (8) the EVENT parameter)

Item (8) of the EVENT parameter:

EVENT_PROBABILITY

Generic name in Finnish

TODENNAKOISYYS

Functions

Item EVENT_PROBABILITY defines the probability to simulate the event for each year defined by the EVENT_YEARS item. The EVENT_PROBABILITY value less than 1.0 should be used only as an extreme measure to limit the total number of management schedules in a random order.

Syntax

```
#EVENT_PROBABILITY value[ value]
```

value	A value '0.0' - '1.0' for defining the probability to simulate the event for each year defined by the EVENT_YEARS item. The last value is automatically repeated if required. Usually the only relevant value is '1.0'.

Notes

1. It is recommended to define the EVENT_PROBABILITY item using the EVENT_DEFAULTS parameter only.

See also

EVENT_YEARS item
EVENT_DEFAULTS item

Examples

Example 1: A definition of the EVENT_PROBABILITY item of the EVENT parameter.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/ha INSTRUCTIONS
#EVENT_PROBABILITY 1.0
```

The first thinning is simulated for all years defined by the EVENT_YEARS parameter, if the event is feasible.

EVENT – EVENT_CALL

Calls of basic event routines

Items (9) – (n) of the EVENT parameter:

EVENT_CALL

Generic name in Finnish

TAPAHTUMAKUTSU

Functions

Item EVENT_CALL transfers the user-supplied argument values to the basic event routines. EVENT_CALL arguments make it possible to call the same basic event routines in optional ways for slightly different events and for different applications.

Syntax

```
#EVENT_CALL argument_value[ argument_value]
```

argument_value A value of the event call argument. The number of EVENT_CALL arguments is different for each basic event group. Both common and specific EVENT_CALL arguments are provided adjacently in any event call.

EVENT_CALL argument types

There are two types of EVENT_CALL arguments

I. common EVENT_CALL arguments for all basic events (A and B in example 1)and

II. specific EVENT_CALL arguments (1 to 38 in example 1) for each basic event.

There are built-in default selection instructions for the general MELA tree selection routine. User-supplied tree selection instructions can be provided for cuttings (see arguments 26 to 38 in example 1) and tending of young stands using the specific EVENT_CALL arguments. Notice that the formal structure of the user-supplied tree selection instructions is checked, but not the validity of argument values.

I. Common EVENT_CALL arguments for all basic events

Legend

```
(A) identification code of the basic event routine being called
        '1'       natural processes
        '2'       cuttings
        '3'       tending of young stands
        '4'       artificial regeneration
        '5'       clearing of regeneration area
        '6'       soil preparation
        '7'       drainage of peat lands
        '8'       fertilization
        '9'       pruning of pine
        '11'      run-time change in the value of a management unit
                  level variable in the simulation record, for
                  example,the change of the forest management category
        '12'      selecting of 'retained trees' to be left standing
                  on the cutting areas
(B)     '1'
```

II. Specific EVENT_CALL arguments for each basic event

1. Specific EVENT_CALL arguments for natural processes

Legend

```
(1)       '1' reserved for system
(2)       '5' reserved for system
(3)       '0' reserved for system
(4)       general adjustment coefficient for basal area increment models
          (on tree level), basic level = 1.0
(5)       general adjustment coefficient for height increment models (on
          tree level), basic level = 1.0
(6)       general adjustment coefficient for ingrowth models (on tree
          level), basic level = 1.0
(7)       general adjustment coefficient for mortality models (on tree
          level), basic level = 1.0
```

See note 1.

2. Specific EVENT_CALL arguments for cuttings

There are six cutting methods available for event definitions:

1 thinning based on basal area instructions
2 clear cutting
3 thinning based on number of stems instructions
4 over story removal
5 seed tree cutting
6 shelter wood cutting

Each cutting method has specific EVENT_CALL arguments. The user defines the desired cutting method (1-6) in the integer part of the first specific EVENT_CALL

argument and since MELA2009 in the decimal part of the first specific EVENT_CALL argument the user defines if the desired cutting concerns traditional roundwood cuttings (pulpwood and logs) and/or if the energy wood is taken also into account.

There are ten (0–9) specifications for each cutting method (x =1,2,...6):

x or x.0 only commercial roundwood cuttings (pulpwood and logs)
x.1 in the roundwood cuttings the branches including partly foliage and stems of felled trees are hauled for energy wood
x.2 in the roundwood cuttings the stumps and roots (> 10 cm) of felled trees are lifted for energy wood (branches and stem residues are left on the ground)
x.3 in the roundwood cuttings the branches (including partly foliage, stems, stumps and roots (> 10 cm) of felled trees are hauled for energy wood
x.4 integrated harvesting of roundwood and energy wood - the energy wood is harvested using whole-tree method
x.5 integrated harvesting of roundwood and energy wood - the energy wood is harvested using partial tree method
x.6 integrated harvesting of roundwood and energy wood - the energy wood is harvested using trunk method
x.7 pure energy wood harvesting using whole-tree method
x.8 pure energy wood harvesting using partial tree method
x.9 pure energy wood harvesting using trunk method

2.1 Thinning based on basal area instructions

In the integrated forest and stand level optimisation of MELA, thinnings for management units are selected from the simulated thinning alternatives. The principal parameters to regulate the simulation of thinnings in MELA are

- thinning intensity,
- tree size selection (from below, equal, from above),
- tree species selection, and
- minimum cutting removal per hectare.

The alternative methods to select the thinning intensity in MELASIM are

(a) relative thinning intensity ("thinning percentages"), and
(b) exogenous density regulation ("thinning models").

Thinning intensity method is selected and adjusted by the specific EVENT_CALL arguments for thinnings.

The endogenicity of each analysis results from the user supplied event definitions in simulation, including thinning options and the branching of simulation. The relative thinning intensity method combined with the branching simulation of thinning alternatives enables the endogenous solution both for the intensity and the timing of thinnings. However, the number of alternative management schedules may rise very high.

Exogenous density regulation using basal area limit after thinning with explicit minimum cutting removal and branching simulation allows endogenous timing of thinnings in optimisation.

Exogenous density regulation with basal area limits before and after thinning without branching leads to exogenous density regulation without alternatives (and without possibility to endogenous selection of thinnings).

Minimum cutting removal requirement prevents the simulation of thinning alternatives considered impracticable in order to minimize the number of management schedules and consequently the endogenicity of thinnings in analysis. Minimum cutting removal for relative thinning intensity method (a) is supplied by the specific EVENT_CALL arguments (4) and (5).

For the exogenous density regulation method (b) the minimum cutting removal requirement is determined either according to the difference of the basal area limits set by the BASAL_AREA_INSTRUCTIONS parameter adjusted by the specific EVENT_CALL arguments (16) - (23) or according to the specific EVENT_CALL arguments (4) and (5), whichever is the higher one.

The tree size and tree species selection is controlled by the tree selection instructions of the EVENT_CALL arguments (26) - (n).

The specific EVENT_CALL arguments for thinning based on basal area instructions are

Legend

(1) '1.0'–'1.9' cutting method = thinning based on basal area instructions.
See the interpretation of the decimal specification
(2) '1' reserved for system
(3) proportion of basal area to be removed (0 - 1.0), if the relative thinning intensity method (a) is applied; otherwise '0'
(4) minimum removal (m^2/hectare) in management unit for relative thinning intensity method (a) or if explicit expression is required instead of minimum basal area before thinning; otherwise '0'
(5) minimum removal (m^2/hectare) on sample plot for relative thinning intensity method (a) or if explicit expression is required instead of minimum basal area before thinning; otherwise '0'
(6) minimum mean height before thinning, m
(7) maximum mean diameter before thinning in relation to the exogenous minimum regeneration diameter requirement (0 - 10.0) (see the MIN_REGENERATION_DIAMETER parameter)
(8) minimum acceptable basal area after thinning in relation (0 - 10.0) to the exogenous basal area requirement after thinning calibrated by the arguments (20) - (23), if the relative thinning intensity method (a) is applied; otherwise '0' (see the lower limit of the parameter BASAL_AREA_INSTRUCTIONS)
(9) maximum mean age before thinning in relation to the exogenous minimum regeneration age requirement (0 - 10.0) (see the MIN_REGENERATION_AGE parameter)
(10) basal area target after thinning in relation (0 - 10.0) to the exogenous basal area requirement after thinning calibrated by the arguments (20) - (23) if the exogenous density regulation method (b) is applied; otherwise '0' (see the lower limit of the BASAL_AREA_INSTRUCTIONS parameter)

```
(11) maximum proportion of basal area to be removed in thinning (0 - 1.0),
     if the exogenous density regulation method (b) is applied; otherwise
     '0'
(12) '0' reserved for system
(13) logging season
     '0' random (1 or 2), weighted by statistics of realized loggings
           '1' summer, logging on unfrozen and snow-free ground
     '2' winter, logging on frozen and snowy ground
(14) mechanized or manual (labour-intensive) logging
     '0' cost minimizing method (1 or 2)
     '1' mechanized logging (one-grip harvester and forwarder)
     '2' manual logging (logging with chainsaw and forwarder)
(15) logging skills for manual time expenditure functions
     '0' or '1' professional
     '2' non-professional, forest owners self-reliant work
(16) calibration coefficient for the minimum basal area requirement of pine
     before thinning defined by the BASAL_AREA_INSTRUCTIONS parameter
(17) calibration coefficient for the minimum basal area requirement of
     spruce before thinning defined by the BASAL_AREA_INSTRUCTIONS parameter
(18) calibration coefficient for the minimum basal area requirement of
     silver birch before thinning defined by the BASAL_AREA_INSTRUCTIONS
     parameter
(19) calibration coefficient for the minimum basal area requirement of downy
     birch and other deciduous trees before thinning defined by the
     BASAL_AREA_INSTRUCTIONS parameter
(20) calibration coefficient for the minimum basal area requirement of pine
     after thinning defined by the BASAL_AREA_INSTRUCTIONS parameter
(21) calibration coefficient for the minimum basal area requirement of
     spruce after thinning defined by the BASAL_AREA_INSTRUCTIONS parameter
(22) calibration coefficient for the minimum basal area requirement of
     silver birch after thinning defined by the BASAL_AREA_INSTRUCTIONS
     parameter
(23) calibration coefficient for the minimum basal area requirement of downy
     birch and other deciduous trees after thinning defined by the
     BASAL_AREA_INSTRUCTIONS parameter
(24) '0' reserved for system
(25) '0' reserved for system
(26) - (n) user-supplied tree selection instructions
```

The arguments (16) - (23) are for the calibration of the values of the BASAL_AREA_INSTRUCTIONS parameter (example 2) by tree species. Notice that the basal area limit before thinning is cancelled by giving the value '0' to the arguments (16) - (19), effecting the arguments (4) and (5) as the minimum cutting removal requirement.

Notice also the multiplicative effects or conflicts of arguments especially when applying the exogenous density regulation method (b). Improper use of arguments may result unintended loss of simulated thinning alternatives and less sound analysis as a consequence. Pay attention to the arguments (4), (5), (8), (10), (11) and (16) - (23). The arguments (4), (5) and (11) may become conflicting with basal area instructions or their calibration results with the arguments (16) - (23). The exogenous basal area requirements after thinning adjusted by the arguments (8) and (10) are first calibrated with the arguments (20) - (23).

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of basal area, see the tree variable (5) of the simulation record..

When user-supplied tree selection instructions are not given, built-in default selection instructions for thinning based on basal area instructions are used.

2.2 Clear cutting

The specific EVENT_CALL arguments for clear cutting are

Legend

```
(1)  '2.0'–'2.9' cutting method = clear cutting.
     See the interpretation of the decimal specification
(2)  '1' reserved for system
(3)  '1' reserved for system
(4)  minimum removal in management unit, m2/hectare
(5)  minimum removal on sample plot, m2/hectare
(6)  minimum mean diameter before cutting in relation to the exogenous
     minimum regeneration diameter requirement (see the
     MIN_REGENERATION_DIAMETER parameter)
     0 - 10.0 relative mean diameter
       > 10.0 absolute mean diameter
(7)  minimum mean age before cutting in relation to the exogenous minimum
     regeneration age requirement (see the MIN_REGENERATION_AGE parameter)
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(8)  maximum basal area for stands mean diameter > 8 cm before cutting in
     relation to the respective exogenous minimum requirement (0 - 10.0) for
     the recognition of the low-stocked stands and the generation of a clear
     cutting option (see the BASAL_AREA_INSTRUCTIONS parameter). For stands
     mean diameter < 8cm the generation of clear cutting option
     (regeneration) is made according to the
     BOUND_FOR_YONG_STAND_REGENERATION parameter.
(9)  minimum mean age before cutting in relation to the exogenous
     regeneration age requirement, if the site type category is 6, 7 or 8
     (barren sites, rocky or sandy areas or open mountains), see the sample
     plot variable (13) of the simulation record and the
     MIN_REGENERATION_AGE parameter
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(10) minimum mean age in relation to the exogenous regeneration age
     requirement when clear cutting option is always simulated, see the
     MIN_REGENERATION_AGE parameter
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(11) '0' reserved for system
(12) '0' reserved for system
(13) logging season
     '0' random (1 or 2), weighted by statistics of realized loggings
     '1' summer, logging on unfrozen and snow-free ground
     '2' winter, logging on frozen and snowy ground
(14) mechanized or manual (labour-intensive) logging
     '0' cost minimizing method (1 or 2)
     '1' mechanized logging (one-grip harvester and forwarder)
     '2' manual logging (logging with chainsaw and forwarder)
(15) logging skills for manual time expenditure functions
     '0' or '1' professional
     '2' non-professional, forest owners self-reliant work
(16) - (n)  user-supplied tree selection instructions
```

See note 2.

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of basal area, see the tree variable (5) of the simulation record.

2.3 Thinning based on number of stems instructions

For the methods (a) and (b) regarding the thinning intensity selection, see the cutting method 2.1 'thinning based on basal area instructions'.

The specific EVENT_CALL arguments for thinning based on number of stems instructions are

Legend

```
(1)  '3.0'–'3.9'  cutting method = thinning based on number of stems
     instructions. See the interpretation of the decimal specification
(2)  '1' reserved for system
(3)  proportion of number of stems to be removed (0 - 1.0) if the relative
     thinning intensity method (a) is applied; otherwise '0'
(4)  minimum removal in management unit, stems/hectare
(5)  minimum removal on sample plot, stems/hectare
(6)  minimum mean diameter before thinning, cm
(7)  maximum mean height before thinning, m
(8)  minimum acceptable number of stems per hectare after thinning in
     relation to the exogenous number of stems per hectare requirement (0 -
     10.0), if the relative thinning intensity method (a) is applied;
     otherwise '0' (see the MIN_NUMBER_OF_STEMS_AFTER_THINNING parameter)
(9)  minimum number of stems per hectare before cutting, stems/hectare
(10) number of stems per hectare after thinning in relation to the exogenous
     number of stems per hectare requirement (0 - 10.0) if the minimum
     growing stock after thinning method (b) is applied; otherwise '0'
     (see the MIN_NUMBER_OF_STEMS_AFTER_THINNING parameter)
(11) maximum proportion of stems per hectare to be removed in thinning
     (0 - 1.0), if the minimum growing stock after thinning method (b) is
     applied; otherwise '0'
(12) '0' reserved for system
(13) logging season
     '0' random (1 or 2), weighted by statistics of realized loggings
     '1' summer, logging on unfrozen and snow-free ground
     '2' winter, logging on frozen and snowy ground
(14) mechanized or manual (labour-intensive) logging
     '0' cost minimizing method (1 or 2)
     '1' mechanized logging (one-grip harvester and forwarder)
     '2' manual logging (logging with chainsaw and forwarder)
(15) logging skills for manual time expenditure functions
     '0' or '1' professional
     '2' non-professional, forest owners self-reliant work
(16) - (n)  user-supplied tree selection instructions
```

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of number of stems per hectare, see the tree variable (1) of the simulation record.

2.4 Over story removal

The specific EVENT_CALL arguments for over story removal are

Legend

```
(1)  '4.0'–'4.9'  cutting method = over story removal.
     See the interpretation of the decimal specification
(2)  '1' reserved for system
(3)  proportion of basal area to be removed in cutting (0 - 1.0)
(4)  minimum removal in management unit, m2/hectare
(5)  minimum removal on sample plot, m2/hectare
(6)  minimum mean diameter before cutting in relation to the exogenous
     minimum regeneration diameter requirement (0 - 10.0) (see the
     MIN_REGENERATION_DIAMETER parameter)
(7)  minimum mean age before cutting in relation to the exogenous minimum
     regeneration age requirement (0 - 10.0) (see the MIN_REGENERATION_AGE
     parameter)
(8)  '0' reserved for system
(9)  '0' reserved for system
(10) minimum number of stems per hectare before over story removal in
     relation to the exogenous number of plants requirement after
     regeneration (0 - 10.0) (see the MIN_NUMBER_OF_SEEDLINGS parameter)
(11) '0' reserved for system
(12) '0' reserved for system
(13) logging season
     '0' random (1 or 2), weighted by statistics of realized loggings
     '1' summer, logging on unfrozen and snow-free ground
     '2' winter, logging on frozen and snowy ground
(14) mechanized or manual (labour-intensive) logging
     '0' cost minimizing method (1 or 2)
     '1' mechanized logging (one-grip harvester and forwarder)
     '2' manual logging (logging with chainsaw and forwarder)
(15) logging skills for manual time expenditure functions
     '0' or '1' professional
     '2' non-professional, forest owners self-reliant work

(16) - (n)  user-supplied tree selection instructions
```

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of basal area, see the tree variable (5) of the simulation record.

2.5 Seed tree cutting

The specific EVENT_CALL arguments for seed tree cutting are

Legend

```
(1)  '5.0'–'5.9'  cutting method = seed tree cutting for natural
     regeneration. See the interpretation of the decimal specification
(2)  '1' reserved for system
(3)  '0' reserved for system
```

```
(4)  minimum removal in management unit, stems/hectare
(5)  minimum removal on sample plot, stems/hectare
(6)  minimum mean diameter before cutting in relation to the exogenous
     minimum regeneration diameter requirement (see the
     MIN_REGENERATION_DIAMETER parameter)
     0 - 10.0 relative mean diameter
       > 10.0 absolute mean diameter
(7)  minimum mean age before cutting in relation to the exogenous minimum
     regeneration age requirement (see the MIN_REGENERATION_AGE parameter
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(8)  minimum basal area before cutting in relation to the exogenous minimum
     basal area requirement after thinning (0 - 10.0) (see the
     BASAL_AREA_INSTRUCTIONS parameter)
(9)  maximum mean age before cutting in relation to the exogenous minimum
     regeneration age requirement (see the MIN_REGENERATION_AGE parameter)
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(10) '0' reserved for system
(11) '0' reserved for system
(12) '0' reserved for system
(13) logging season
     '0' random (1 or 2), weighted by statistics of realized loggings
     '1' summer, logging on unfrozen and snow-free ground
     '2' winter, logging on frozen and snowy ground
(14) mechanized or manual (labour-intensive) logging
     '0' cost minimizing method (1 or 2)
     '1' mechanized logging (one-grip harvester and forwarder)
     '2' manual logging (logging with chainsaw and forwarder)
(15) logging skills for manual time expenditure functions
     '0' or '1' professional
     '2' non-professional, forest owners self-reliant work
(16) - (n)  user-supplied tree selection instructions
```

See note 2.

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of number of stems per hectare, see the tree variable (1) of the simulation record.

When user-supplied tree selection instructions are not given, built-in default selection instructions for seed tree cutting are used.

2.6 Shelter wood cutting

The specific EVENT_CALL arguments for shelterwood cutting are

Legend

```
(1)  '6.0'–'6.9'  cutting method = shelterwood cutting for natural
     regeneration. See the interpretation of the decimal specification
(2)  '1' reserved for system
(3)  '0' reserved for system
(4)  minimum removal in management unit, stems/hectare
(5)  minimum removal on sample plot, stems/hectare
```

```
(6)  minimum mean diameter before cutting in relation to the exogenous
     minimum regeneration diameter requirement (see the
     MIN_REGENERATION_DIAMETER parameter)
     0 - 10.0 relative mean diameter
       > 10.0 absolute mean diameter
(7)  minimum mean age before cutting in relation to the exogenous minimum
     regeneration age requirement (see the MIN_REGENERATION_AGE parameter)
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(8)  minimum basal area before cutting in relation to the exogenous minimum
     basal area requirement after thinning (0 - 10.0) (see the
     BASAL_AREA_INSTRUCTIONS parameter)
(9)  maximum mean age before cutting in relation to the exogenous minimum
     regeneration age requirement (see the MIN_REGENERATION_AGE parameter)
     0 - 10.0 relative mean age
       > 10.0 absolute mean age
(10) '0' reserved for system
(11) '0' reserved for system
(12) '0' reserved for system
(13) logging season
     '0' random (1 or 2), weighted by statistics of realized loggings
     '1' summer, logging on unfrozen and snow-free ground
     '2' winter, logging on frozen and snowy ground
(14) mechanized or manual (labour-intensive) logging
     '0' cost minimizing method (1 or 2)
     '1' mechanized logging (one-grip harvester and forwarder)
     '2' manual logging (logging with chainsaw and forwarder)
(15) logging skills for manual time expenditure functions
     '0' or '1' professional
     '2' non-professional, forest owners self-reliant work
(16) - (n)  user-supplied tree selection instructions
```

See note 2.

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of number of stems per hectare, see the tree variable (1) of the simulation record.

3. Specific EVENT_CALL arguments for tending of young stands

Legend

```
(1)  '0' reserved for system
(2)  '1' reserved for system
(3)  adjustment coefficient to the exogenous number of stems requirement
     after tending (0 - 10.0) (see the MIN_NUMBER_OF_ SEEDLINGS parameter)
(4)  minimum number of stems before tending in relation to the exogenous
     number of stems requirement after tending (0 - 10.0) (see the
     MIN_NUMBER_OF_ SEEDLINGS parameter)
(5)  minimum mean diameter before tending, cm
(6)  maximum mean diameter before tending, cm
(7)  minimum number of stems (per hectare) to be removed in management unit
     and on sample plot
(8)  minimum mean height before tending, m
(9)  maximum mean height before tending, m
(10) '0'
(11) '0'
```

```
(12) '0'
(13) '0'
(14) '0'
(15) '0'
(16) - (n)  user-supplied tree selection instructions
```

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of number of stems per hectare, see the tree variable (1) of the simulation record.

4. Specific EVENT_CALL arguments for regeneration

Legend

```
(1)  type of regeneration
     '0' random (type 1 or 2)
     '1' seeding
     '2' planting
     '3' supplementary planting
(2)  '1' reserved for system
(3)  seeding or planting: years from clear cutting to regeneration;
           supplementary planting: years from regeneration to supplementary
     planting
(4)  tree species used in regeneration
       0 random
     > 0 tree species: valid tree species, see the tree variable (2) of the
     initial data record
(5)  number of plants per hectare used in regeneration (see the
     MIN_NUMBER_OF_SEEDLINGS parameter)
        0 based on the exogenous number of plants requirement
     < 10 number of plants in relation to the exogenous number of plants
     requirement
     > 10 absolute number of plants
(6)  mean age of plants at the moment of regeneration, year
(7)  mean height of plants at the moment of regeneration, m
(8)  probability of plants to survive (0 - 1.0)
       0 based on the regeneration model (random)
     > 0 probability given by user
(9)  lower bound for the site type, see sample plot variable (13) of the
     initial data record
(10) upper bound for the site type
```

5. Specific EVENT_CALL arguments for clearing of regeneration area

Legend

```
(1)  '0' reserved for system
(2)  '1' reserved for system
(3)  lower bound for the site type, see the sample plot variable (13) of the
     initial data record
(4)  upper bound for the site type
```

The trees to be removed (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of number of stems per hectare, see the tree variable (1) of the simulation record.

6. Specific EVENT_CALL arguments for site preparation

Legend

```
(1)  '0' reserved for system
(2)  '1' reserved for system
(3)  lower bound for the site type, see the sample plot variable (13) of the
     initial data record
(4)  upper bound for the site type
```

7. Specific EVENT_CALL arguments for drainage of peatlands

Legend

```
(1)  type of drainage
     '1' new ditching
     '2' ditch cleaning and supplementary ditching
(2)  '1' reserved for system
```

8. Specific EVENT_CALL arguments for fertilization

Legend

```
(1)  '1' reserved for system
(2)  '1' reserved for system
(3)  minimum mean diameter before fertilization in relation to the exogenous
     minimum regeneration diameter requirement (0 - 10.0), see the
     MIN_REGENERATION_DIAMETER parameter
(4)  maximum mean diameter before fertilization in relation to the exogenous
     minimum regeneration diameter requirement (0 - 10.0)
(5)  minimum basal area before fertilization in relation to the exogenous
     minimum basal area requirement after thinning (0 - 10.0), see the
     BASAL_AREA_INSTRUCTIONS parameter
(6)  maximum basal area before fertilization in relation to the exogenous
     minimum basal area requirement after thinning (0 - 10.0)
(7)  minimum mean age before fertilization in relation to the exogenous
     minimum regeneration age requirement (0 - 10.0), see the
     MIN_REGENERATION_AGE parameter
(8)  maximum mean age before fertilization in relation to the exogenous
     minimum regeneration age requirement (0 - 10.0)
(9)  lower bound for the site type, see the sample plot variable (13) of the
     initial data record
(10) upper bound for the site type
```

9. Specific EVENT_CALL arguments for pruning of pine

Legend

```
(1)  '0' reserved for system
(2)  '1' reserved for system
(3)  minimum mean height before pruning, m
(4)  maximum mean height before pruning, m
(5)  number of stems to be pruned, stems/hectare
(6)  lower bound for the site type, see the sample plot variable (13) of the
     initial data record
(7)  upper bound for the site type
```

The trees to be pruned (i.e. the selection quantity and maximum selection intensity in tree selection) are expressed in terms of number of stems per hectare, see the tree variable (1) of the simulation record.

11. Specific EVENT_CALL arguments for the run-time change of the value of a management unit variable in the simulation record

Legend

```
(1)  '0' reserved for system
(2)  '1' reserved for system
(3)  management unit variable to be changed
(4)  new value of management unit variable
(5)  lower bound for the old value of the management unit variable
(6)  upper bound for the old value of the management unit variable
(7)  '0' reserved for system
(8)  '0' reserved for system
(9)  '0' reserved for system
```

12. Specific EVENT_CALL arguments for selecting of 'retained trees' to be left standing on regeneration areas

Legend

```
(1)  '0' reserved for system
(2)  '0' reserved for system
(3) '0' reserved for system
(4)  maximum number of 'retained trees' on calculation unit,stems/hectare
(5)  maximum number of 'retained trees' on sample plot, stems/hectare
(6)  minimum mean diameter before selecting of 'retained trees' in relation
     to the exogenous minimum regeneration diameter requirement (see the
     MIN_REGENERATION_ DIAMETER parameter)
           0 - 10.0   relative mean diameter
           >10        absolute mean diameter
(7)  minimum mean age before selecting of 'retained trees' in relation to
     the exogenous minimum regeneration age requirement (see the
     MIN_REGENERATION_AGE parameter)
           0 - 10.0   relative mean age
           >10        absolute mean age
```

```
(8)  ‘0’ reserved for system
(9)        ‘0’ reserved for system
(10)       ‘0’ reserved for system
(11) '0' reserved for system
(12) '0' reserved for system
(13)       ‘0’ reserved for system
(14)       ‘0’ reserved for system
(15)       ‘0’ reserved for system
(16) - (n)  user-supplied tree selection instructions (optional)
```

This event is designed to be used together with regeneration cuttings, clear cutting, seed tree cutting (for natural regeneration of pine, birch and alder) and shelter wood cutting (for natural regeneration of spruce). The retained trees are left untouched in respective regeneration cutting and further cuttings and silvicultural treatments.

Selecting of retained trees and respective regeneration cutting are declared in one event definition with two successive basic event calls (EVENT_CALL items). The event is simulated if both basic events are successively feasible. The order of the basic event calls decides the simulation order of the basic events.

Selecting of retained trees uses the general tree selection routine. Trees to be selected as retained trees are those which are included in the selection group definition and which are left untouched in the selection routine (i.e. the retained trees are complement from the tree selection).

Optional tree selection instructions are declared in the EVENT_CALL item. The values of the EVENT_CALL item can be splitted on several lines with continuation items.

The trees to be selected (i.e. the selection quantity and maximum selection intensity in tree selection are expressed in terms of stem volume; see the tree variable (8) of the simulation record.

See note 3.

Notes

1. The actual effects of general adjustment coefficients to the volume increment should be examined in each particular case with a relevant test material.

2. If either diameter (6) or mean age (7) is reached, regeneration cutting can be simulated with regard to the rotation period rules (6) and (7).

3. If either diameter (6) or mean age (7) is reached, selecting of retained trees can be simulated with regard to the rotation period rules (6) and (7).

See also

Tree selection routine
Variables of simulation record
Variables of initial data record

event identification item
BASAL_AREA_INSTRUCTIONS parameter
BOUND_FOR_YOUNG_STAND_REGENERATION parameter
MIN_REGENERATION_ DIAMETER parameter
MIN_REGENERATION_AGE parameter
MIN_NUMBER_OF_STEMS_AFTER_THINNING parameter
MIN_NUMBER_OF_SEEDLINGS parameter

Examples

Example 1: A definition of the EVENT_CALL item of the EVENT parameter and different EVENT_CALL argument types.

```
EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
#EVENT_CALL  2 1  3.0 1 0 800 800 8 12 0 1500  1 0.5  0  0  0  0
*            A B  1 2 3   4   5 6  7 8    9 10  11 12 13 14 15

#>>    1  3  3 99  3  3 15 99  3  1  0  2 -1 -1  8
*     16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

#>> -0.5  0  0  0  0  8 -0.5  0
*     31 32 33 34 35 36   37 38
```

Argument types: common (A, B) and specific ones (1-38) are defined. The explanations for the specific arguments are given in the legend of thinning based on numbers of stems instructions. Notice multiple continuation items '#>>' of the EVENT_CALL item. The lines starting with character '*' are comment lines.

Example 2: Two different EVENT_CALL definitions for thinnings with the basal area instructions method.

```
#EVENT_CALL 2 1   1.0 1 0 4 4 10 1.2 0 1.5 0.9 0.5 0 0 0 0
#>>               0 0 0 0 1 1 1 1 0 0

#EVENT_CALL 2 1   1 1 0 0 0 10 1.2 0 1.5 1 1 0 0 0 0
#>>               0.8 0.8 0.8 0.8 1 1 1 1 0 0
```

In the first EVENT_CALL definition the minimum cutting removal (4 m²/ha) is explicitly determined by arguments 4 and 5 and by setting the arguments 16-19 (calibration coefficients of the minimum basal area before thinning) to zeros. The minimum basal areas after thinning for all tree species are 90 % of the default values, for argument 10 is 0.9 and arguments 20-23 are 1. The maximum proportion of removed

basal area is 50 % (argument 11). Explanations for other arguments are given in the legend of thinning based on basal area instructions.

In the second EVENT_CALL the minimum basal areas before (arguments 16-19) and after (arguments 19-23) thinning are in use, which implicitly define the minimum cutting removal and therefore there is no need for arguments 4-5. The minimum basal areas before thinning are 80 % of the default values.

Example 3: An event definition with two event calls.

```
EVENT
#30 CLEAR CUTTING WITH CLEARING OF REGENERATION AREA
#COMPARABLE_EVENTS        10 20 27 25 28 29
#FEASIBLE_PRECEDESSORS    70 71 99
#FOREST_CATEGORIES        3 30 0 -1.99999
#EVENT_CALL 2 1   2.0 0 1 0 0 0.9 0.9 0.5 2 1.15 0 0 0 0 0
#EVENT_CALL 5 1   0 1 1 6
```

Two successive events are defined with EVENT_CALL: first clear cutting and then clearing of regeneration area. Explanations for the first EVENT_CALL arguments are given in the legend of clear cutting and for the second EVENT_CALL in the legend of clearing of regeneration area.

Example 4: An event definition with an explicit tree selection instruction.

```
EVENT
#20 THINNING - BASAL AREA INSTRUCTIONS
#COMPARABLE_EVENTS  10 27 25 28 29 30
#FOREST_CATEGORIES  3 30 0 -3.99999
#EVENT_CALL 2 1   1.0 1 0 4 2 10 1.5 0 1.5 0.9 0.35
#>>  0 0 0 0 0.0 0.0 0.0 0.0 1.0 1.0 1.0 1.0 0 0
#>>  1 3 6 99 2 2 -1 -1 8 -0.5 0 0 0 0 8 -0.5 0
```

The item EVENT_CALL defines a basal area thinning on the first and second line with tree selection arguments (26-42) on the third line: trees with diameter 6 - 99 cm form the overall selection range (1 3 6 99), first all trees than dominant ones are cut (2 -1 -1 8 -0.5 1), and if the defined cutting drain is not achieved then all trees left still untouched can be selected for cutting starting from the smaller ones (0 0 0 8 -0.5 1).

Example 5: An event definition with explicit logging instructions.

```
EVENT
#20 THINNING - BASAL AREA INSTRUCTIONS
#COMPARABLE_EVENTS      10 25 27 28 29 30
```

```
#FEASIBLE_PRECEDESSORS  70 71 99
#FOREST_CATEGORIES      3 30 0 -3.99999 2 32 2
#EVENT_CALL 2 1   1.0 1 0 4 4 10 1.2 0 1.5 0.9 0.5 0 2 2 0
#>>               0 0 0 0 1 1 1 1 0 0
```

Manual winter thinning for spruce stands: the item FOREST_CATEGORIES defines that the event is valid only for spruce stands (last three arguments 2 32 2), and the special EVENT_CALL arguments (13-14: 2 2) define that the basal area thinning can be executed only during winter and only manually.

Example 6: An event definition with two event calls.

```
EVENT
#30 SELECTING OF RETAINED TREES AND CLEAR CUTTING
*-------------------------------------------------------
#COMPARABLE_EVENTS       10 20 25 27 28 29
#FEASIBLE_PRECEDESSORS   70 71 99
#FOREST_CATEGORIES       3 30 0 -1.99999
* basic event call for selecting of retained trees
#EVENT_CALL 12 1  0 0 0 20 20 0.9 0.9 0 0 0 0 0 0 0 0
* tree selection instructions in continuation items
#>>         2.   3.  7.0 40. 17. -99.   1.
#>>         1.   0.  0.   0.  8.  -0.5  4.
* basic event call for clear cutting
#EVENT_CALL  2 1  2 1 1 0 0 0.9 0.9 0.5 2 1.15 0 0 0 0 0
```

The selecting of retained trees and clear cutting are declared in one event definition. The event is simulated if both basic events are successively feasible. The order of the basic event calls decides the simulation order of the basic events. The values of the EVENT_CALL item for retained are splitted on several lines with continuation items.

EVENT_DEFAULTS

Generic name in Finnish

TAPAHTUMA_OLETUSARVOT

Functions

Parameter EVENT_DEFAULTS defines the default values for optional event definition items, which control the simulation of the events:

- EVENT_YEARS,
- EVENT_INTERVALS,
- EVENT_BRANCHING,
- COMPARABLE_EVENTS,
- FEASIBLE_PRECEDESSORS,
- FOREST_CATEGORIES, and
- EVENT_PROBABILITY.

The parameter makes it possible to omit these optional items from the actual event definitions, because the default values are used instead. However, the actual event definition items override the values provided with the EVENT_DEFAULTS parameter.

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

1-7

Default values

None

Valid since

MELA96

Syntax

```
#event_definition_item value [value]
```

event_definition_item The name of optional event definition item

value	A relevant value for each optional event definition item

Notes

1. The items EVENT_YEARS, EVENT_INTERVALS, EVENT_BRANCHING, and EVENT_PROBABILITY can be often, but not categorically, repeated as such from one event definition to another. FOREST_CATEGORIES, COMPARABLE_EVENTS and FEASIBLE_PRECEDESSORS have almost always event-specific values.

See also

EVENT_YEARS item
EVENT_INTERVALS item
EVENT_BRANCHING item
COMBARABLE_EVENTS item
FEASIBLE_PRECEDESSORS item
FOREST_CATEGORIES item
EVENT_PROBABILITY item

Examples

Example 1: A definition of the EVENT_DEFAULTS parameter

```
EVENT_DEFAULTS
#EVENT_YEARS               6 10
#EVENT_INTERVALS             10
#EVENT_BRANCHING              1
#FEASIBLE_PRECEDESSORS       99
#FOREST_CATEGORIES            0
#EVENT_PROBABILITY            1
```

Branching (EVENT_BRANCHING = 1) is allowed, i.e. alternative schedules are possible, which is a prerequisite for endogenous analyses. The value 0 for the FOREST_CATEGORIES item means that the event can be simulated for all management categories.

FEASIBLE_TREE_SPECIES

Generic name in Finnish

PUULAJIOHJE

Functions

Parameter FEASIBLE_TREE_SPECIES provides the guiding (maximum) proportions (values 0.−1.0) for the tree species considered feasible in a stand. The parameter is used, for example, in determining acceptable dominant tree species and in selecting tree species for regeneration or for logging.

Following parameter values have specific interpretations:

1.00	the most suitable tree species, feasible for regeneration
0.99	suitable tree species
≥ 0.50	acceptable as dominant tree species
< 0.50	not acceptable as dominant tree species

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

192

Default values

Example 1

Valid since

MELA99, changed in MELA2007

Legend

```
(1) - (192) Guiding proportions (0.0-1.0) of tree species in a stand.
        Categories:
        • soil and peatland category: 3 (see the sample plot variable
          (12) of the initial data record)
           1 mineral soils
           2 spruce mires
           3 pine mires and treeless mires
        • forest site type: 8 (see the sample plot variable (13) of the
          initial data record)
```

- **tree species: 8 (see the tree variable (2) of the initial data record)**

Notes

1. The default values of parameter have been changed in MELA2007.

See also

Tree selection instructions
Initial data record

Examples

Example 1: A definition of the FEASIBLE_TREE_SPECIES parameter (default values).

```
FEASIBLE_TREE_SPECIES
* SOIL AND PEATLAND CATEGORY 1 (mineral soils)
* Forest site type category 1
* Tree species:
*  1    2    3    4    5    6    7    8
 0.25 0.75 1.00 0.50 1.00 0.50 0.45 0.99
* Forest site type category 2
 0.45 1.00 1.00 0.50 0.99 0.49 0.50 0.49
* Forest site type category 3
 1.00 1.00 1.00 0.50 0.50 0.10 0.99 0.49
* Forest site type category 4
 1.00 0.49 0.20 0.20 0.10 0.10 0.99 0.10
* Forest site type category 5
 1.00 0.49 0.10 0.10 0.10 0.10 0.75 0.10
* Forest site type category 6
 1.00 0.49 0.10 0.10 0.10 0.10 0.75 0.10
* Forest site type category 7
 1.00 0.50 0.50 0.50 0.50 0.50 0.50 0.50
* Forest site type category 8
 1.00 1.00 0.99 0.99 0.50 0.50 0.50 0.50
* SOIL AND PEATLAND CATEGORY 2 (spruce mires)
 0.25 1.00 0.75 1.00 1.00 0.75 0.45 0.99
 0.45 1.00 0.50 1.00 0.50 0.45 0.50 0.45
 1.00 1.00 0.50 1.00 0.10 0.10 0.99 0.10
 1.00 0.50 0.50 0.50 0.10 0.10 0.99 0.10
 1.00 0.49 0.10 0.49 0.10 0.10 0.10 0.10
 1.00 0.49 0.10 0.10 0.10 0.10 0.10 0.10
 1.00 0.50 0.50 0.50 0.50 0.50 0.50 0.50
 1.00 1.00 0.99 0.99 0.50 0.50 0.50 0.50
* SOIL AND PEATLAND CATEGORY 3 to 5 (pine mires and treeless mires)
 0.50 1.00 0.50 1.00 0.50 0.50 0.50 0.99
 0.75 1.00 0.50 1.00 0.50 0.45 0.50 0.45
 1.00 1.00 0.50 1.00 0.10 0.10 0.99 0.10
 1.00 0.49 0.10 0.50 0.10 0.10 0.99 0.10
 1.00 0.49 0.10 0.49 0.10 0.10 0.10 0.10
```

```
1.00 0.49 0.10 0.10 0.10 0.10 0.10 0.10
1.00 0.50 0.50 0.50 0.50 0.50 0.50 0.50
1.00 1.00 0.99 0.99 0.50 0.50 0.50 0.50
```

The default values are derived from the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006).

FILE_NAMING

Generic name in Finnish

TIEDOSTOT

Functions

Parameter FILE_NAMING provides user-supplied instructions for the automatic naming of the MELA files linked to the input/output units in the MELA programs. Explicit instructions are needed if the actual naming of the MELA files deviate from the default instructions.

Origin

System parameter

Program

MELASIM, MELAOPT

Type

Character (character items may contain also numerical parts)

Number of items

Optional, explicit instructions are needed for those files deviating from default instructions

Default values

See the definitions of each file type

Valid since

MELA96

Syntax

```
#unit_number ext delimiter name_component[ name_component]
```

unit_number Number of input/output unit. The unit numbers are built-in constants in MELA programs and the user cannot change them.

ext File name extension.

delimiter Delimiter between the naming components in the file name. The character '-' prevents the use of delimiters in the file name.

`name_component`	Name of the file naming component. The naming components can be names of command arguments, names of character type parameters, and character constants.

In the generation of the file name, the names of command arguments and parameters are substituted by their actual values provided in a MELA program session while character constants are used as such. For instance in example 1 `APPLICATION` is the name of the MELASIM command argument (i.e. the name of the **par** type file containing MELASIM parameters), `PROBLEM` is the name of the MELAOPT command argument (i.e. the name of the **mdl** type file containing JLP problem definitions) and `FORESTRY_UNIT` is the value of the character type parameter FORESTRY_UNIT, likewise `SUB_UNIT` is the name of the lowest level sub-unit. If the file naming component does not find any interpretation, the naming component is treated as a character constant as the characters `S` and `O` in example 1. A delimiter, if provided, is added between each of the naming components.

The relevant way to define file names depends on the MELA application in question. The current defaults of the file naming instructions are designed for managing a single or hierarchical forestry unit with one simulation application and multiple optimisation problems (example 1). In the case of more complicated analysis designs, more naming components are likely needed and they should be carefully designed in order to generate unique file names.

Notes

1. The FILE_NAMING parameter should be provided in the **MELA_SET.PAR** file.

2. Confusions with files are likely to appear, for example, if the file naming is not compatible with the analysis design or if the file names get longer than the maximum length allowed by the operating system.

See also

Automatic file naming in MELA
Current files
MAX_LENGTH_OF_FILENAME parameter
Initial parameter settings file (MELA_SET.PAR file)

Examples

Example 1: The default naming instructions of MELA files.

```
FILE_NAMING
* forest level summary report file of MELASIM
#01 SUM _ FORESTRY_UNIT  SUB_UNIT  PROBLEM  S
* forest level summary report file of MELAOPT
#01 SUM _ FORESTRY_UNIT  SUB_UNIT  PROBLEM  O
*
#09  RSD  _  SUB_UNIT
#10  MSC  _  SUB_UNIT
#11  MSD  _  SUB_UNIT
#13  SMS  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#15  PAR  _  APPLICATION
#16  SMR  _  SUB_UNIT
* forest level summary files of MELASIM
#20  MSC  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM  S
#21  MSD  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM  S
* forest level summary files of MELAOPT
#22  MSC  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM  O
#23  MSD  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM  O
*
#25  SYM  _  SYMBOL
#26  MPS  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#61  SOL  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#62  SHP  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#63  MRG  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#64  SCH  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#66  RSU  _  SUB_UNIT
#67  SMU  _  SUB_UNIT
#68  SMT  _  SUB_UNIT
#69  SMS  _  SUB_UNIT
#70  MPU  _  FORESTRY_UNIT  SUB_UNIT  PROBLEM
#71  VOL  _  VOLUME
#81  CFG  _  USER
```

The current defaults of the file naming instructions are for hierarchical forestry units, single simulation application, and multiple optimisation problems.

Example 2. Naming instructions of MELA files in a case of single forestry unit, single simulation application and multiple optimisation problems.

```
FILE_NAMING
#09   RSD  _  FORESTRY_UNIT
#10  MSC  _  FORESTRY_UNIT
#11  MSD  _  FORESTRY_UNIT
#22  MSC  _  FORESTRY_UNIT  PROBLEM  O
#23  MSD  _  FORESTRY_UNIT  PROBLEM  O
```

Example 3. Naming instructions of MELA files in a case of hierarchical forestry units, multiple simulation applications and multiple optimisation problems.

```
FILE_NAMING
#09   RSD  _  SUB_UNIT
#10  MSC  _  SUB_UNIT  APPLICATION
#11  MSD  _  SUB_UNIT  APPLICATION
#22  MSC  _  FORESTRY_UNIT  SUB_UNIT  APPLICATION  PROBLEM  O
#23  MSD  _  FORESTRY_UNIT  SUB_UNIT  APPLICATION  PROBLEM  O
```

FOREST_DATA_FILES

Generic name in Finnish

METSAVARATIEDOT

Functions

Parameter FOREST_DATA_FILES controls the use of the data files (**rsd** and **rsu** type files) and the files containing standwise management instructions (**sms** and **smu** type files).

Origin	System parameter
Program	**MELASIM/extensions**
Type	Numerical
Number of items	2
Default values	2 2
Valid since	MELA96

Legend

```
(1)     Stand data files
        '0' Data is read from rsd type files
        '1' Data is read from rsu type files
        '2' Data is read from rsu type files and will be written to rsd
        typefile
(2)     Standwise management instructions
        '0' Instructions are read from sms type files
        '1' Instructions are read from smu type files
        '2' Instructions are read from smu type files and will be
        written to sms type files
        '3' Instructions are read from smu type files (only
            instructions related to treatments already made)
        '4' Instructions are read from smu type files and will be
        written to sms type files (only instructions related to
        treatments already made)
```

Notes

1. The data files (**rsd** and **rsu** type files) can be controlled only with the MELASIM version including the optional initial data conversion. The standwise management instructions (**sms** and **smu** type files) can be controlled only with the MELASIM version including the optional simulation instruction conversion.

2. Standwise management instructions can be either already implemented operations or treatment prescriptions to be made in the near future. Implemented operations have to be done between the inventory date and the beginning of the calculation time.

3. If the data and the standwise management instructions are defined to be read from **rsd** and **sms** type files but the files are missing, MELASIM-program will try to use **rsu** and **smu** type files instead. If also **smu** type file is missing, simulation continues without standwise management instructions. If also **rsu** type file is missing, the simulation will be interrupted.

4. MELAOPT-program requires a **rsd** type file as the data file. If the data is read from a **rsu** type file in simulation and the data will not be written to a **rsd** type file, the optimisation will be interrupted.

See also

MELA extensions
Initial data files (**rsd** type files)
Stand data text files (**rsu** type files)
Standwise simulation instruction files (**sms** type files)
Stand simulation instruction text files (**smu** type files)

Examples

Example 1: A definition of the FOREST_DATA_FILES parameter.

```
FOREST_DATA_FILES 2 2
```

In the simulation, the data is read from a **rsu** type file and the standwise management instructions are read from a **smu** type file. Furthermore, the **rsu** type file is written to a **rsd** type file and the **smu** type file to a **sms** type file.

FOREST_REPORT

Generic name in Finnish

METSARAPORTTI

Functions

Parameter FOREST_REPORT describes the design, content and layout of the MELA forest level summary report line by line (see **sum** type files).

Each occurrence of the FOREST_REPORT parameter contains the instructions for the generation of a reportable entity. The maximum length of a report definition is 500 lines for each single occurrence while the number of the FOREST_REPORT occurrences in a summary report is unlimited.

Origin	System parameter
Program	**MELASIM, MELAOPT**
Type	Numerical and character
Number of items	Optional (max. 500 lines for single occurrence)
Default values	None
Valid since	MELA2002, changed in MELA2005

Syntax

There are three types of definition items available:

a) **Data line items** contain data collection requests and explanations defining lines with collectible variables.
b) **Auxiliary line items** generate comment lines, headings, form feeds, intermediate lines etc.
c) **Option items** control the overall shape of other lines and reports, but the option items do not generate any lines of their own.

Empty items and items containing spaces are just omitted without any line generation.

a) The general syntax of the **data line items** of the FOREST_REPORT parameter

```
# explanation - data_expression'(format)'
```

`explanation` A character string (explanation) for substituting the automatically generated default explanation of the collective variable. A space must precede the explanation or the collective, as the indicator of the data line item.

`-` Indicator of the concatenation of the user-supplied explanation and the default explanation. If missing, user supplied explanation overrides default explanation.

`data_expression` A data definition, either

- a collective variable name or a data collection request (data definition can also be a single decision data variable, i.e. number of the decision variable preceded by 'x'), or

```
RC
RC[EV.eht][s.sp]
x195
```

- an addition or subtraction of collective variables and/or references to the Pmin and Pmax functions. See note 8.

```
RL+RP
Pmax(RC,RC,node)-RC
Pmax(RC[s=1],RC,node)-RC[s=1]
```

`'(format)'` A formatting instruction for the generation of one data field. The same instruction is repeated automatically for every single data field for all sub-periods. If missing, the automatically scaling 8 digit MELA default format is applied. Following FORTRAN editing codes (floating point) are valid:

Code	Representation	Sample format	Sample result	Resp. default format
f	floating point	'(f10.0)'	1234567890	123457e4
		'(f10.2)'	1234567.89	1234568
x	space	'(f6.0,4x)'	12345.	12345.0
h	characters	'(f8.0,2h *)'	1234567. *	1234567

```
RC'(f8.0)'
RC[EV.eht][s.pl]'(f10.0)'
x195'(f5.2)'
```

See note 2 and note 3.

b) The general syntax of the **auxiliary line items** of the FOREST_REPORT parameter

```
#edit_code
```

edit_code One of the following character strings:

Character string	Meaning
<>	A new page with the <>MELA<> logo and the licence holder information.
>	Generates a line containing the verbal data identification of the respective data files.
<	Generates a line with the absolute years corresponding the actual YEARS parameter. The years appear as the headings of the data field columns for the respective sub-periods.
/	Generates an empty line.
	A single character other than above is repeated filling the entire line.

Any set of characters other than above generates a line with respective characters. See example 1, where '-' and '=' characters are used to generate separator lines.

c) The general syntax of the **option items** of the FOREST_REPORT parameter (note 4)

```
#/option qualifier
```

`/` The indicator of the option item.

`option` One of the following character strings:
`FIELD_DELIMITER`
`TRAILING_NAME`
`DECIMAL_POINT`

Option	Meaning
`FIELD_DELIMITER`	A user-supplied delimiter for the data fields and for explanation fields. Explicitly defined delimiter is required for summary tables used as spreadsheet input, for example.

```
#/FIELD_DELIMETER 'delimiter'
```

`delimiter` A character string (in `''`)added between each data and explanation field.

Default field delimiter is a space (`' '`). The maximum length of a delimiter is 20 characters.

`TRAILING_NAME` The printing of the (internal standard) names of collective variables at the ends of data rows.

```
#/TRAILING_NAME 'c'
```

`c` One of the following numerical (integer) values

Value	Explanation
`0`	Trailing names disabled.
`1`	Trailing names enabled.

```
#/TRAILING NAME 1
```

`DECIMAL_POINT` A user-supplied character for substituting default decimal point `'.'` in decimal data fields. Alternative decimal expression may be required for summary tables used as spreadsheet input, for example.

```
#/DECIMAL_POINT 'character'
```

`character` A character (in `''`) used as decimal point in data fields.

```
#/DECIMAL_POINT ' , '
```

Notes

1. Pay attention to the report design. The readability of the reports and the comprehensibility of results come from report definitions. For example, the use of the TRAILING_NAME option (value 1) or explanations lengthens the lines. Long report lines may be continued to the next lines, and this could reduce the readability of the report.

2. Do not use repetition factors in formatting instructions because same instruction is repeated automatically for every single data field for all sub-periods. If used, the program will use default format.

3. Use apostrophes (') in formatting instructions. Using any other character may lead program not to understand the data expression.

4. Option items are valid only for each respective occurrence of the FOREST_REPORT parameter.

5. The parameter setting must be consistent with each other, i.e a variable to be reported by MELAOPT must have been established or selected earlier in the simulation. Conventional MELA decision variables that are used in FOREST_REPORT definitions must be defined also in MSD_VARIABLES parameter.

6. Do not use time expressions (sub-periods) for conventional decision data variables in the FOREST_REPORT definition. Values for those variables are calculated automatically for each sub-period.

7. In the simulation summary reports are produced only if one management schedule per calculation unit is simulated.

8. Classifications do not apply for arithmetic operations. You must specify each collective variable separately and fully.

See also

classification parameter
Summary report files (**sum** type files)
Collective variables
MELA decision data record (MSD) variables
MSD_VARIABLES parameter

Examples

Example 1: A simple definition of the FOREST_REPORT parameter.

```
FOREST_REPORT
#=
#>
#=
#<
#-
#=
# RC
# RC[EV.cm][s.sp]
#=
```

The FOREST_REPORT definition prints out first total cutting removal (RC) and then cutting removal by cutting methods according to the event identification codes (EV.cm) and tree species (s.sp). Notice that classifications ("cm" and "sp") following the category variables ("EV" and "s") are user-defined classification parameters.

Example 2: The forest level summary report generated by the FOREST_REPORT parameter definition described in the example 1.

```
=============================================================================================
TESTI111_VAC - SK-4 % - all:
=============================================================================================
                                          2001     2011     2021     2031     2041     2051
---------------------------------------------------------------------------------------------
=============================================================================================
<>RC                                     6767.4   6936.5   7055.3   7270.9   7515.2
..<>RC[first thinning][pine]               89.2    151.7     56.3    158.2    100.7
..<>RC[thinning][pine]                    359.5    513.4    689.7    877.7   1144.4
..<>RC[over story removal][pine]           70.1    295.5    123.6    154.8    165.3
..<>RC[seed tree cutting][pine]           410.7    212.6    335.4    375.6    305.5
..<>RC[shelterwood cutting][pine]         122.7     49.6     26.8     18.9     12.5
..<>RC[clear cutting][pine]               040.0    204.6    140.7    302.7    379.5
..<>RC[total][pine]                      2092.3   1427.4   1372.5   1887.9   2107.9
..<>RC[first thinning][spruce]             34.9    107.0     49.9     15.9      0.3
..<>RC[thinning][spruce]                  556.2   1025.0   1512.2   1361.5   2229.3
..<>RC[over story removal][spruce]         64.9    344.5    163.0    116.5     82.5
..<>RC[seed tree cutting][spruce]          32.6     62.5     84.2     88.5     24.3
..<>RC[shelterwood cutting][spruce]       119.8     87.3     69.9     47.9     19.5
..<>RC[clear cutting][spruce]            2386.0   2639.7   2499.5   2413.1   1641.8
..<>RC[total][spruce]                    3294.5   4266.0   4378.7   4043.5   3997.8
..<>RC[first thinning][birch]              48.9     87.7     18.1      9.3      0.5
..<>RC[thinning][birch]                   338.1    568.8    641.5    783.3    908.3
..<>RC[over story removal][birch]          36.9     21.5      2.9      2.0      3.4
..<>RC[seed tree cutting][birch]           77.1     34.6     56.4     41.3     12.2
..<>RC[shelterwood cutting][birch]         87.2     51.1     51.6     56.4     44.6
..<>RC[clear cutting][birch]              438.6    218.1    288.6    244.8    315.5
..<>RC[total][birch]                     1026.7    981.9   1059.1   1137.1   1284.5
..<>RC[first thinning][other deciduous]    23.0     18.2      3.1      0.2      0.7
..<>RC[thinning ][other deciduous]        140.0    138.4    144.7    103.3     76.3
..<>RC[over story removal][other deciduous]  9.6      5.8      1.1      0.5      0.1
..<>RC[seed tree cutting][other deciduous]  10.2      2.7      2.6      0.4      0.0
..<>RC[shelterwood cutting][other deciduous] 16.1     14.8      6.5      5.3      0.1
..<>RC[clear cutting][other deciduous]    155.1     81.4     87.1     92.7     47.9
..<>RC[total][other deciduous]            354.0    261.2    245.0    202.4    125.0
..<>RC[first thinning][total]             196.0    364.7    127.4    183.6    102.2
..<>RC[thinning][total]                  1393.9   2245.7   2988.1   3125.8   4358.4
..<>RC[over story removal][total]         181.5    667.3    290.5    273.8    251.3
..<>RC[seed tree cutting][total]          630.5    312.4    478.5    505.8    342.0
..<>RC[shelterwood cutting][total]        345.9    202.7    154.9    128.6     76.7
..<>RC[clear cutting][total]             4019.6   3143.7   3015.8   3053.3   2384.6
..<>RC[total][total]                     6767.4   6936.5   7055.3   7270.9   7515.2
=============================================================================================
```

Example 3: Another example of the FOREST_REPORT parameter definition.

```
FOREST_REPORT
#=
#>
#=
#<
#-
#=
#/TRAILING_NAME 1
# RL[EV.cm][s.sp]'(f6.3)'
#=
# RP[EV.cm][s.sp]'(f8.2)'

# Total volume - x900'(f4.3)'
# Cutting area - x007'(f4.3)'
#*
```

In this example a few conventional decision variables are used with collective variables. Notice the different formatting instructions, option item (TRAILING_NAME) and user-defined explanations.

Example 4: Example of the forest level summary report generated by the FOREST_REPORT parameter definition described in the example 3.

```
================================================================================
MS ES-03  ES-03
================================================================================
                                        2000     2010     2020     2030     2040
--------------------------------------------------------------------------------
================================================================================
..<>RL[first thinning][pine]             0.000    0.000    0.000    0.000       - RL[EV=10,11][s=1,7]
..<>RL[thinning][pine]                   0.000    0.000    0.000    0.000       - RL[EV=20,21][s=1,7]
..<>RL[over story removal][pine]        32.200   17.782   17.765    0.000       - RL[EV=25][s=1,7]
..<>RL[seed tree cutting][pine]          0.000    0.000    0.000    0.000       - RL[EV=27,28][s=1,7]
..<>RL[shelterwood cutting][pine]        0.000    0.000    0.000    0.000       - RL[EV=29][s=1,7]
..<>RL[clear cutting][pine]              0.000    0.000    0.000    0.000       - RL[EV=30][s=1,7]
..<>RL[total][pine]                     32.200   17.782   17.765    0.000       - RL[EV>0][s=1,7]
..<>RL[first thinning][spruce]           0.000    0.000    0.000    0.000       - RL[EV=10,11][s=2]
..<>RL[thinning][spruce]                 0.000    0.000    0.000    0.000       - RL[EV=20,21][s=2]
..<>RL[over story removal][spruce]       0.152    0.000    0.000    0.000       - RL[EV=25][s=2]
..<>RL[seed tree cutting][spruce]        0.000    0.000    0.000    0.000       - RL[EV=27,28][s=2]
..<>RL[shelterwood cutting][spruce]      0.000    0.000    0.000    0.000       - RL[EV=29][s=2]
..<>RL[clear cutting][spruce]            0.000    0.000    0.000    0.000       - RL[EV=30][s=2]
..<>RL[total][spruce]                    0.152    0.000    0.000    0.000       - RL[EV>0][s=2]
..<>RL[first thinning][birch]            0.000    0.000    0.000    0.000       - RL[EV=10,11][s=3=4]
..<>RL[thinning][birch]                  0.000    0.000    0.000    0.000       - RL[EV=20,21][s=3=4]
..<>RL[over story removal][birch]        0.396    0.052    0.421    0.000       - RL[EV=25][s=3=4]
..<>RL[seed tree cutting][birch]         0.000    0.000    0.000    0.000       - RL[EV=27,28][s=3=4]
..<>RL[shelterwood cutting][birch]       0.000    0.000    0.000    0.000       - RL[EV=29][s=3=4]
..<>RL[clear cutting][birch]             0.000    0.000    0.000    0.000       - RL[EV=30][s=3=4]
..<>RL[total][birch]                     0.396    0.052    0.421    0.000       - RL[EV>0][s=3=4]
..<>RL[first thinning][other deciduous]  0.000    0.000    0.000    0.000       - RL[EV=10,11][s=5,6,8]
..<>RL[thinning][other deciduous]        0.000    0.000    0.000    0.000       - RL[EV=20,21][s=5,6,8]
..<>RL[over story removal][other deciduous] 0.000 0.000    0.000    0.000       - RL[EV=25][s=5,6,8]
..<>RL[seed tree cutting][other deciduous] 0.000  0.000    0.000    0.000       - RL[EV=27,28][s=5,6,8]
..<>RL[shelterwood cutting][other deciduous] 0.000 0.000   0.000    0.000       - RL[EV=29][s=5,6,8]
..<>RL[clear cutting][other deciduous]   0.000    0.000    0.000    0.000       - RL[EV=30][s=5,6,8]
..<>RL[total][other deciduous]           0.000    0.000    0.000    0.000       - RL[EV>0][s=5,6,8]
..<>RL[first thinning][total]            0.000    0.000    0.000    0.000       - RL[EV=10,11][s>0]
..<>RL[thinning][total]                  0.000    0.000    0.000    0.000       - RL[EV=20,21][s>0]
..<>RL[over story removal][total]       32.748   17.834   18.186    0.000       - RL[EV=25][s>0]
..<>RL[seed tree cutting][total]         0.000    0.000    0.000    0.000       - RL[EV=27,28][s>0]
..<>RL[shelterwood cutting][total]       0.000    0.000    0.000    0.000       - RL[EV=29][s>0]
..<>RL[clear cutting][total]             0.000    0.000    0.000    0.000       - RL[EV=30][s>0]
..<>RL[total][total]                    32.748   17.834   18.186    0.000       - RL[EV>0][s>0]
================================================================================
..<>RP[first thinning][pine]             0.00     0.00     0.00     0.00        - RP[EV=10,11][s=1,7]
..<>RP[thinning][pine]                   0.00     0.00     0.00     0.00        - RP[EV=20,21][s=1,7]
..<>RP[over story removal][pine]        10.94     9.45     5.32     0.00        - RP[EV=25][s=1,7]
..<>RP[seed tree cutting][pine]          0.00     0.00     0.00     0.00        - RP[EV=27,28][s=1,7]
..<>RP[shelterwood cutting][pine]        0.00     0.00     0.00     0.00        - RP[EV=29][s=1,7]
..<>RP[clear cutting][pine]              0.00     0.00     0.00     0.00        - RP[EV=30][s=1,7]
..<>RP[total][pine]                     10.94     9.45     5.32     0.00        - RP[EV>0][s=1,7]
..<>RP[first thinning][spruce]           0.00     0.00     0.00     0.00        - RP[EV=10,11][s=2]
..<>RP[thinning][spruce]                 0.00     0.00     0.00     0.00        - RP[EV=20,21][s=2]
..<>RP[over story removal][spruce]       0.24     0.05     0.32     0.00        - RP[EV=25][s=2]
..<>RP[seed tree cutting][spruce]        0.00     0.00     0.00     0.00        - RP[EV=27,28][s=2]
..<>RP[shelterwood cutting][spruce]      0.00     0.00     0.00     0.00        - RP[EV=29][s=2]
..<>RP[clear cutting][spruce]            0.00     0.00     0.00     0.00        - RP[EV=30][s=2]
..<>RP[total][spruce]                    0.24     0.05     0.32     0.00        - RP[EV>0][s=2]
..<>RP[first thinning][birch]            0.00     0.00     0.00     0.00        - RP[EV=10,11][s=3=4]
..<>RP[thinning][birch]                  0.00     0.00     0.00     0.00        - RP[EV=20,21][s=3=4]
..<>RP[over story removal][birch]        0.27     1.06     0.49     0.00        - RP[EV=25][s=3=4]
..<>RP[seed tree cutting][birch]         0.00     0.00     0.00     0.00        - RP[EV=27,28][s=3=4]
..<>RP[shelterwood cutting][birch]       0.00     0.00     0.00     0.00        - RP[EV=29][s=3=4]
..<>RP[clear cutting][birch]             0.00     0.00     0.00     0.00        - RP[EV=30][s=3=4]
..<>RP[total][birch]                     0.27     1.06     0.49     0.00        - RP[EV>0][s=3=4]
..<>RP[first thinning][other deciduous]  0.00     0.00     0.00     0.00        - RP[EV=10,11][s=5,6,8]
..<>RP[thinning][other deciduous]        0.00     0.00     0.00     0.00        - RP[EV=20,21][s=5,6,8]
..<>RP[over story removal][other deciduous] 0.00  0.00     0.00     0.00        - RP[EV=25][s=5,6,8]
..<>RP[seed tree cutting][other deciduous] 0.00   0.00     0.00     0.00        - RP[EV=27,28][s=5,6,8]
..<>RP[shelterwood cutting][other deciduous] 0.00 0.00     0.00     0.00        - RP[EV=29][s=5,6,8]
..<>RP[clear cutting][other deciduous]   0.00     0.00     0.00     0.00        - RP[EV=30][s=5,6,8]
..<>RP[total][other deciduous]           0.00     0.00     0.00     0.00        - RP[EV>0][s=5,6,8]
..<>RP[first thinning][total]            0.00     0.00     0.00     0.00        - RP[EV=10,11][s>0]
..<>RP[thinning][total]                  0.00     0.00     0.00     0.00        - RP[EV=20,21][s>0]
..<>RP[over story removal][total]       11.46    10.56     6.13     0.00        - RP[EV=25][s>0]
..<>RP[seed tree cutting][total]         0.00     0.00     0.00     0.00        - RP[EV=27,28][s>0]
..<>RP[shelterwood cutting][total]       0.00     0.00     0.00     0.00        - RP[EV=29][s>0]
..<>RP[clear cutting][total]             0.00     0.00     0.00     0.00        - RP[EV=30][s>0]
..<>RP[total][total]                    11.46    10.56     6.13     0.00        - RP[EV>0][s>0]
================================================================================
Total volume - 900                   35571.2  63998.8  95507.8   125681   153348  - x900
Cutting area - 007                       .804     .451      1.2     .000        - x007
********************************************************************************
```

Example 5: FOREST_REPORT parameter definition with Pmax function calls.

```
FOREST_REPORT
#=
#>
#=
#<
#-
#=
#RC
#Pmax(RC,RC,node)
#Pmax(RC,RC,node)-RC
#-
#Pmax(RC[s=1],RC,node)-RC[s=1]
#Pmax(RC[s=2],RC,node)-RC[s=2]
#Pmax(RC[s>2],RC,node)-RC[s>2]
#-
#Pmax(V,RC,node)
#Pmax(V[s=1],RC,node)
#Pmax(V[s=2],RC,node)
#Pmax(V[s>2],RC,node)
#=
```

In this example, first Pmax call provides the maximum value of commercial cuttings (local extrema, for all periods). Second call provides the margin of the commercial cuttings (how much is possible to cut - how much is cut). Following three calls provides margins of the commercial cuttings by tree species. Call `Pmax(V,RC,node)` provides the conditional volume of the growing stock (V) at the end of sub-periods assuming that actual cutting potential (RC) were totally cut during that sub-period. Last three provides the same by three species.

FORESTRY_UNIT

Generic name in Finnish

METSATALOUSYKSIKKO

Functions

Parameter FORESTRY_UNIT provides the name of the forestry unit for a MELA program session. The name of the forestry unit is needed for the decision hierarchy operations in the case of multiple level forestry units.

The parameter defines also the name of the **par** type file containing the decision hierarchy definitions for the forestry unit. MELA programs read the **forestry_unit.PAR** file for the case that the definitions are provided in this file.

Origin

System parameter

Program

MELASIM, MELAOPT

Type

Character

Number of items

1

Default values

None

Valid since

MELA96

Legend

```
(1) Name of the forestry unit in a MELA program session
```

Notes

1. The user-defined parameters forestry_unit_LEVELS and forestry_unit_members are usually provided together in the same **par** type, decision hierarchy definition file to be referred by the FORESTRY_UNIT parameter .

2. The default value of the FORESTRY_UNIT parameter should be provided in the **MELA_SET.PAR** file if there is no particular reason to define it later in the MELA session.

3. It is possible to refer also to the lower level members of the decision hierarchy in MELA commands, besides the uppermost ones.

See also

MELA decision hierarchy
SIMULATE command
SOLVE command
forestry_unit_LEVELS parameter
forestry_unit_members parameter
Initial parameter settings file (MELA_SET.PAR file)

Examples

Example 1: A definition of the FORESTRY_UNIT parameter.

```
FORESTRY_UNIT#FX
```

The name of the forestry unit is FX. Decision hierarchy definitions are read from the **FX.PAR** file if it exists

forestry_unit_LEVELS

Generic name in Finnish

metsatalousyksikko_TASOT

Functions

Parameter forestry_unit_LEVELS defines the names of the decision hierarchy levels appearing in the forestry_unit_members parameter. In the parameter definition, the string 'forestry_unit' is substituted by the actual name of the forestry unit.

Origin	User parameter
Program	**MELASIM, MELAOPT**
Type	Character
Number of items	Optional
Default values	None
Valid since	MELA96

Legend

```
(1) - (n) Names of the decision hierarchy levels appearing in the
    definition of the forestry_unit_members parameter.
```

Notes

1. The user-defined parameters forestry_unit_LEVELS and forestry_unit_members are usually provided together in the same **par** type, decision hierarchy definition file that is referred via the FORESTRY_UNIT parameter in a MELA program session

See also

MELA decision hierarchy
FORESTRY_UNIT parameter
forestry_unit_members parameter
LOWEST_LEVEL parameter

Examples

Example 1: A definition of the forestry_unit_LEVELS parameter.

```
 FX_LEVELS
#FX
#REGION
#DISTRICT
```

The example defines the hierarchy levels (FX, REGION and DISTRICT) of the forestry unit FX. Notice that the name of a user parameter begins at column 2.

forestry_unit_members

Generic name in Finnish

metsatalousyksikko_jasenet

Functions

Parameter forestry_unit_members defines the names of the sub-units. The parameter has to be defined for each decision hierarchy member having lower level members, i.e. sub-units. The name of each upper level member is used once as a parameter name at the lower level and the names of the lower level members as parameter values.

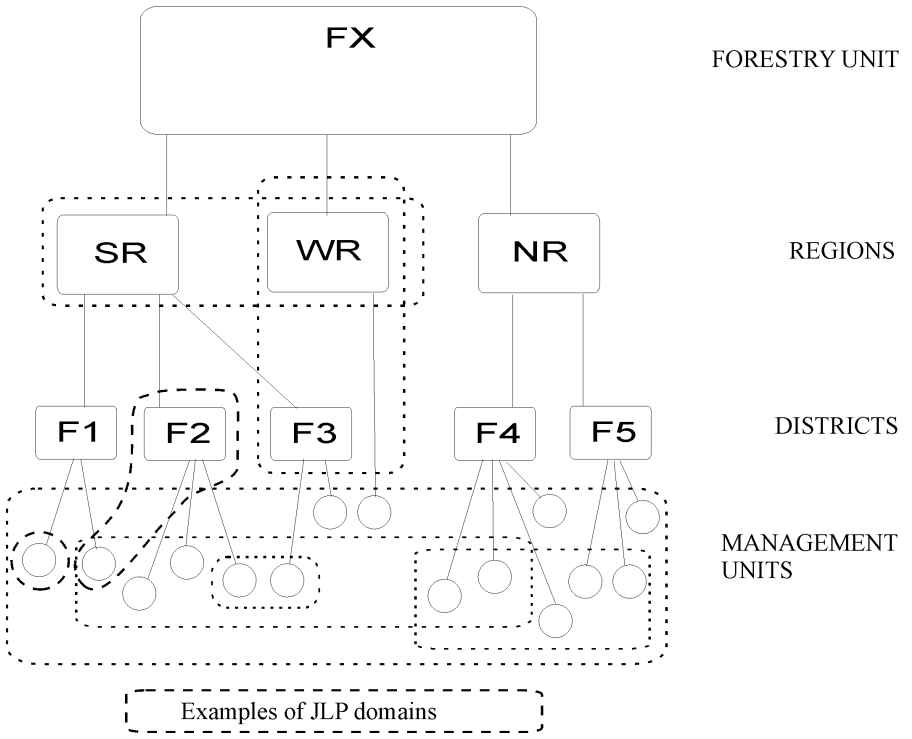

Figure 1. The hierarchical structure of the forestry unit FX and examples of JLP domains.

Origin User parameter

Program **MELASIM, MELAOPT**

Type Character

Number of items Optional

Default values None

Valid since MELA96

Legend

```
(1) - (n) name_of_sub_unit {explanation}
```

name_of_sub_unit **N**ame of the lower level member (or sub-unit) in a decision hierarchy.

explanation Verbal description, for example explanatory comment.

Notes

1. The user-defined parameters forestry_unit_LEVELS and forestry_unit_members are usually provided together in the same **par** type, decision hierarchy definition file that is referred via the FORESTRY_UNIT parameter in a MELA program session.

See also

FORESTRY_UNIT parameter
forestry_unit_LEVELS parameter
MELA decision hierarchy

Examples

Example 1: In the FX.PAR file the parameters forestry_unit_LEVELS and the forestry_unit_members are defined for the forestry unit FX. See also figure 1.

```
* FX.PAR *

* Decision hierarchy levels of the forestry unit FX

 FX_LEVELS
#FX
#REGION
#DISTRICT

* The names of the members of each level
* in the decision hierarchy.

* Region level sub-units of FX
```

```
 FX
#SR Southern Region
#NR Northern Region
#WR Western Region

* District level sub-units of SR

 SR
#F1 District F1
#F2 District F2
#F3 District F3

* District level sub-units of NR

 NR
#F4 District F4
#F5 District F5

* Notice that WR has no lower level members.
```

GROWTH_CALIBRATION

Generic name in Finnish

KASVUN_TASOKORJAUS

Functions

Parameter GROWTH_CALIBRATION provides adjustment coefficients for tree level basal area increment and height increment models. Coefficients are given by tree species. In the specific EVENT_CALL arguments for natural processes there are also general adjustment coefficients for basal area and height increment models.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 4

Default values 1.0 1.0 1.0 1.0

Valid since MELA96, changed in MELA2009

Legend

```
Adjustment coefficients for
(1)     pine
(2)     spruce
(3)     birch
(4)     other deciduous species
```

Notes

1. The actual effects of the adjustment coefficients to the volume increment should be examined and adjusted in each particular case with a relevant test material.

See also

EVENT_CALL

Examples

Example 1: A definition of the GROWTH_CALIBRATION parameter.

```
GROWTH_CALIBRATION

* (1) pine
* (2) spruce
* (3) birch
* (4) other deciduous species

* (1)  (2)  (3)  (4)
  1.05 1.05 0.95 1.00
```

H50_CALIBRATION

Generic name in Finnish

H50_KALIBROINTI

Functions

Parameter H50_CALIBRATION enables the adjustment of the growth models by the calibration of dominant height indices (H50) on the basis of the age and height measurements of the initial trees, if available. H50 indices are used by sample plots as predicting variables of the growth models on mineral soils (see Ojansuu 1996). In the calibration procedure, trees larger than mean diameter at breast height are used.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1

Default values 0

Valid since MELA99

Legend

```
(1)     Calibration of H50 indices.
        '0'         calibration disabled
        '1'        calibration enabled
```

Notes

1. Only true age and height measurements of sample trees should be used for calibration.

Examples

Example 1: A definition of the H50_CALIBRATION parameter.

```
H50_CALIBRATION 1
```

HEATING_VALUES

Generic name in Finnish

LAMPOARVOT

Functions

With this parameter effective heating values of biomass are given to the simulation. Default values are based on figures published by Nurmi (1997) and they are effective heating values (GJ/ton of dry mass) assuming 50 % relative humidity of biomass when burned for heating energy. In default values it is assumed that foliage is not utilized for heating energy (effective heating value is set to zero for foliage).

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	28
Default values	Example 1
Valid since	MELA2009

Legend

```
(1) - (28) Effective heating values (GJ/ton of dry mass) for the biomass
     estimates assuming 50 % relative humidity of biomass.
     Categories:
     • Biomass components of a tree: 7 (stem wood, stem bark, living
     branches, foliage, dead branches, stump, roots)
     • tree species categories: 4 (pine, spruce, birch, deciduous trees
     other than birch)
```

Examples

Example 1: A definition of the HEATING_VALUES parameter.

```
HEATING_VALUES
* effective heating values for scots pine
       17.1    17.1    17.6     0.0    17.6    18.6    18.6
* effective heating value for norway spruce
       16.8    16.8    17.0     0.0    17.0    16.9    16.9
* effective heating values for birch
       16.6    16.6    17.0     0.0    17.0    16.6    16.6
* effective heating values for deciduous trees other than birch
       16.4    16.4    16.9     0.0    16.9    16.4    16.4
```

INTEGERAPPROXIMATION

Generic name in Finnish

KOKONAISLUKURATKAISU

Functions

Parameter INTEGERAPPROXIMATION controls the computation of an integer approximation from the conventional JLP solution.

Origin System parameter

Program **MELAOPT**

Type Numerical

Number of items 1

Default values 0

Valid since MELA96

Legend

```
(1)  Calculation of the integer approximation
     '0' no integer approximation
     '1' integer approximation is calculated and presented
```

Notes

1. The integer approximation solution is calculated in JLP using for each calculation unit only the schedule with largest weight, which may lead far from the real optimum. In MELA, calculation units correspond management units.

See also

SOLVE command

Examples

Example 1: A definition of the INTEGERAPPROXIMATION parameter.

```
INTEGERAPPROXIMATION 1
```

LAND_VALUES

Generic name in Finnish

MAAN_ARVOT

Functions

Parameter LAND_VALUES defines the values of future tree generations, i.e. soil expectation values beyond the simulation period used as a component of the net present value calculation.

The explicit definition of the LAND_VALUES parameter replaces the built-in land values for discount rates of 1, 2, 3, 4 and 5 %. The built-in form of default land values tabulated according to interest rate, site type, soil and peatland category and temperature sum (example 2) differs from the definition of the LAND_VALUES parameter (example 1). The built-in land values are interpolated with respect to the temperature sum (but not with the interest rates). There is no interpolation in the use of user-defined land values.

Relevant land values are needed for every application, region, growth models, prices, costs, etc. An application-specific set of land values according to the Faustmann (1849) formula can be generated by a specific MELA simulation using respective (bare land) data of **rsd** or **rsu** type files and user-supplied discount rates. The items (16) and (17) of the SIMULATION_CONTROL parameter must also be specified.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	160
Default values	See functions and example 2
Valid since	MELA96, changed in MELA99

Legend

```
(1) - (160) Land values (€ per hectare).
        Categories:
        • soil and peatland category: 4 (see the sample plot variable
         (12) of the initial data record)
        • forest site type category: 8 (see the sample plot variable
         (13) of the initial data record)
        • discount rate: 5 (see the DISCOUNT_RATES parameter)
```

Notes

1. User has to ensure that land values are compatible with discount rates and other parameter values used in simulation and optimisation and with summary reports being applied.

2. The default values of parameter have been changed in MELA2002.

3. The used land values can be printed out by management units (stands) into the **mpu** type files by defining the collective variables LDV1-LDV5 in the COLLECTIVES and in the MPS_VARIABLES –parameters.

See also

DISCOUNT_RATES parameter
SIMULATION_CONTROL parameter
COLLECTIVES parameter
MPS_VARIABLES parameter
Net Present Value
Decision data variables (801-805)
Decision data variables (951-960)
Income/revenues/returns variable
Costs variable
Initial data record

Examples

Example 1: A definition of the LAND_VALUES parameter, €/ha.

```
LAND_VALUES
* SOIL AND PEATLAND CATEGORY 1 (mineral soils)
*   Forest site type categories 1-8 (lines 1-8)
* Default discount rates, %
*     1        2       3      4       5
   23838    7218    2816    1093     332
   22237    6291    2308     832     200
   17653    5227    2009     832     322
```

```
   11155    3054    1091     394     102
   10352    2627     853     295      70
    1894     178       0       0       0
    1777     119       0       0       0
    2791     519      31       0       0
* SOIL AND PEATLAND CATEGORY 2 (spruce mires)
   23838    7218    2816    1093     332
   22237    6291    2308     832     200
   17653    5227    2009     832     322
   11155    3054    1091     394     102
   10352    2627     853     295      70
    1894     178       0       0       0
    1777     119       0       0       0
    2791     519      31       0       0
* SOIL AND PEATLAND CATEGORY 3 (pine mires)
   23838    7218    2816    1093     332
   22237    6291    2308     832     200
   17653    5227    2009     832     322
   11155    3054    1091     394     102
   10352    2627     853     295      70
    1894     178       0       0       0
    1777     119       0       0       0
    2791     519      31       0       0
* SOIL AND PEATLAND CATEGORY 4-5 (treeless mires)
       0       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
```

Example 2: The current built-in default land values (€/hectare) for mineral soils.

```
* TEMPERATURE SUM 600
* forest site type categories 1-8 (lines 1-8)
* Discount rates, %
*    1         2       3       4       5
    2052      29      10       0       0
    2565      34      12       0       0
    1568      22       5       0       0
    1379      17       2       0       0
    1316       0       0       0       0
     429       0       0       0       0
       0       0       0       0       0
       0       0       0       0       0
* TEMPERATURE SUM 800
    4541     521      18       8       4
    5718     858      18       8       4
    3406     589      13       3       2
    2708     425       3       1       0
    2641     395       0       0       0
    1219      50       0       0       0
       0       0       0       0       0
       0       0       0       0       0
```

```
* TEMPERATURE SUM 1000
   11456    2168     214      53      25
   12110    2767     628      48      22
    9074    2023     401      26      10
    6874    1807     563     118       2
    6113    1424     360      24       0
    3365     627      44       0       0
       0       0       0       0       0
       0       0       0       0       0
* TEMPERATURE SUM 1100
   20771    5298    1598     294      63
   16567    4121    1093      76      38
   12984    3952     938     135      28
    9334    2565     908     286      17
    8956    2397     774     215       0
    4322     824      88       0       0
       0       0       0       0       0
       0       0       0       0       0
* TEMPERATURE SUM 1200
   25144    6807    2251     806     202
   21674    5970    2214     754     147
   16877    4167    1452     537     108
   10442    2998    1108     391      56
    9828    2704     949     309      47
    5218    1107     267      42       0
       0       0       0       0       0
       0       0       0       0       0
* TEMPERATURE SUM 1300
   29224    9044    3598    1678     748
   22550    7722    3329    1466     594
   21426    6778    2809    1198     425
   14189    4337    1744     753     307
   13274    3931    1518     614     213
    6627    1700     502      84       0
       0       0       0       0       0
       0       0       0       0       0
```

LOG_VOLUME_CALIBRATION

Generic name in Finnish

TUKKITILAVUUDEN_TASOKORJAUS

Functions

Parameter LOG_VOLUME_CALIBRATION provides adjustment coefficients for tree level log volumes (volumes defined by models). Calibration is based on average adjustment coefficients given by tree species.

Adjustment of log volume of trees is made by following principle:
$VL_C = VL_M * AC_V * Ř * AC_{VL}$
where
VL_C = calibrated saw log volume
VL_M = saw log volume from log volume model (Laasasenaho 1982) (maximum log volume)
AC_V = volume adjustment coefficient (see VOLUME_CALIBRATION parameter)
Ř = log volume reduction (see LOG_VOLUME_REDUCTION parameter)
AC_{VL} = log volume adjustment coefficient (LOG_VOLUME_CALIBRATION)

Adjustment coefficient value less than 1.0 means that the log volume is decreasing and pulp volume is correspondingly increasing. Value greater than 1.0 means that log volume is increasing and pulp volume is correspondingly decreasing. See example 1.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	4
Default values	1.0 1.0 1.0 1.0
Valid since	MELA2002 (updated version, released in February 2004), changed in MELA2009

Legend

```
Adjustment coefficients for
(1)     pine
(2)     spruce
(3)     birch
(4)     other deciduous species
```

Notes

1. Users must use this parameter carefully and with consideration.

2. The maximum log volume of the tree is always the log volume given by the model. Therefore users cannot adjust log volume greater than this maximum volume. If log volume of individual trees after the log volume calibration comes greater than the maximum volumes is, the MELA assigns that maximum log volume to the tree. To avoid this, adjustment coefficient greater than 1.1 should not be used (in other words greater increase to the log volume than 10%).

3. During a simulation a severe warning is always given to the simulation report when maximum log volume is exceeded and therefore the number of warnings may be considerable. When severe warnings are noticed, it is recommened to reduce adjustment coefficients and simulate the data again.

See also

Stand data text file variables (RSU variables)
VOLUME_CALIBRATION parameter
LOG_VOLUME_REDUCTION parameter
Volume variable

Examples

Example 1: A definition of the LOG_VOLUME_CALIBRATION parameter.

```
LOG_VOLUME_CALIBRATION

* (1) pine
* (2) spruce
* (3) birch
* (4) other deciduous species

* (1)  (2)  (3)  (4)
  1.05 1.05 0.95 1.00
```

LOG_VOLUME_REDUCTION

Generic name in Finnish

TUKKIVAHENNYS

Functions

Parameter LOG_VOLUME_REDUCTION controls the use of the built-in saw log volume reduction model and the use of the log volume reduction given in the initial data files (in rsd type files tree variable 7 and in the rsu type files tree stratum variable 11 or tree variable 10).

Since MELA2005 it has been possible to use two different log volume reduction models. Redcution model is chosen by LOG_VOLUME_REDUCTION_MODEL parameter.

Default log volume reduction models since MELA2005 (Mehtätalo 2002) are composed by tree species and land use categories. The models are functions of tree age, diameter, temperature sum, coordinates, height above sea level and dummy variables [1].

$\check{R} = f(a,d,dd,x,y,hsl,dums)$, [1]

where

$\check{R}$ = log volume reduction
a = age (at breast height)
d = diameter at breast height
dd = temperature sum
x,y = x and y coordinates
hsl = height of the stand above sea level
dums = dummy variables such as origin, site type, soil and peatland category, forestry centre

When using optional FNFI7 based log volume reduction mode (for method, see Päivinen 1983), model is is function of tree species, age and diameter [2].

$\check{R} = f(s,a,d)$, [2]

where

$\check{R}$ = log volume reduction
s = tree species
a = age
d = diameter at breast height

$VL_{\check{R}} = \check{R} * VL$, [3]

where

$VL_{\check{R}}$ = log volume based on built-in log volume reduction model
$\check{R}$ = log volume reduction

VL = saw log volume from log volume model (Laasasenaho 1982)

The reduced saw log volume [3] can be further adjusted with the user-supplied log volume information given in the forest resource data. The user-supplied log volume information can be either 1) a log volume reduction coefficient κ_{data} for the log volume model or 2) saw log volume percentage, which is also converted into log volume reduction coefficient.

The saw log reduction coefficient κ_{data} is used for calculating calibration coefficient for the saw log reduction [4].

$$\kappa = \kappa_{data} * VL_0 / VL_{\check{R}0}, \quad [4]$$

where

κ = calibration coefficient
VL_0 = saw log volume from log volume model at time t = 0
$VL_{\check{R}0}$ = log volume based on built-in log volume reduction model at time t = 0

Using the calibration coefficient κ a new calibrated log volume is calculated [5].

$$VL_\kappa = \kappa * VL_{\check{R}}, \quad [5]$$

where

VL_κ = calibrated log volume ($\forall \kappa, VL_\kappa < VL$)

The calibration coefficient is calculated in the beginning of the simulation and it is used through the whole simulation. In the beginning of the simulation the calibrated saw log volumes VL_κ's are at the level of the user-supplied log volume information.

The calibration procedure is used only if log volume information in the forest resource data is found and if the trees are tall enough to have saw log volume in the beginning of the simulation. For all other trees, only the built in log volume reduction model is applied. For trees generated during the simulation, calibration is not applied. The 'reduced' part of the saw log volume of the estimates either $VL\text{-}VL_{\check{R}}$ or $VL\text{-}VL_\kappa$ is added to the pulpwood so that the total volume of timber remains unchanged.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1

Default values 1

Valid since

MELA96, changed in MELA2000 and MELA2002 (updated version)

Legend

```
(1)     Application of the saw log volume reduction model.
        '0' no saw log volume reduction
        '1' saw log volume reduction on the basis of the built-in
            reduction model
        '2' saw log volume reduction on the basis of the built-in log
            volume reduction model calibrated with user-supplied log
            volume information.
```

Notes

1. The calibration procedure is activated by the LOG_VOLUME_REDUCTION parameter value, not by the presence of user supplied log volume information in the initial forest resource data.

2. User-supplied log volume information should be given only to those strata or trees where it is considered necessary.

See also

Reduction of saw log volume variable
Volume variable

Volume table files (**vol** type files)
Initial data files (**rsd** type files)
Stand data text files (**rsu** type files)

VOLUME_CALIBRATION parameter
LOG_VOLUME_CALIBRATION parameter
LOG_VOLUME_REDUCTION_MODEL parameter

Examples

Example 1: A definition of the LOG_VOLUME_REDUCTION parameter.

```
LOG_VOLUME_REDUCTION 0
```

No saw log reduction is done.

LOG_VOLUME_REDUCTION_MODEL

Generic name in Finnish

TUKKIVAHENNYSMALLI

Functions

With this parameter users may choose the log volume reduction model to be used in the simulation. By default, the FNFI9 based log volume reduction model (Mehtätalo 2002) is used. Another model which can be used is FNFI7 based log volume reduction model used in MELA96 – MELA2000.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1

Default values Example 1

Valid since MELA2002 (updated version, released February 2004)

Legend

```
(1) Log volume reduction model in use:
    '0' FNFI7 based model (MELA96, Päivinen)
    '1' FNFI9 based model (MELA2002, Mehtätalo)
```

See also

LOG_VOLUME_REDUCTION parameter
LOG_VOLUME_CALIBRATION parameter

Examples

Example 1: A definition of the LOG_VOLUME_REDUCTION_MODEL parameter

```
LOG_VOLUME_REDUCTION_MODEL 1
```

LOGGING_COSTS

Generic name in Finnish

KORJUUKUSTANNUKSET

Functions

Parameter LOGGING_COSTS defines the unit costs (€/hour) of felling and forest haulage. Unit cost is a component of the logging cost calculations besides cutting removal and time expenditure. This parameter is provided by the sub-periods corresponding to the YEARS parameter. The number of the given sub-periods can be 1 to 9. If the first given sub-period is 'k', the default values are used for the sub-periods 1 to k-1 and for the sub-periods beyond the k, the values of the k are used until the next given sub-period.

The costs of logging and silvicultural operations are used together with the roadside prices in the calculation of net revenues and net present values, consequently determining the preference and the priority of management operations in the analysis from the economic point of view. The consistency of prices and costs is of great importance, besides the general cost level.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	7 for each given sub-period, the maximum number of sub-periods is 9 and the maximum number of given items 63
Default values	1 24.75 85.0 60.0 18.50 0.0 0.0
Valid since	MELA99, changed in MELA2009 2nd ed

Legend

```
(1)  The ordinal number of the sub-period.
(2)  Manual felling, €/hour
(3)  Mechanized felling, €/hour
(4)  Forest haulage, €/hour
```

```
(5)  Supervision, €/h
(6)  Organisation costs, €/m³
(7)  Machine transfer costs/entry costs, €/stand
```

Notes

1. The default values of parameter have been changed in MELA2007.

See also

SILVICULTURAL_COSTS parameter
ROADSIDE_PRICES parameter
TIME_EXPENDITURE_IN_LOGGING parameter
YEARS parameter

Income/revenues/returns variable
Costs variable
Net present value variable

Examples

Example 1: A definition of the LOGGING_COSTS parameter.

```
LOGGING_COSTS
 2 25.00 90.50 65.50 18.50 3.50 65.00
 5 25.00 95.00 67.25 20.10 3.50 85.00
```

For the 1st sub-period the default values are used, for the sub-periods 2−4 the values of the given sub-period 2 are used and for the 5th and the subsequent sub-periods the values of the sub-period 5 are applied.

LOWEST_LEVEL

Generic name in Finnish

ALIN_TASO

Functions

Parameter LOWEST_LEVEL limits the depth of the decision hierarchy in the MELA program session up to the specified level instead of using the complete hierarchy defined by the forestry_unit_LEVELS parameter.

The LOWEST_LEVEL parameter makes it possible to avoid multiple decision hierarchy definitions for the same forestry unit if, for example, an upper level sample is required instead of the complete decision hierarchy in some step of the analysis process. For the data requirements, see the forestry_unit_members parameter.

Origin System parameter

Program **MELASIM, MELAOPT**

Type Character

Number of items 1

Default values None

Valid since MELA96

Legend

```
(1) Name of the lowest level of the decision hierarchy
```

Notes

1. The LOWEST_LEVEL parameter is provided as an option of a command - see general information of MELA commands

See also

MELA decision hierarchy
FORESTRY_UNIT parameter
forestry_unit_LEVELS parameter
forestry_unit_members parameter
General syntax of MELA commands

Examples

Example 1: A definition and the use of the LOWEST_LEVEL parameter.

```
FORESTRY_UNIT#FX
SIMULATE/LOWEST_LEVEL=REGION MS FX
```

The decision hierarchy for the forestry unit FX is limited up to the level REGION. **SR.RSD**, **NR.RSD** and **WR.RSD** will be used as initial data files in the simulation. The initial data files would be **F1.RSD**, ..., **F5.RSD** and **WR.RSD** without the definition 'LOWEST_LEVEL=REGION'

Example 2: Another definition of the use of the LOWEST_LEVEL parameter.

```
FORESTRY_UNIT#FX
SOLVE/LOWEST_LEVEL=REGION S1 FX
```

The decision hierarchy for the forestry unit FX (see Example 3.11) is limited up to the level REGION. Correspondingly, **SR.RSD**, **SR.MSC**, **SR.MSD**, **NR.RSD**, **NR.MSC**, **NR.MSD**, **WR.RSD**, **WR.MSC** and **WR.MSD** will be used as input data files in the optimisation.

MANAGEMENT_CATEGORY_GROUPS

Generic name in Finnish

KASITTELYLUOKAT

Functions

Parameter MANAGEMENT_CATEGORY_GROUPS defines ten forest management category groups for collecting certain variables of the decision data record. The management category groups are defined as a function of the forest management category (the sample plot variable (30) of the simulation record).

The general definition of the parameter allows the same management unit to belong to several management category groups making it possible to define groups that are sums of other groups as well as any other aggregates of management units.

Origin

System parameter

Program

MELASIM

Type

Character (character items may contain also numerical parts)

Number of items

10

Default values

Example 1

Valid since

MELA96

Legend

```
(1) - (10) group_id management_category
```

group_id An index of the management category group.

management_category A value for the forest management category (the sample plot variable (30) of the simulation record) belonging to the management category group. The sign '-' immediately preceding the management category refers

to a range from the previous value of the management category to the current absolute value.

Notes

1. The MANAGEMENT_CATEGORY_GROUPS parameter is independent from the definition of the TIMBER_PRODUCTION_LAND parameter.

See also

TIMBER_PRODUCTION_LAND parameter
Sample plot variable (30) of the simulation record
Decision data variables (MSD variables)

Examples

Example 1: A definition of the MANAGEMENT_CATEGORY_GROUPS parameter.

```
MANAGEMENT_CATEGORY_GROUPS
#1 0 -1.99999
#2 2 -2.99999
#3 3 -3.99999
#4 2 -4.99999
#5 0 -5.99999
#6 6 -6.99999
#7 7 -7.99999
#8 8 -8.99999
#9 7 -9.99999
#10 0 -10.99999
```

The default values of the MANAGEMENT_CATEGORY_GROUPS parameter.

Example 2: A definition of the MANAGEMENT_CATEGORY_GROUPS parameter.

```
MANAGEMENT_CATEGORY_GROUPS
#1  1.1 1.3
#2  1.2 1.4 -1.7 1.9
#3  1.8 2 -3.3
#4  4 -5.3
#5  6
#6  7.1 -7.3
#7  8.1 -8.3 9.1 -9.3
#8  0 -5.3
#9  7 -9.3
#10 0 -9.3
```

The management category group 1 includes the values 1.1 and 1.3 of the sample plot variable (30) of the simulation record. The management category group 2 includes the values 1.2, 1.4, 1.9 and all values between 1.4-1.7 (also the upper limit of the range).

MANAGEMENT_UNIT_TYPE

Generic name in Finnish

LASKENTAYKSIKON_TARKENNE

Functions

Parameter MANAGEMENT_UNIT_TYPE defines the type of the management units and, if necessary, the average size of stands in the management units of the initial data.

In the MELA analysis, management units can be true stands with actual area (default) or they may represent an aggregate set of stands with an average area of stands. If the management units are stand aggregates, the average size of stands is needed for the calculation of appropriate logging and silvicultural costs. When defining the silvicultural costs, the average cutting area of the last cutting method (the sample plot variable (70) of the simulation record) is used. If the last cutting method hasn't been defined the average area in clear cuttings is used.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1 or 7

Default values 0

Valid since MELA99

Legend

```
(1)  Type of the management units in the initial data.
     '0' real stands without items (2) - (7)
     '1' stands are aggregate ones without items (2) - (7), built-in values
     for items (2) - (7) are used
     '2' stands are aggregate ones with items (2) - (7)
(2)  Average cutting area in thinnings based on basal area, hectares.
(3)  Average cutting area in clear cuttings, hectares.
(4)  Average cutting area in thinnings based on number of stems, hectares.
```

```
(5)  Average cutting area in over story removal, hectares.
(6)  Average cutting area in seed tree cuttings, hectares.
(7)  Average cutting area in shelterwood cuttings, hectares.
```

Notes

1. When value '1' are given for item (1), built-in values are used, see example 1.

See also

LOGGING_COSTS parameter
SILVICULTURAL_COSTS parameter
Sample plot variable (70) at the simulation record

Examples

Example 1: A definition of the MANAGEMENT_UNIT_TYPE parameter.

```
MANAGEMENT_UNIT_TYPE
 2 4.0 3.0 4.0 3.5 3.5 3.5
```

The values of the items 2-7 are built in values for aggregate stands when the value of the 1 st item is ‘1’.

MAX_LENGTH_OF_FILENAME

Generic name in Finnish

TIEDOSTONIMEN_PITUUS

Functions

Parameter MAX_LENGTH_OF_FILENAME defines the maximum allowable length for file names generated by the MELA programs.

On some operating systems, the length of the file name is restricted, for example, up to eight characters. The parameter makes it possible to truncate extra characters from the end of the file name generated by the MELA programs. In the case of truncation, confusions are likely to appear. Instead of truncation, shorter naming components, for example command argument values, should be used to keep the file names simultaneously unique and short.

Origin System parameter

Program **MELASIM, MELAOPT**

Type Numerical

Number of items 1

Default values None

Valid since MELA96

Legend

```
(1) Maximum number of characters in a file name (extension excluded).
```

See also

FILE_NAMING parameter

Examples

Example 1: A definition of the MAX_LENGTH_OF_FILENAME parameter.

```
MAX_LENGTH_OF_FILENAME 8
```

The maximum length of the file name is defined to 8 characters.

MAX_REGENERATION_TIME

Generic name in Finnish

SALLITTU_UUDISTUMISAIKA

Functions

Parameter MAX_REGENERATION_TIME defines the maximum acceptable time from regeneration cutting to an acceptable regeneration result. Maximum regeneration time is used in the calculation of simulated development class.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 8

Default values Example 1

Valid since MELA99

Legend

```
(1) - (8) Years from the regeneration cutting to an acceptable
          regeneration result.

          Categories:
          • regeneration type: 2 (natural, artificial)
          • tree species: 4 (pine, spruce, birch, other deciduous species)
```

Notes

1. The default values of the parameter have been changed in MELA2002.

See also

The sample plot variable (24) of the simulation record

Examples

Example 1: A definition of the MAX_REGENERATION_TIME parameter.

```
MAX_REGENERATION_TIME

* Tree species:
* (1) pine
* (2) spruce
* (3) birch
* (4) other deciduous

* (1)  (2)  (3)  (4)
* natural regeneration
   7    7    7    7
* artificial regeneration
   3    3    3    3
```

The default values are derived from the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006).

MIN_NUMBER_OF_SEEDLINGS

Generic name in Finnish

MIN_VILJELYTIHEYS

Functions

Parameter MIN_NUMBER_OF_SEEDLINGS defines the general guiding number of seedlings (or seedling density plants per hectare) for silvicultural management operations.

The parameter values serve as simulation control for artificial regeneration, tending of young stands, and over story removal, for example.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 16

Default values

2000 1800 1600 2000
2000 1800 1600 2000
2000 1800 1600 2000
2000 1800 1600 1800

Valid since MELA96, changed in MELA99

Legend

```
(1) - (16) Number of seedlings per hectare.

        Categories:
        • forest site type category: 4
        1 for values 1 and
        2 for value 3
        3 for value 4
        4 for values 5, 6, 7 and 8
        • tree species: 4 (pine, spruce, silver birch, other deciduous)
```

Notes

1. The default values of parameter have been changed in MELA2007.

See also

BOUND_FOR_SUPPLEMENTARY_PLANTING parameter
BOUND_FOR_YOUNG_STAND_REGENERATION parameter
EVENT parameter
The specific EVENT_CALL arguments of artificial regeneration, tending of young stands, and over story removal
Site type category variable

Examples

Example 1: A definition of the MIN_NUMBER_OF_SEEDLINGS parameter.

```
MIN_NUMBER_OF_SEEDLINGS

* Tree species:
* (1) pine
* (2) spruce
* (3) silver birch
* (4) other deciduous species

*  (1)   (2)   (3)   (4)
* Forest site type category 1-2
  2500  2000  1600  2000
* Forest site type category 3
  2500  1800  1600  1800
* Forest site type category 4
  2000  1800  1600  1800
* Forest site type category 5-8
  2000  1800  1600  1800
```

The user-supplied parameter values are used to control the silvicultural management operations in the simulation.

The default values are based on the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006).

MIN_NUMBER_OF_STEMS_AFTER_THINNING

Generic name in Finnish

MIN_RLUKU_HARV_JALKEEN

Functions

Parameter MIN_NUMBER_OF_STEMS_AFTER_THINNING defines the number of stems left to grow after thinning based on number of stems instructions in young stands.

Origin System parameter

Program MELASIM

Type Numerical

Number of items 16

Default values

1200	1000	800	1000
1200	1000	800	1000
1100	1000	800	1000
900	1000	800	1000

Valid since MELA99

Legend

(1) - (16) Number of trees per hectare after thinning based on number of stems instructions.

Categories:
- **forest site type category: 4**
  - **1 for values 1 and 2**
  - **2 for value 3**
  - **3 for value 4**
  - **4 for values 5, 6, 7 and 8**
- **tree species: 4 (pine, spruce, silver birch and other deciduous species, downy birch)**

Notes

1. The default values of parameter have been changed in MELA2007.

See also

BASAL_AREA_INSTRUCTIONS parameter
EVENT parameter
The specific EVENT_CALL arguments for thinnings based on number of stems instructions
Site type category variable

Examples

Example 1: A definition of the MIN_NUMBER_OF_STEMS_AFTER_THINNING parameter.

```
MIN_NUMBER_OF_STEMS_AFTER_THINNING

* Tree species:
* (1) pine
* (2) spruce,
* (3) silver birch and other deciduous species
* (4) downy birch

*  (1)   (2)   (3)   (4)
* Forest site type category 1-2
  1400  1300  1100  1400
* Forest site type category 3
  1400  1300  1100  1400
* Forest site type category 4
  1300  1300  1100  1400
* Forest site type category 5-8
  1100  1300  1100  1400
```

The user-supplied parameter values are used to control the simulation of the thinnings based on the number of stems instructions.

The default values are derived from the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006).

MIN_REGENERATION_AGE

Generic name in Finnish

MIN_UUDISTUSIKA

Functions

Parameter MIN_REGENERATION_AGE defines the guiding minimum rotation periods in terms of biological age for controlling the generation of cutting alternatives in the simulation.

Parameter is applied in conjunction with the MIN_REGENERATION_ DIAMETER parameter and the specific EVENT_CALL arguments for cuttings. Regeneration alternatives are simulated if the minimum regeneration age, the minimum mean diameter or both of them are reached.

In the absence of user-supplied parameter values, built-in default values are used with modifications as a function of the temperature sum. Default values are applied in simulation as such for temperature sums above 1100 dd. For temperature sums below 1100 dd the values of minimum regeneration ages are increased 10-20 years for each 100 dd. However, the maximum increase for deciduous species is limited to 20 years. For example, modified minimum regeneration age defaults for pine at 750 dd vary from 120 to 160 years.

The user-supplied parameter values are used as such (without modifications on the basis of temperature sum).

Origin System parameter

Program MELASIM

Type Numerical

Number of items 20

Default values

70 70 60 60 50
70 70 60 60 50
80 70 60 60 50
90 70 60 60 50

Valid since

MELA96, changed in MELA99 and in MELA2007

Legend

```
(1) - (20) Minimum rotation periods (years) based on biological age.

        Categories:
        • forest site type category: 4
        1 for values 1 and 2
        2 for value 3
        3 for value 4
        4 for values 5, 6, 7 and 8
        • tree species: 5 (pine, spruce, silver birch, downy birch,
        other deciduous species)
```

Notes

1. The default values of parameter have been changed in MELA2007.

See also

The specific EVENT_CALL arguments for cuttings
MIN_REGENERATION_ DIAMETER parameter
Site type category variable

Examples

Example 1: A definition of the MIN_REGENERATION_AGE parameter.

```
MIN_REGENERATION_AGE

* Tree species:
* (1) pine,
* (2) spruce
* (3) silver birch
* (4) downy birch
* (5) other deciduous species
* (1)  (2)  (3)  (4)  (5)

* Forest site type category 1-2
   80   80   60   60   50
* Forest site type category 3
   80   90   70   60   50
* Forest site type category 4
   90   90   70   60   50
* Forest site type category 5-8
  110   90   70   60   50
```

The user-supplied parameter values are applied as such without modifications as a function of the temperature sum.

The default values are derived from the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006).

MIN_REGENERATION_DIAMETER

Generic name in Finnish

MIN_UUDISTUSLAPIMITTA

Functions

Parameter MIN_REGENERATION_DIAMETER defines the guiding minimum rotation periods in terms of the mean diameter for controlling the generation of cutting alternatives in the simulation.

Parameter is often applied in conjunction with the MIN_REGENERATION_AGE parameter and the specific EVENT_CALL arguments for cuttings. Regeneration alternatives are simulated if the minimum regeneration age, the minimum mean diameter or both of them are reached.

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

20

Default values

26 28 28 23 23
26 26 27 23 23
25 24 25 21 21
22 22 22 19 19

Valid since

MELA96, changed in MELA99

Legend

(1) - (20) Minimum mean diameters (cm) before regeneration.

Categories:
• forest site type category: 4
1 for values 1 and 2
2 for value 3
3 for value 4
4 for values 5, 6, 7 and 8
• tree species: 5 (pine, spruce, silver birch, downy birch, other deciduous species)

Notes

1. The default values of parameter have been changed in MELA2007.

See also

The specific EVENT_CALL arguments for cuttings
MIN_REGENERATION_AGE parameter
Site type category variable

Examples

Example 1: A definition of the MIN_REGENERATION_DIAMETER parameter.

```
MIN_REGENERATION_DIAMETER

* Tree species:
* (1) pine
* (2) spruce
* (3) silver birch
* (4) downy birch
* (5) other deciduous species

*  (1)  (2)  (3)  (4)  (5)
* Forest site type category 1-2
   29   28   28   25   25
* Forest site type category 3
   29   26   26   25   25
* Forest site type category 4
   27   26   26   25   25
* Forest site type category 5-8
   25   26   26   25   25
```

The user-supplied parameter values are used to control the generation of cutting alternatives in the simulation.

The default values are derived from the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2006).

MPS_VARIABLES

Generic name in Finnish

MPS_MUUTTUJAT

Functions

Parameter MPS_VARIABLES defines the variables of

- management report records for storing into **mps** type files, or
- management report text records for storing into **mpu** type files

and further for the transmission of information about the selected management schedules to user programs and databases.

Management report records (or management report text records) are constructed in MELASIM and MELAOPT from the variables of management schedule records originating from simulation records and decision data records assuming that the variables in question are stored **msc** and **msd** type files in MELASIM. In MELA2009 it is also possible to use all collective variables. It is also possible to use c-variables from the management unit records (from the **rsd /rsu** type files).

Use the MSD_VARIABLES parameter for storing variables of the decision data record and the MSR_VARIABLES parameter for storing variables of the management schedule record in MELASIM. Use FOREST_REPORT parameter and/or COLLECTIVES parameter for storing collective variables.

The item (1) of the OUTPUT parameter controls the generation of management schedule (**msc** and **msd** type) files. In MELASIM **mpu** type file is always created if MPS_VARIABLE parameter is defined. In MELAOPT command REPORT SUMMARY generates **mps**/**mpu** type files. The STAND_MANAGEMENT_FILES parameter controls the output.

A definition of the MPS_VARIABLES parameter with the preceding definitions of the YEARS, MSR_VARIABLES and MSD_VARIABLES parameters in MELASIM is presented in example 1. The example suites for both management report record/**mps** type files and management report text records/**mpu** type files.

Origin

System parameter

Program

MELASIM, MELAOPT

Type Character (character items may contain also numerical parts)

Number of items 1 - 500

Default values None

Valid since MELA96, changed in MELA2009

Legend

```
(1) - (n) origin sub-period variable {variable_name}
```

- for the variables originating from **decision data** records

origin 'MSD'

sub-period An index of the sub-period (see the actual definition of the YEARS parameter and **mdl** type files)
'0' for the beginning of the first sub-period
'1' for the first sub-period and its end
'2' for the second sub-period and its end
etc.

variable An identification number of the decision variable (see variables of the decision data record)

variable_name User-defined name to the variable (optional, see note 4)

- for the variables in management schedule records (originating from **simulation records**)

origin 'MSR'

sub-period '0'

variable An index of the variable in a management schedule record generated according to the instructions of the MSR_VARIABLES parameter

variable_name User-defined name to the variable (optional, see note 4)

- for the variables in management unit records (originating from the **rsu** /**rsd** type files)

origin 'C'

sub-period '0'

variable	Name of the c-variable (see note 3)
variable_name	User-defined name to the variable (optional, see note 4)

- for the collective variables (defined in FOREST_REPORT or/and COLLECTIVES parameter)

origin	'CV'
sub-period	An index of the sub-period (see the actual definition of the YEARS parameter and **mdl** type files) '0' for the beginning of the first sub-period '1' for the first sub-period and its end '2' for the second sub-period and its end etc.
variable	Name of the collective variable (see note 5)
variable_name	User-defined name to the variable (optional, see note 4)

Notes

1. Variables of the decision data record and management schedule record may appear in the same definition of the MPS_VARIABLES parameter.

2. The order of the variables in management report records of **mps** type files (or management report text records of **mpu** type files) is the same as in the definition of the MPS_VARIABLES parameter.

3. Name of the c-variable must be given here exactly in same way as in the C_VARIABLES parameter definition. See example 2.

4. It is possible to give clear names to the variables (from MELA2005 version). Maximum length of the variable name is 18 characters. Be careful that length doesn't exceed width of the data field (see MPU_FORMAT parameter). Variable names are used as data field names in the **mpu** file. They have no effect in binary type **mps** file. This feature is often useful when results are transferred into other programs for further handling. See example definition from the example 2.

5. Name of the collective variable must be given exactly the same way as it is given in FOREST_REPORT or COLLECTIVES parameter. Only categorical definitions are allowed, not references to a classification.

See also

REPORT SUMMARY command

MSD_VARIABLES parameter

MSR_VARIABLES parameter
OUTPUT parameter
STAND_MANAGEMENT_FILES parameter
YEARS parameter
FOREST_REPORT parameter
COLLECTIVES parameter
C_VARIABLES parameter
MPU_FORMAT parameter

Simulation records
Management report records

Management schedule files (**msc** and **msd** type files)
Stand management files (**mps** and **mpu** type files)
Problem definition files (**mdl** type files)

Examples

Example 1: A definition of the MPS_VARIABLES parameter.

The preceding MELASIM session:

```
* The beginning (0) and the ends (1) and (2)
* of the sub-periods in the simulation
*
YEARS  1   11  21
*     (0) (1) (2)
*
* variables (1)-(22) of a management schedule record
* for storing into a msd type file
*
MSR_VARIABLES
* Variables (1)-(3) of a management schedule record
  1  1  3
* Variables (4)-(6) of a management schedule record
  1 32 33
  1 36 36
* Variables (7)-(8) of a management schedule record
 11 28 28
 11 70 70
* Variables (9)-(16) of a management schedule record
 11  1  3
 11 32 33
 11 36 36
 21 28 28
 21 70 70
* Variables (17)-(22) of a management schedule record
 21  1  3
 21 32 33
 21 36 36
*
* variables of a decision data record
* for storing into a msd type file
```

```
*
MSD_VARIABLES
* numbers of the decision variables
*  ...
 195 350 370 400 700
*  ...
```

The following MELAOPT session:

```
* Variables (1)-(26) in a management report record
* for storing into a mps type file
* Variables in the record are in the order of
* the provided definition
*
MPS_VARIABLES
*
* item variable in the 'MSR' case:
* index of the variable in a management schedule record
*
* item variable in the 'MSD' case:
* number of the variable in a decision data record
*
#MSR 0 2
#MSR 0 3
#MSR 0 4
#MSR 0 5
#MSR 0 6
#MSD 0 700
#MSR 0 7
#MSR 0 8
#MSD 1 195
#MSD 1 370
*
#MSR 0 10
#MSR 0 11
#MSR 0 12
#MSR 0 13
#MSR 0 14
#MSD 1 700
#MSR 0 15
#MSR 0 16
#MSD 2 195
#MSD 2 370
*
#MSR 0 18
#MSR 0 19
#MSR 0 20
#MSR 0 21
#MSR 0 22
#MSD 2 700
```

Sample interpretations:

(14) '#MSR 0 13' is a reference to the variable (13) of the management schedule record, i.e. the management unit variable (33) of the simulation record (mean age of the dominant story) in relative year 11, see the MSR_VARIABLES parameter above.

(26) '#MSD 2 700' is a reference to the variable (700) of the decision data record (volume of the growing stock) at the end of the second sub-period, i.e. in the beginning of relative year 21, see the YEARS parameter above.

Example 2: Short example of the MPS_VARIABLES parameter definition with c-variables, collective variables and variable names.

Parameter definitions for the simulation and optimisation:

```
C_VARIABLES#YEAR#AREA#OWNER  * c-variables from the user data

COLLECTIVES #P#P[s=1,7]      * if not defined with FOREST_REPORT
                             *parameter

STAND_MANAGEMENT_FILES 1 1   * mpu file is written
```

The following MELAOPT session:

```
*
MPS_VARIABLES
*
* item variable in the 'MSR' case:
* index of the variable in a management schedule record
*
* item variable in the 'MSD' case:
* number of the variable in a decision data record
*
* item variable in the 'C' case:
* name of the c-variable in management unit record (text or binary)
*
* item variable in the 'CV' case:
* name of the collective variable
*

#MSR 0 2 YEAR
#MSR 0 3 AREA
#MSD 1 400 TotInc
#MSD 1 195 CutRem
#MSD 1 370 NetRev
#C 0 AREA Area
#C 0 OWNER Owner
#CV 0 P P..0m
#CV 1 P[s=1,7] P..1m
*
```

Sample interpretations:

(3) '#MSD 0 400 TotInc' is a reference to the variable (400) of the decision data record (total increment) at the end of the first sub-period, i.e. in the beginning of relative year 11. Variable is named “TotInc” (by user).

(6) '#C 0 AREA Area' is a reference to the c-variable named “AREA” in the management unit record. Variable is named “Area” (by user).

MPU_FORMAT

Generic name in Finnish

MPU_MUOTOILU

Functions

Parameter MPU_FORMAT describes the design and layout of the text type stand management files (**mpu** type files). This parameter is useful when results are transferred to other programs for further handling. If MPU_FORMAT parameter is not defined **mpu** file is written in MELA2002 format (see note 4).

Origin	System parameter
Program	**MELASIM, MELAOPT**
Type	Numerical and character
Number of items	1-6 option items
Default values	See definitions of the option items
Valid since	MELA2005, changed in MELA2009 (november 2009)

Syntax

a) General syntax of the MPU_FORMAT parameter

```
MPU_FORMAT
{1-6 option item lines (each line is optional)}
```

b) The general syntax of the **option items** of the MPU_FORMAT parameter

```
#/option {qualifier}
```

/	The indicator of option item.
option	One of the following character strings: NAMES DECIMAL_POINT FIELD_DELIMITER ALIGNMENT

FORMAT
AFORMAT

Option	Meaning

NAMES — When this option is turned on (option is defined), user-defined variable names are written into first line of **mpu** file as data field names. Variable names are defined in MPS_VARIABLES parameter. By default this option is off.

```
#/NAMES
```

DECIMAL_POINT — A user-supplied character for substituting **default decimal delimiter '.'** in decimal form data fields. Alternative decimal delimiter may be required for summary tables used as input for spreadsheet, for example.

```
#/DECIMAL_POINT 'character'
```

`character` — A character (in '') used as decimal delimiter.

```
#/DECIMAL_POINT ','
```

FIELD_DELIMITER — A user-supplied delimiter for the data fields. Explicitly defined field delimiter is required for summary tables used as spreadsheet input, for example. This option does not have any effect to the data field names, if that option is defined (NAMES option item). It is recommened that this option is not used when NAMES otion item is defined. By default data fields are separated with spaces. See note 2.

```
#/FIELD_DELIMETER 'delimiter'
```

`delimiter` — A character string (in '') added between data fields. Length of the delimiter is limited into one character.

```
#/FIELD_DELIMITER ';'
```

ALIGNMENT — Alignment of the numerical values within the data fields is defined with this option. By default values are aligned to the right. Notice that variable names are always aligned to the left when used as column headers (NAMES option).

```
#/ALIGNMENT 'align_char'
```

`align_char` — One of the following characters (in '')

Value	Explanation

<	Numerical values in the data fields are aligned to the left
>	Numerical values in the data fields are aligned to the right

```
#/ALIGNMENT '<'
```

FORMAT — A formatting instruction for the numerical values. Default width for the data field is 18 characters and default number of the digits after the decimal part is 8 (values are scaled to 8 digit MELA default format). Minimum width of the data field is 12 characters. Default formatting instruction is used when FORMAT option item is missing from MPU_FORMAT parameter. See note 3.

```
#/FORMAT '(format)'
```

format — Floating point type FORTRAN edit code (in '( )').

```
#/FORMAT '(f12.4)'
```

AFORMAT — A formatting instruction for the variable names (data field names). Default width for variable name column is 18 characters. Default formatting instruction is used when MPU_FORMAT parameter and NAMES option item are defined, but AFORMAT option item is not defined. It is always preferred to set This option item does not have any effect if NAMES option item is not defined. See note 3.

```
#/AFORMAT '(aformat)'
```

aformat — Character type FORTRAN edit code (in '( )').

```
#/AFORMAT '(a12)'
```

Notes

1. MPU_FORMAT parameter does not have any effect to the binary type stand management files (**mps** type files).

2. There is always a number of empty spaces between data fields (i.e. spaces before or after numerical values) regardless of FIELD_DELIMITER option. The number of spaces depends on the width of the data field and the length of the numerical values.

3. Take care of the compatibility of the FORMAT and AFORMAT option items. Usually it is better to set these values to the same data field width.

4. If MPU_FORMAT parameter is not defined then **mpu** file is written in MELA2002 format. This means that width for the data field is then 18 characters and number of the digits after the decimal part is 7 (values are scaled to 7 digit MELA default format). Columns are aligned to the right.

See also

MPS_VARIABLES parameter
Stand management files (**mps** and **mpu** type files)

Examples

Example 1: Example definition of the MPU_FORMAT parameter.

```
MPU_FORMAT
#/NAMES
#/DECIMAL_POINT ','
#/FIELD_DELIMITER ';'
#/ALIGNMENT '<'
#/FORMAT '(f12.4)'
#/AFORMAT '(a13)'
```

MSD_VARIABLES

Generic name in Finnish

MSD_MUUTTUJAT

Functions

Parameter MSD_VARIABLES expresses in MELASIM the variables of decision data records to be stored in management schedule files (**msc** and **msd** type files) for further processing by MELAOPT. The defined decision data variables are stored automatically for all the sub-periods defined by the YEARS parameter.

Decision data variables should be selected according to actual decision problems and reporting needs.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1 - 1000

Default values Example 1

Valid since MELA96

Syntax

```
variable[ {-}variable]
```

variable An identification number of the decision data variable. The sign '-' immediately preceding an identification number refers to a range from the previous identification number to the current absolute value of this number.

Notes

1. Decision data variables that are used in the forest level summary report definitions in FOREST_REPORT parameter must always be introduced in MSD_VARIABLES parameter.

See also

FOREST_REPORT parameter
MPS_VARIABLES parameter
YEARS parameter
Management schedule files (**msc** and **msd** type files)
Decision data variables (MSD variables)

Examples

Example 1: A definition of the MSD_VARIABLES parameter.

```
MSD_VARIABLES
   1    2    4  -15   20   25  -27   29   30   35  -38
  60   65   86  -90  100  181 -195  210  225  240  260
 265  270  340  346 -350  365  370  445  454  458  462
 466  470  474  478  482  486  490  494  498 -510  537
 600  620  640  660  680  684  688  692  696 -700  705
 710  715  720  725  800 -810  816 -823  840  845  850
 900  915  920  925  940 1000
```

The default values of MSD_VARIABLES parameter are a collection of the decision data variables.

MSR_VARIABLES

Generic name in Finnish

MSR_MUUTTUJAT

Functions

Parameter MSR_VARIABLES defines the management unit variables of the simulation record that are stored in management schedule records of **msc** and **msd** type files and transmitted via MELAOPT for further processing. Management unit variables are stored in management schedule records for the defined years only.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	1 – 200 groups of three elements (max 200 variables, see note 3)
Default values	None
Valid since	MELA96

Legend

```
(1) - (n) year first_variable last_variable
```

year	A relative year. The relative year '0' refers to the initial state before pre-simulation.
first_variable	An index of the first management unit variable in the simulation record to be stored in management schedule records by this definition.
last_variable	An index of the last management unit variable in the simulation record to be stored in management schedule records by this definition.

Notes

1. The first_variable and last_variable have the same value if there is only one variable in a definition.

2. The variables of management schedule records are not used in the optimization. They are only transferred through MELAOPT.

3. Every item line includes three elements. Maximum number of item lines is 200 as well as maximum number of defined variables.

See also

MPS_VARIABLES parameter
Variables of the simulation record

Examples

Example 1: A definition of the MSR_VARIABLES parameter.

```
MSR_VARIABLES
* Variables (1)-(3) of a management schedule record
  1  1  3
* Variables (4)-(6) of a management schedule record
  1 32 33
  1 36 36
* Variables (7)-(8) of a management schedule record
 11 28 28
 11 70 70
* Variables (9)-(16) of a management schedule record
 11  1  3
 11 32 33
 11 36 36
 21 28 28
 21 70 70
* Variables (17)-(22) of a management schedule record
 21  1  3
 21 32 33
 21 36 36
```

These parameter values define 22 variables to be stored in management schedule records of **msc** and **msd** type files. The first variable is the identification number of the management unit (management unit variable (1) of the simulation record) at the relative year 1. The last variable is the mean diameter of the dominant story (management unit variable (36) of the simulation record) at the relative year 21.

In this example there are 13 item lines (maximum number of item lines is 200).

NUMBER_OF_SEED_TREES

Generic name in Finnish

SIEMENPUIDEN_MAARA

Functions

Parameter NUMBER_OF_SEED_TREES defines the guiding number of trees to be left for seeding in natural regeneration cuttings.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 24

Default values Example 1

Valid since MELA99

Legend

```
(1)-(24) Number of trees (per hectare) to be left for seeding in natural
         regeneration cuttings.

         Categories:
         • forest site type category: 8 (see the sample plot variable
          (13) of the initial data record)
         • tree species: 3 (pine, spruce, deciduous species)
```

Notes

1. The default values of parameter have been changed in MELA2002.

See also

Tree selection routine
EVENT_CALL arguments
Site type category variable

Examples

Example 1: A definition of the NUMBER_OF_SEED_TREES parameter.

```
NUMBER_OF_SEED_TREES

* Tree species:
* (1) pine
* (2) spruce
* (3) deciduous tree species

* (1)  (2)  (3)
* Forest site type category 1
  150  300   20
* Forest site type category 2
  150  300   20
* Forest site type category 3
  125  250   20
* Forest site type category 4
  100  200   20
* Forest site type category 5
   50  150   20
* Forest site type category 6
   50  150   10
* Forest site type category 7
   50  150   10
* Forest site type category 8
   50  150   10
```

The default values are derives from the Finnish recommendations for Southern Finland by the Forestry Development Centre Tapio (Hyvän metsänhoidon ... 2001).

OUTPUT

Generic name in Finnish

TULOSTUS

Functions

Parameter OUTPUT selects terminal printing and file generation options for simulation.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	10
Default values	1 0 2 0 0 0 0 0 0 0
Valid since	MELA96, changed in MELA2002

Legend

(1)	**Generation of management schedule (msc and msd type) files for the transfer of simulation information from MELASIM to MELAOPT.** **'0' generation of management schedule files disabled** **'1' generation of management schedule files enabled**
(2)	**Generation of forest level summary report files (sum type files) for printing and forest level summary data (msc and msd type) v files for further processing. The forest level summary report files are generated only when one management schedule is simulated for each management unit (for example, in re-simulation). In the re-simulation, the summary information comes from the management schedules selected in the MELAOPT solution in question, providing more information than the respective MELAOPT summary generated from the variables of management schedule (msc and msd type) files.** **'0' generation of forestry unit level summary information files disabled**

'1' generation of forestry unit level summary information files enabled

(3) Generation of a management schedule summary report to the terminal from all management schedules being simulated. The report is intended for monitoring both the simulation of optional management schedules and the re-simulation of the selected management schedules. The report is generated mainly from the management unit variables of the simulation record converted to per hectare form. Notice the large size of reports in larger simulation tasks.See example 2.

'0' generation of a management schedule summary report disabled
'1' generation of a minimal (one management schedule per line) report
'2' generation of a one sub-period per line report without repeated first lines
'3' generation of a one sub-period per line report with repeated first lines

(4) Generation of a simulation data report (the variables of simulation records) to the terminal. Notice the large size of reports in any simulation tasks.See example 3.

'0' generation of a simulation data report disabled
'1' generation of a simulation data report in the beginning of simulation (year 1)
'2' generation of a simulation data report by sub-periods, see the YEARS parameter
'3' generation of a simulation data report after each event

(5) Generation of a management unit level summary report file (sum type file) from all management schedules being simulated. The report is intended for monitoring the simulation of optional management schedules and the re-simulation of the selected management schedules. Notice the large size of reports in any simulation tasks.

'0' generation of management schedule level summary reports disabled
'1' generation of management schedule level summary reports enabled

(6) '0' reserved for system.

(7) '0' reserved for system.

(8) '0' reserved for system.

(9) Generation of simulation record (smr type) files for the transfer of simulation records from MELASIM to user programs or to another MELASIM application.

'0' generation of an smr type file disabled
'1' generation of an smr type file enabled, simulation records are stored once under control of the item (12) of the SIMULATION_CONTROL parameter, one management unit in each record
'1.2' generation of an smr type file enabled, simulation records are stored once under control of the item (12) of the SIMULATION_CONTROL parameter, one sample plot in each record

```
            '2' generation of an smr type file enabled, simulation records
            are stored by sub-periods defined by the YEARS parameter, one
            management unit in each record
            '2.2' generation of an smr type file enabled, simulation records
            are stored by sub-periods defined by the YEARS parameter, one
            sample plot in each record
            '3' generation of an smr type file enabled, simulation records
            are stored after each  event, one management unit in each record
            '3.2' generation of an smr type file enabled, simulation records
            are stored after each event, one sample plot in each record

  (10)      '0' reserved for system.
```

Notes

1. The large size of management schedule summary reports, simulation data reports and management unit level summary reports in larger simulation tasks.

2. The items (2), (7), (8) and (10) have been changed in MELA2002.

See also

MELA files
Simulation record files (**smr** type files)
Management schedule files (**msc** and **msd** type files)
Summary report files (**sum** type files)

Simulation record
Simulation instruction record

Decision data variables (MSD variables)

FOREST_REPORT parameter
MSD_VARIABLES parameter
MSR_VARIABLES parameter
RE_SIMULATION_INSTRUCTIONS parameter
SIMULATION_CONTROL parameter
YEARS parameter

Examples

Example 1: A definition of the OUTPUT parameter.

```
OUTPUT 0 0 3 0 0 0 0 0 0 0
```

Management schedule summary reports are directed to the terminal. No files for further processing of management schedules are generated. This kind of definition suits, for example, for preliminary simulation tests.

Example 2: A management schedule summary report.

```
* MELASIM session log (page 1/2) *

MELASIM > SIMULATE MS T3

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.. <>    2.0000 ..
 -----------------
.   M_unit  year    area        X   Y  nr  alt    TS  o u l s t t d d     dt   ft   st  n  clt dc   at   tt   pt   ct fbd   cat lc
 >>    2.0<<2001.   1.47 1.5 6896.598.  0.  80. 1143. 0.1.1.3.0.2.0.0.0.   0.   0.   0. 0.   0. 7.   0.   0.   0.   0.  9.   1. 0.
 -----------------
 >>>>    1<<  372>   (1.000)    34815.    18251.    12906.    10271.     8650.
. row  year     cat  dc     ns sp    ba   vol psbo value age     D    H   fel psbo cut  cl s a c t p d f  mort ivol ival    revs  costs
    1> 2001    1.00  7 0   845. 3. 25.0 234.7 3070  7937. 38. 21.0 20.0 118.1 8020 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  362.   3534.  1121.
    2> 2011    1.00  8 0   332. 3. 16.3 192.6 00X0  8035. 50. 26.2 26.1 223.4 00X0 2.030 0.1.1.0.0.0.0.0. 0.00  0.0  170.   9737.  2321.
    3> 2021    1.00  3 0  2500. 1.  0.0   0.0          0.  4.  0.0  0.8   0.2 X000 0.000 0.0.0.0.1.0.0.0. 0.00  0.0   52.      0.    56.
    4> 2031    1.00  5 0  2341. 1.  7.2  30.4 X000   531. 14.  7.5  7.3   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  274.      0.     0.
    5> 2041    1.00  6 0  4241. 1. 21.6 136.8 X000  3310. 24. 12.3 12.2  72.9 X000 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  347.   1859.  1022.
    6> 2051    1.00  7 0  3099. 1. 23.8 186.3 X000  4968. 34. 16.0 16.4 253.1 X000 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  456.   8963.  2403.
    7> 2096    1.00  8 0   368. 1. 24.8 301.0 X000 16574. 78. 30.2 29.9   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0    0.      0.     0.

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 >>>>   82<<  565>   (1.000)    31752.    13233.     6906.     3915.     2288.
. row  year     cat  dc     ns sp    ba   vol psbo value age     D    H   fel psbo cut  cl s a c t p d f  mort ivol ival    revs  costs
  568> 2001    1.00  7 0   845. 3. 25.0 234.7 3070  7937. 38. 21.0 20.0   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  416.      0.     0.
  569> 2011    1.00  7 0   827. 3. 30.1 324.1 3070 12109. 48. 23.2 23.3   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  430.      0.     0.
  570> 2021    1.00  7 0   808. 3. 34.7 408.0 3070 16425. 58. 25.1 26.0   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  380.      0.     0.
  571> 2031    1.00  8 0   774. 3. 37.7 471.7 3070 20309. 68. 26.8 28.3   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  287.      0.     0.
  572> 2041    1.00  8 0   733. 3. 39.5 517.0 3070 23282. 78. 28.2 30.2   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  229.      0.     0.
  573> 2051    1.00  8 0   694. 3. 40.8 550.3 3070 25662. 88. 29.5 31.9   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  115.      0.     0.
  574> 2056    1.00  8 0   675. 3. 41.2 563.5 4060 26274. 93. 30.1 32.7   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0    0.      0.     0.
.. <*>     2       2.000    82 1.000 <*>

* <clip> ... Part of the file was cut out ... <clip>

.. <>   38.0000 ..
 -----------------
.   M_unit  year    area        X   Y  nr  alt    TS  o u l s t t d d     dt   ft   st  n  clt dc   at   tt   pt   ct fbd   cat lc
 >>   38.0<<2001.   0.89 0.9 6896.598.  0.  80. 1143. 0.1.1.4.0.3.0.0.0.   0.   0.   0. 0.   0. 7.   0.   0.   0.   0.  9.   1. 0.
 -----------------
 >>>>    1<< 1009>   (1.000)    19104.    11594.     8662.     6923.     5723.
. row  year     cat  dc     ns sp    ba   vol psbo value age     D    H   fel psbo cut  cl s a c t p d f  mort ivol ival    revs  costs
    1> 2001    1.00  7 0   411. 1. 21.0 216.9 9100  9655. 89. 26.9 22.6  52.1 6400 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  357.   2226.   443.
    2> 2011    1.00  8 0   301. 1. 19.6 213.7 X000 10997.100. 29.7 24.7 130.4 X000 5.028 1.1.0.0.0.0.0.0. 0.00  0.0  250.   6273.   986.
    3> 2021    1.00  8 0  1556. 1. 10.0 115.8 X000  7222.110. 35.9 27.3 125.2 X000 4.025 0.0.0.0.1.0.0.0. 0.00  0.0  104.   8263.   718.
    4> 2031    1.00  5 0  1900. 1.  1.0   3.1 X000     0. 10.  4.1  4.1   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  116.      0.     0.
    5> 2041    1.00  6 0  2157. 1. 11.5  54.2 X000  1165. 19. 10.4  8.6   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  258.      0.     0.
    6> 2051    1.00  6 0  3268. 1. 23.5 146.7 X000  3756. 29. 14.2 12.4 262.7 X000 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  320.   8007.  3167.
    7> 2091    1.00  8 0   550. 1. 20.3 198.1 X000  8549. 69. 27.1 23.6   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0    0.      0.     0.

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```

```
* MELASIM session log (page 2/2) *

>>>>   23<<  148>   (1.000)    18653.    11636.     9127.     7724.     6782.
. row  year     cat  dc     ns sp    ba   vol psbo value age     D    H   fel psbo cut  cl s a c t p d f  mort ivol ival    revs  costs
  155> 2001    1.00  7 0   411. 1. 21.0 216.9 9100  9655. 89. 26.9 22.6 154.7 9100 5.028 1.1.0.0.0.0.0.0. 0.00  0.0  264.   6656.  1220.
  156> 2011    1.00  2 0  2034. 1.  8.7  97.7 X000  5645.  1.  0.0  0.7 108.2 X000 4.025 0.0.0.0.1.0.0.0. 0.00  0.0  106.   6710.   677.
  157> 2021    1.00  5 0  1887. 1.  1.7   5.1 X000     0. 10.  6.0  4.7   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  109.      0.     0.
  158> 2031    1.00  6 0  2673. 1. 13.6  58.4 X000  1094. 20. 11.2  7.7   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  285.      0.     0.
  159> 2041    1.00  6 0  2653. 1. 26.0 148.4 X000  3949. 30. 14.9 11.1  95.2 X000 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  309.   2653.  1199.
  160> 2051    1.00  7 0  1216. 1. 20.8 142.7 X000  4387. 40. 18.4 14.1 139.6 X000 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  319.   4815.  1533.
  161> 2081    1.00  8 0   356. 1. 20.1 197.1 X000  9132. 70. 28.4 21.4   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0    0.      0.     0.

* <clip> ... Part of the file was cut out ... <clip>

 >>>>   49<<  332>   (1.000)    19997.    11318.     7686.     5535.     4103.
. row  year     cat  dc     ns sp    ba   vol psbo value age     D    H   fel psbo cut  cl s a c t p d f  mort ivol ival    revs  costs
  337> 2001    1.00  7 0   411. 1. 21.0 216.9 9100  9655. 89. 26.9 22.6   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  366.      0.     0.
  338> 2011    1.00  8 0   410. 1. 24.7 268.0 9100 13319. 99. 29.0 24.3   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  384.      0.     0.
  339> 2021    1.00  8 0   409. 1. 28.1 317.5 9100 17163.109. 30.8 25.9 222.3 9100 5.028 1.1.0.0.0.0.0.0. 0.00  0.0  284.  11510.  1531.
  340> 2031    1.00  8 0   764. 1. 10.7 127.8 X000  8498.120. 37.0 28.9 136.5 X000 4.025 0.0.0.0.1.0.0.0. 0.00  0.0   51.   9005.   735.
  341> 2041    1.00  5 0  1900. 1.  0.5   1.5 X000     0.  9.  2.5  3.2   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0   89.      0.     0.
  342> 2051    1.00  6 0  2074. 1. 10.2  45.1 X000   898. 19.  8.9  7.9 275.1 X000 1.020 0.0.0.0.0.0.0.0. 0.00  0.0  319.   8248.  3074.
  343> 2106    1.00  8 0   475. 1. 22.1 223.4 X000 10221. 74. 27.5 23.9   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0    0.      0.     0.

* <clip> ... Part of the file was cut out ... <clip>

 >>>>   60<<  411>   (1.000)    18459.     8625.     4736.     2716.     1586.
. row  year     cat  dc     ns sp    ba   vol psbo value age     D    H   fel psbo cut  cl s a c t p d f  mort ivol ival    revs  costs
  414> 2001    1.00  7 0   411. 1. 21.0 216.9 9100  9655. 89. 26.9 22.6   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  366.      0.     0.
  415> 2011    1.00  8 0   410. 1. 24.7 268.0 9100 13319. 99. 29.0 24.3   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  384.      0.     0.
  416> 2021    1.00  8 0   409. 1. 28.1 317.5 9100 17163.109. 30.8 25.9   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  395.      0.     0.
  417> 2031    1.00  8 0   408. 1. 31.2 364.7 9100 21119.119. 32.3 27.4   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  328.      0.     0.
  418> 2041    1.00  8 0   408. 1. 34.1 409.4 9100 24399.129. 33.7 28.8   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  310.      0.     0.
  419> 2051    1.00  8 0   407. 1. 36.8 451.7 9100 27499.139. 35.0 30.1   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0  249.      0.     0.
  420> 2056    1.00  8 0   406. 1. 38.0 471.9 9100 28744.144. 35.5 30.7   0.0      0.000 0.0.0.0.0.0.0.0. 0.00  0.0    0.      0.     0.
.. <*>    38      38.000    60 1.000 <*>
.. Simulation summary:
.. <*> CALCULATION UNITS         38
.. <*> MANAGEMENT SCHEDULES    1779
 ================================================================================
.. <MELASIM> end of command: MS T3

MELASIM>
```

Interpretation of the management schedule summary report

The summary report for the monitoring of the generation of the management schedules consists of three parts for each management schedule:

- an identification of the management unit and a selection of management unit variables (see Simulation Record variables),
- a row for the identification of the management schedule, it's proportion (in the solution) and the net present values for the management schedule by the given discount rates see DISCOUNT_RATES parameter), and
- a row for each sub-period with a selection of variables from the simulation and decision data records describing the state of the growing stock in the beginning of the sub-period and the events during the sub-period.

state in the beginning of sub-period

row	line number
year	year
cat	forest management category
dc	development class
ns	number of trees/ha
sp	dominant tree species
ba	basal area, m^2/ha
vol	volume, m^3/ha
psbo	proportion of pine, spruce, birch and other deciduous sp.
value	value, €/ha
age	mean stand age, a
D	mean stand diameter, cm
H	mean stand height, m

events during sub-period

fel	cutting drain, m^3/ha/a
psbo	proportion of pine, spruce, birch and other deciduous sp.
cut	cutting method
cl	clearing – 0 (no) / 1 (yes)
s	soil surface preparation – 0/1
a	artificial regeneration – 0/1
c	supplementary planting – 0/1
t	tending of young stands – 0/1
p	pruning – 0/1
d	drainage – 0/1
f	fertilization – 0/1
mort	mortality, m3/ha/a
ivol	increment, m3/ha/a
ival	value increment, €/ha/a
revs	gross income, €/ha/a
costs	costs, €/ha/a

Notice, however, that the event variables on the second last row represent the development of the growing stock after the calculation period until the simulation period. The last row shows the final state of the growing stock at the end of the simulation. No events are simulated after that.

NOTE: The compact 132 character lines of the management schedule summary report should never be broken on several lines while displaying or printing them.

Example 3: A simulation data (sample plot and sample tree) report.

```
* MELASIM session log (page 1/2) *

MELASIM > SIMULATE MS T3

* <clip> ... Part of the file was cut out ... <clip>

>>
    7<<
     7.0 2001.0    2.2    2.2 6895.9  597.8    0.0   80.0   1143.0    0.00
       1.0    1.0    3.0    0.0    2.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    8.0    0.0    0.0    0.0    0.0    9.0    1.00
     390.3    2.0   78.8  260.4   24.0   30.7   23.6  179.1  12184.9  259.04
       0.0    0.0    0.0    0.0    0.0   22.5   25.6   23.4    0.0    0.00
       3.0   20.0    1.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0 2001.0    0.0   31.0  218.8   10.6    0.0  260.38
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       7.0 2001.0    2.2    2.2    0.0    0.0    0.0   80.0   1143.0    0.00
       1.0    1.0    3.0    0.0    2.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    8.0    0.0    0.0    0.0    0.0    9.0    1.00
     390.3    2.0   78.8  260.4   24.0   30.7   23.6  179.1  12184.9  259.04
       0.0    0.0    0.0    0.0    0.0   22.5   25.6   23.4    0.0    0.00
       3.0   20.0    1.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0   46.0    0.0    0.0    0.0   31.0  218.8   10.6    0.0  260.38
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       7.0 2001.0    2.2    2.2    0.0    0.0    0.0   80.0   1143.0    0.00
       1.0    1.0    3.0    0.0    2.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    1.0    0.0    0.0    0.0    0.0    9.0    1.00
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       3.0   20.0    1.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
         1
     7.0 2001.0    2.2    2.2 6895.9  597.8   75.0   80.0   1143.0    0.00
       1.0    1.0    3.0    0.0    2.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    8.0    0.0    0.0    0.0    0.0    9.0    1.00
     390.3    2.0   78.8  260.4   24.0   30.7   23.6  179.1  12184.9  259.04
       0.0    0.0    0.0    0.0    0.0   22.5   25.6   23.4    0.0    0.00
       3.0   20.0    1.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0 2001.0    0.0   31.0  218.8   10.6    0.0  260.38
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
     7.0 2001.0    2.2    2.2 6895.9  597.8   75.0   80.0   1143.0    0.00
       1.0    1.0    3.0    0.0    2.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0    0.0    8.0    0.0    0.0    0.0    0.0    9.0    1.00
     390.3    2.0   78.8  260.4   24.0   30.7   23.6  179.1  12184.9  259.04
       0.0    0.0    0.0    0.0    0.0   22.5   25.6   23.4    0.0    0.00
       3.0   20.0    1.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
       0.0    0.0   46.0    0.0    0.0    0.0   31.0  218.8   10.6    0.0  260.38
       0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.00
```

```
* MELASIM session log (page 2/2) *

     7.0 2001.0    2.2    2.2 6895.9  597.8   75.0   80.0   1143.0   0.00
      1.0    1.0    3.0    0.0    2.0    0.0    0.0    0.0      0.0   0.00
      0.0    0.0    0.0    1.0    0.0    0.0    0.0    0.0      9.0   1.00
      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0      0.0   0.00
      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0      0.0   0.00
      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0      0.0   0.00
      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0      0.0   0.00
      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0      0.0   0.00
      0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0      0.0   0.00
. tree  n sp   d    h    ba             vol age  sl   pw  value                                id   ih     if
   1    0. 3 14.6 17.9 0.017  72 0.14 0.140  80 0.00 0.13   3.7   0.6  1  0  0 1.0 0 0.13  0.0 0.00    0.0 301.   0.   0.00  0.00
   2    0. 3 16.9 19.4 0.022  72 0.20 0.203  80 0.00 0.20   5.5   0.5  1  0  0 1.0 0 0.20  0.0 0.00    0.0 302.   0.   0.00  0.00
   3    1. 3 19.2 20.6 0.029  72 0.28 0.278  80 0.00 0.27   7.6   0.4  1  0  0 1.0 0 0.27  0.0 0.00    0.0 303.   0.   0.00  0.00
   4    2. 3 21.5 21.7 0.036  72 0.36 0.364  80 0.13 0.23  11.8   0.4  1  0  0 1.0 0 0.36  0.0 0.00    0.0 304.   0.   0.00  0.00
   5    3. 3 23.8 22.6 0.044  72 0.46 0.460  80 0.22 0.23  17.5   0.4  1  0  0 1.0 0 0.46  0.0 0.00    0.0 305.   0.   0.00  0.00
   6    4. 3 26.1 23.4 0.053  72 0.56 0.565  80 0.30 0.26  24.5   0.3  1  0  0 1.0 0 0.56  0.0 0.00    0.0 306.   0.   0.00  0.00
   7    4. 3 28.4 24.1 0.063  72 0.68 0.678  80 0.37 0.30  31.6   0.3  1  0  0 1.0 0 0.67  0.0 0.00    0.0 307.   0.   0.00  0.00
   8    3. 3 30.7 24.7 0.074  72 0.80 0.798  80 0.45 0.34  38.4   0.4  1  0  0 1.0 0 0.79  0.0 0.00    0.0 308.   0.   0.00  0.00
   9    1. 3 33.0 25.2 0.086  72 0.92 0.923  80 0.51 0.41  45.4   0.4  1  0  0 1.0 0 0.92  0.0 0.00    0.0 309.   0.   0.00  0.00
  10    1. 3 35.3 25.7 0.098  72 1.05 1.051  80 0.58 0.47  52.1   0.4  1  0  0 1.0 0 1.05  0.0 0.00    0.0 310.   0.   0.00  0.00
  11   42. 2 17.4 17.1 0.024  67 0.21 0.210  80 0.00 0.21   6.7   0.5  1  0  0 1.0 0 0.21  0.0 0.00    0.0 201.   0.   0.00  0.00
  12   73. 2 21.2 19.7 0.035  67 0.35 0.353  80 0.15 0.20  12.5   0.3  1  0  0 1.0 0 0.35  0.0 0.00    0.0 202.   0.   0.00  0.00
  13   71. 2 25.1 21.8 0.049  67 0.53 0.529  80 0.33 0.20  21.3   0.2  1  0  0 1.0 0 0.53  0.0 0.00    0.0 203.   0.   0.00  0.00
  14   56. 2 28.9 23.6 0.065  67 0.73 0.734  80 0.56 0.17  33.4   0.1  1  0  0 1.0 0 0.73  0.0 0.00    0.0 204.   0.   0.00  0.00
  15   38. 2 32.7 25.0 0.084  67 0.96 0.961  80 0.76 0.20  47.1   0.1  1  0  0 1.0 0 0.96  0.0 0.00    0.0 205.   0.   0.00  0.00
  16   23. 2 36.5 26.1 0.105  67 1.21 1.206  80 1.03 0.18  65.2   0.1  1  0  0 1.0 0 1.20  0.0 0.00    0.0 206.   0.   0.00  0.00
  17   13. 2 40.3 27.0 0.128  67 1.46 1.463  80 1.25 0.21  81.3   0.1  1  0  0 1.0 0 1.46  0.0 0.00    0.0 207.   0.   0.00  0.00
  18    7. 2 44.1 27.7 0.153  67 1.73 1.727  80 1.46 0.26  98.1   0.1  1  0  0 1.0 0 1.72  0.0 0.00    0.0 208.   0.   0.00  0.00
  19    3. 2 47.9 28.3 0.180  67 2.00 1.997  80 1.67 0.33 117.7   0.1  1  0  0 1.0 0 1.99  0.0 0.00    0.0 209.   0.   0.00  0.00
  20    2. 2 51.7 28.7 0.210  67 2.27 2.268  80 1.85 0.41 132.6   0.1  1  0  0 1.0 0 2.27  0.0 0.00    0.0 210.   0.   0.00  0.00
  21    0. 1 15.8 17.5 0.019  62 0.17 0.170  70 0.00 0.17   4.4   0.5  1  0  0 1.0 0 0.17  0.0 0.00    0.0 101.   0.   0.00  0.00
  22    0. 1 18.1 18.9 0.026  62 0.24 0.238  70 0.07 0.16   7.1   0.4  1  0  0 1.0 0 0.23  0.0 0.00    0.0 102.   0.   0.00  0.00
  23    2. 1 20.5 20.0 0.033  62 0.32 0.317  70 0.15 0.16  10.7   0.4  1  0  0 1.0 0 0.31  0.0 0.00    0.0 103.   0.   0.00  0.00
  24    4. 1 22.9 21.0 0.041  62 0.41 0.407  70 0.21 0.19  14.8   0.3  1  0  0 1.0 0 0.40  0.0 0.00    0.0 104.   0.   0.00  0.00
  25    7. 1 25.3 21.8 0.050  62 0.51 0.508  70 0.33 0.17  20.9   0.3  1  0  0 1.0 0 0.50  0.0 0.00    0.0 105.   0.   0.00  0.00
  26   10. 1 27.7 22.5 0.060  62 0.62 0.620  70 0.42 0.20  28.1   0.3  1  0  0 1.0 0 0.62  0.0 0.00    0.0 106.   0.   0.00  0.00
  27   10. 1 30.1 23.0 0.071  62 0.74 0.742  70 0.51 0.23  37.1   0.2  1  0  0 1.0 0 0.74  0.0 0.00    0.0 107.   0.   0.00  0.00
  28    7. 1 32.5 23.5 0.083  62 0.88 0.875  70 0.61 0.26  45.4   0.2  1  0  0 1.0 0 0.87  0.0 0.00    0.0 108.   0.   0.00  0.00
  29    4. 1 34.9 23.9 0.096  62 1.02 1.019  70 0.72 0.29  55.0   0.2  1  0  0 1.0 0 1.02  0.0 0.00    0.0 109.   0.   0.00  0.00
  30    1. 1 37.3 24.3 0.109  62 1.17 1.173  70 0.88 0.29  70.4   0.2  1  0  0 1.0 0 1.17  0.0 0.00    0.0 110.   0.   0.00  0.00
 -----

* <clip> ... Part of the file was cut out ... <clip>
```

The variables in the simulation data report refer to the structure of the simulation record.

NOTE: The length of the simulation data (sample plot and tree) is tens or hundreds of rows for each individual state of each management schedule.

PRINT_INPUT_LINES

Generic name in Finnish

SYOTTORIVIEN_TULOSTUS

Functions

Parameter PRINT_INPUT_LINES controls the display of input lines on the terminal making it possible to monitor the input lines included from command files.

Origin System parameter

Program **MELASIM, MELAOPT**

Type Numerical

Number of items 1

Default values 0

Valid since MELA96

Legend

```
(1)     Display of input lines on the terminal.

        '0' display of input lines disabled
        '1' display of input lines enabled
```

Examples

Example 1: A definition of the PRINT_INPUT_LINES parameter.

```
PRINT_INPUT_LINES 1
```

The display of the input lines to the terminal is enabled.

RE_SIMULATION_INSTRUCTIONS

Generic name in Finnish

TOISTO_OHJE

Functions

Parameter RE_SIMULATION_INSTRUCTIONS controls in MELASIM the storing of re-simulation instructions in **msc** and **msd** type files. Re-simulation instructions are required later on for the re-simulation of the selected management schedules on the basis of MELAOPT solutions.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	1
Default values	1
Valid since	MELA96

Legend

```
(1)     Storing of re-simulation instructions.

        '0' storing of re-simulation instructions disabled
        '1' storing of re-simulation instructions enabled
```

See also

Program MELASIM
Management schedule files (**msc** and **msd** type files)

Examples

Example 1: A definition of the RE_SIMULATION_INSTRUCTION parameter.

```
RE_SIMULATION_INSTRUCTIONS 0
```

Re-simulation instructions will not be stored in **msc** and **msd** type files. The re-simulation of management schedules after MELAOPT solutions and consecutive reports will be disabled.

ROADSIDE_LOG_PRICE_ADJUSTMENT

Generic name in Finnish

TIENVARSIHINNAN_JAREYSKORJAUS

Functions

Parameter ROADSIDE_LOG_PRICE_ADJUSTMENT adjusts the average saw log price at the roadside on the basis of stem size. Primarily, the parameter controls the use of the default adjustment coefficients. Adjustment coefficients other than the defaults can also be provided. The average saw log prices are defined by the ROADSIDE_PRICES parameter.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	1 or 421
Default values	Example 2
Valid since	MELA96

Legend

```
(1)     Adjustment of the average saw log price at the roadside.

        '0' saw log price adjustment disabled
        '1' saw log price adjustment enabled. In absence of the items
        (2) - (421), default coefficients are applied

(2) - (421) Adjustment coefficients for average saw log prices at the
        roadside.

        Categories:
        • tree species: 3 (pine, spruce, birch)
        • diameter classes: 14 (19, 21, 23, ..., 43, 45 cm)
        • height classes: 10 (11, 13, 15, ..., 27, 29 m)
```

Notes

1. The default values of the parameter origin from the 1970's (Laasasenaho & Sevola 1971)

See also

ROADSIDE_PRICES parameter

Examples

Example 1: A definition of the ROADSIDE_LOG_PRICE_ADJUSTMENT parameter.

```
ROADSIDE_LOG_PRICE_ADJUSTMENT 0
```

Saw log price adjustment is disabled.

Example 2: A definition of the ROADSIDE_LOG_PRICE_ADJUSTMENT parameter.

```
ROADSIDE_LOG_PRICE_ADJUSTMENT 1

* Adjustment coefficients for pine, spruce and birch
* Mean height (m)
*  11   13   15   17   19   21   23   25   27   29
*
* PINE, diameter classes 19, 21, 23, ..., 43, 45 cm
*   Diameter class 19 cm
 0.70 0.77 0.80 0.80 0.80 0.79 0.82 0.85 0.90 0.95
 0.73 0.82 0.86 0.87 0.87 0.87 0.90 0.94 1.00 1.06
 0.75 0.86 0.91 0.93 0.94 0.95 0.98 1.03 1.08 1.15
 0.78 0.89 0.96 0.99 1.01 1.02 1.06 1.11 1.17 1.24
 0.80 0.93 1.00 1.04 1.07 1.08 1.13 1.18 1.24 1.32
 0.82 0.96 1.04 1.09 1.12 1.14 1.19 1.24 1.31 1.39
 0.84 0.99 1.08 1.13 1.17 1.20 1.25 1.31 1.38 1.46
 0.86 1.02 1.11 1.18 1.22 1.25 1.30 1.36 1.44 1.53
 0.89 1.04 1.15 1.21 1.26 1.30 1.35 1.42 1.50 1.59
 0.91 1.07 1.18 1.25 1.30 1.34 1.40 1.47 1.55 1.64
 0.93 1.09 1.21 1.28 1.34 1.39 1.44 1.52 1.60 1.70
 0.96 1.12 1.23 1.32 1.38 1.43 1.49 1.56 1.65 1.75
 0.98 1.15 1.26 1.35 1.41 1.46 1.53 1.60 1.69 1.80
*   Diameter class 45 cm
 1.01 1.17 1.29 1.38 1.44 1.50 1.56 1.64 1.74 1.84
*
* SPRUCE, diameter classes 19, 21, 23, ..., 43, 45 cm
*   Diameter class 19 cm
 0.59 0.73 0.83 0.88 0.92 0.94 0.97 1.04 1.13 1.23
 0.59 0.75 0.85 0.92 0.96 0.99 1.02 1.06 1.15 1.25
 0.60 0.75 0.87 0.95 1.00 1.04 1.07 1.11 1.20 1.30
 0.60 0.75 0.88 0.97 1.03 1.07 1.11 1.14 1.20 1.30
```

```
 0.61 0.76 0.88 0.98 1.05 1.10 1.14 1.18 1.23 1.32
 0.63 0.76 0.88 0.99 1.06 1.12 1.17 1.21 1.25 1.32
 0.65 0.77 0.89 0.99 1.07 1.14 1.19 1.24 1.28 1.33
 0.67 0.79 0.89 0.99 1.08 1.15 1.21 1.26 1.31 1.37
 0.68 0.81 0.90 1.00 1.09 1.16 1.23 1.28 1.34 1.40
 0.68 0.84 0.92 1.00 1.09 1.17 1.24 1.30 1.36 1.42
 0.69 0.85 0.94 1.01 1.09 1.18 1.25 1.32 1.38 1.45
 0.70 0.85 0.96 1.03 1.10 1.18 1.26 1.33 1.40 1.47
 0.72 0.86 0.98 1.05 1.11 1.19 1.27 1.35 1.42 1.49
*   Diameter class 45 cm
 0.74 0.86 0.99 1.07 1.13 1.20 1.28 1.36 1.44 1.51
*
* BIRCH, diameter classes 19, 21, 23, ..., 43, 45 cm
*   Diameter class 19 cm
 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51
 0.51 0.51 0.51 0.89 0.87 0.88 0.84 0.82 0.91 0.87
 0.52 0.94 0.95 0.96 0.95 0.91 1.04 1.04 1.04 1.03
 1.01 1.01 1.02 0.99 0.98 1.14 1.14 1.15 1.15 1.15
 1.05 1.05 1.07 1.05 1.21 1.19 1.21 1.20 1.24 1.24
 1.12 1.08 1.10 1.08 1.27 1.27 1.26 1.30 1.31 1.29
 1.15 1.14 1.12 1.30 1.31 1.32 1.32 1.34 1.34 1.35
 1.18 1.16 1.17 1.33 1.34 1.35 1.34 1.39 1.40 1.38
 1.21 1.21 1.19 1.38 1.39 1.38 1.42 1.41 1.42 1.43
 1.26 1.23 1.41 1.42 1.41 1.42 1.44 1.45 1.44 1.45
 1.28 1.25 1.43 1.44 1.44 1.43 1.46 1.46 1.47 1.47
 1.31 1.28 1.47 1.47 1.47 1.46 1.48 1.48 1.47 1.48
 1.33 1.30 1.48 1.48 1.48 1.50 1.50 1.50 1.49 1.49
*   Diameter class 45 cm
 1.35 1.31 1.49 1.49 1.49 1.50 1.51 1.50 1.51 1.50
```

The saw log price adjustment is enabled. A stem with diameter 25 cm and height 18 m has the adjustment coefficient 1.00 (Laasasenaho & Sevola 1971).

ROADSIDE_PRICES

Generic name in Finnish

TIENVARSIHINNAT

Functions

Parameter ROADSIDE_PRICES defines timber prices at the roadside by tree species and timber assortments. The parameter is provided by the sub-periods corresponding to the YEARS parameter. The number of the given sub-periods can be 1 to 9. If the first given sub-period is 'k', the default values are used for the sub-periods 1 to k-1 and for the sub-periods beyond the k, the values of the k are used until the next given sub-period.

The roadside prices of timber and the costs of logging and silvicultural operations play a key role in the calculation of net revenues and net present values. They also determine the preference and priority of management operations in the analysis from the economic point of view. The consistency of prices and costs is of great importance, besides the price level.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 17 for each given sub-period, the maximum number of sub-periods is 9 and the maximum number of given items 153

Default values Example 1

Valid since MELA96, changed in MELA2007

Legend

```
(1)     The ordinal number of the sub-period.

(2) - (17) Roadside prices (€/m3).

        Categories:
        • timber assortment types: 2 (saw timber, pulpwood)
```

```
          • tree species: 8
```

Notes

1. By default, roadside prices for saw logs are adjusted according to the default coefficients in the ROADSIDE_LOG_PRICE_ADJUSTMENT parameter.

2. The default values of the parameter have been changed in MELA2007.

See also

LOGGING_COSTS parameter
ROADSIDE_LOG_PRICE_ADJUSTMENT parameter
SILVICULTURAL COSTS parameter
STUMPAGE PRICES parameter
YEARS parameter

Income/revenues/returns variable
Costs variable
Net present value variable
Tree species variable

Examples

Example 1: A definition of the ROADSIDE_PRICES parameter.

```
ROADSIDE_PRICES
 1
*saw log prices by tree species
 51.25 48.15 49.35 49.35 27.30 27.30 26.80 27.30
*pulpwood prices by tree species
 26.80 33.25 27.30 27.30 27.30 27.30 26.80 27.30
 5
 56.55 53.20 54.45 54.45 27.15 27.15 27.50 27.15
 27.50 35.70 27.15 27.15 27.15 27.15 27.50 27.15
```

For the sub-periods 1−4 the values of the given sub-period 1 are used, and for the 5th and the subsequent sub-periods the values of sub-period 5 are applied.
The values of the 1st sub-period are the default values of the MELA2009 calculated as arithmetic means of the actual Finnish delivery prices realised during the years 1997−2006 (Metinfo 2007) deflated to the year 2006.

SILVICULTURAL_COSTS

Generic name in Finnish

METSANHOITOKUSTANNUKSET

Functions

Parameter SILVICULTURAL_COSTS defines the costs of silvicultural operations. The parameter is provided by the sub-periods corresponding to the YEARS parameter. The number of the given sub-periods can be 1 to 9. If the first given sub-period is 'k', the default values are used for the sub-periods 1 to k-1 and for the sub-periods beyond the k, the values of the k are used until the next given sub-period.

The costs of silvicultural and logging operations are used together with the roadside and/or stumpage prices to calculate net revenues and to determine the preference and priority of management operations in the analysis from the economic point of view. The consistency of prices and costs is of great importance, besides the cost level.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 20 for each given sub-period, the maximum number of sub-periods is 9 and the maximum number of given items 180

Default values Example 1

Valid since MELA96, changed in MELA99, changed in MELA2002, changed in MELA2007

Legend

```
(1)  The ordinal number of the sub-period
(2)  Cost of clearing of regeneration area, €/hectare.
(3)  Cost of harrowing and scarification for mineral soils, €/hectare.
(4)  Cost of ploughing and mounding for peatlands, wet mineral soils,
     €/hectare.
(5)  Cost of seeds, €/hectare.
(6)  Purchase price of a pine seedling, €/seedling.
(7)  Purchase price of a spruce seedling, €/seedling.
(8)  Purchase price of a birch seedling, €/seedling.
```

```
(9)  Purchase price of a pine seedling for supplementary planting,
     €/seedling.
(10) Purchase price of a spruce seedling for supplementary planting,
     €/seedling.
(11) Purchase price of a birch seedling for supplementary planting,
     €/seedling.
(12) Cost of prevention of grass, €/hectare.
(13) '0' reserved for system.
(14) Cost of pruning, €/stem.
(15) Cost of fertilization, €/hectare.
(16) Cost of forest drainage, €/hectare.
(17) Cost of ditch cleaning, €/100 meters.
(18) Cost of supplementary drainage, €/100 meters.
(19) Unit cost of silvicultural work, €/hour.
(20) Unit cost of felling work, €/hour.
```

Notes

1. The item 2 (cost of clearing of regeneration area) is used only for calculating the stumpage price value of the growing stock (see Value variable). Otherwise, the costs of the clearing of regeneration area and the costs of the tending of seedling stands are calculated by unit cost of felling work (item 20) and time expenditures (Metsäpalkkarakenteen ... 1995). The costs of other silvicultural works are calcalated by unit cost of silvicultural work (item 19) and time expenditures.

2. The default values of the parameter have been changed in MELA2007.

See also

LOGGING_COSTS parameter
ROADSIDE_PRICES parameter
STUMPAGE_PRICES parameter
YEARS parameter

Income/revenues/returns variable
Costs variable
Net present value variable
Value variable
Decision data variables (MSD variables)

Examples

Example 1: A definition of the SILVICULTURAL_COSTS parameter.

```
SILVICULTURAL_COSTS
 1
 72.00 149.85 221.70 220.00 0.15 0.18 0.25 0.15 0.23 0.30
 151.65 0.00 0.90 199.75 114.60 40.00 40.00 18.50 24.75
 5
 82.80 165.85 254.85 220.00 0.15 0.18 0.25 0.15 0.23 0.30
 151.65 0.00 0.90 209.75 120.35 42.00 42.00 20.10 25.00
```

For the sub-periods 1−4 the values of the given sub-period 1 are used, and for the 5th and the subsequent sub-periods the values of sub-period 5 are applied.
The values of the 1st sub-period are the default values of the MELA2009 calculated as arithmetic means of the actual Finnish silvicultural costs realised during the years 1997−2006 (Metinfo 2007) deflated to the year 2006.

SIMULATION_CONTROL

Generic name in Finnish

SIMULOINNIN_OHJAUS

Functions

Parameter SIMULATION_CONTROL provides a collection of items for the control of the simulation process.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	17
Default values	Example 1
Valid since	MELA96, changed MELA2002

Legend

```
(1)     Relative year when the generation of alternative management
        schedules is finished in the simulation. The value '0' refers to
        the end of the calculation period. Where required, the
        simulation of each management schedule is continued until the
        end of the calculation period by automatically selecting the
        first feasible event for each new state. In the same way, the
        simulation of each management schedule is continued after the
        calculation period until the end of the on-going rotation period
        for the calculation of the net present values. The unconditional
        finish of the simulation is provided by the item (15), which
        cannot have higher value than relative year 151.

(2)     Maximum number of event definitions.

(3)     '0' reserved for system.

(4)     '0' reserved for system.
(5)     '1000' reserved for system.
```

```
(6)     '0' reserved for system.

(7)     '1' reserved for system.

(8)     Maximum number of management schedules for each management unit.
        Notice that one management schedule only with natural processes
        is simulated in addition to the maximum number of management
        schedules.

(9)     '0' reserved for system.

(10)    '0' reserved for system.

(11)    Maximum number of sample plots for each management unit. '0'
        refers to all sample plots. The number of sample plots should
        not exceed 50-100, depending on the data in question. The
        additional sample plots will generate automatically extra
        management units with potential confusions later on.

(12)    Relative year for storing simulation records into simulation
        record (smr type) files if the item (9) of the OUTPUT parameter
        has value '1' or '1.2'. The value '0' of the item (12) refers to
        the end of the calculation period.

(13)    '0' reserved for system.

(14)    '0' reserved for system.

(15)    Relative year to always finish the simulation of management
        schedules. The simulation for the calculation of net present
        values after the calculation period is also finished even though
        the regeneration criterion is not met yet. If the net present
        value is not calculated, the item (15) should have the value '0'
        that refers to the end of the calculation period. See also the
        item (1) of the SIMULATION_CONTROL parameter, which cannot have
        higher value than relative year 151.

(16)    Calculation of land values. Specific input data are required.
        See the LAND_VALUES parameter and the item (17) of the
        SIMULATION_CONTROL parameter.

        '0' conventional simulation
        '1' calculation of land values with specific input data

(17)    Simulation mode.

       '-1' calculation of land values
          - variable length calculation period controlled by the
          regeneration criterion and the item (15) of SIMULATION_CONTROL
          - land values are calculated from simulation results
       '0' conventional simulation
          - fixed length calculation period controlled by the YEARS
          parameter and the item (15) of SIMULATION_CONTROL
          - user-supplied land values are used, see the LAND_VALUES
          parameter
       '1' stand level optimisation
          - variable length calculation period controlled by the
          regeneration criterion and the item (15) of SIMULATION_CONTROL
          - user-supplied land values are used, see the LAND_VALUES
          parameter
```

Notes

1. There is no direct linkage or data transfer between the calculation of land values and the LAND_VALUES parameter.

2. The item (4) has been changed in MELA2002.

See also

LAND_VALUES parameter
OUTPUT parameter
YEARS parameter
Net present value variable

Examples

Example 1: A definition of the SIMULATION _CONTROL parameter.

```
SIMULATION_CONTROL 51 50 0 0 1000 0 1 999 0 0 100 0 0 0 151 0 0
```

The default values for the maximum number of management schedules is 999, the maximum number of sample plots for each management unit is 100, and no longer period for the calculation of the net present value than 151 years is allowed.

SMALL_TREE_DIAMETER_MODEL

Generic name in Finnish

LAPIMITTAJAKAUMAMALLI

Functions

Parameter SMALL_TREE_DIAMETER_MODEL controls the choice of the diameter model used in the calculation of the diameter for the description trees derived from the height distribution. The height distribution is used for tree strata where mean diameter is below 5 cm.

Origin

System parameter

Program

MELASIM/extensions

Type

Numerical

Number of items

1

Default values

0

Valid since

MELA2000

Legend

```
(1)     Choice of the diameter model.

        '0' the diameter models by Ojansuu (2000)
        '1' the mean diameter model used in MELA99
```

See also

MELA extensions

Examples

Example 1: A definition of the SMALL_TREE_DIAMETER _MODEL parameter.

```
SMALL_TREE_DIAMETER_MODEL 1
```

The mean diameter model used in MELA99 is selected to be used in the calculation of the diameters.

SMT_VARIABLES

Generic name in Finnish

SMT_MUUTTUJAT

Functions

Parameter SMT_VARIABLES defines the variables of the updated stratum data record to be stored into the **smt** type files for updating user's database by the natural processes (growth and mortality).

Origin System parameter

Program **MELASIM/extensions**

Type Numerical

Number of items 1 - 36

Default values 9 6 5 1 3 4 8 19 101 102 103

Valid since MELA96

Legend

```
(1) - (n) Identification number of the variable of the updated stratum data
    record.
```

See also

SMT_WEIGHTS parameter
UPDATED_STAND_DATA_FILES parameter
Updated stratum data record
Updated stratum data text files (**smt** type files)
Updated stratum data record variable

Examples

Example 1: A definition of the SMT_VARIABLES parameter.

```
SMT_VARIABLES 9 6 5
```

The updated stratum data record definition consists of three variables.

SMT_WEIGHTS

Generic name in Finnish

SMT_PAINOT

Functions

Parameter SMT_WEIGHTS defines the weighting measure to be used during the updating the specific variables of the updated stratum data record. These specific variables are: diameter at the 1.3 m height (variable 3), height (4), age at the 1.3 m height (6), biological age (9), age at 1.3 m height when reached 10 cm diameter at breast height (16) and lower bound for the living crown (27).

Origin System parameter

Program **MELASIM/extensions**

Type Numerical

Number of items 1

Default values 0

Valid since MELA96

Legend

```
(1)     The weighting measure of the stand stratum data variables.

        '0' arithmetic mean
        '1' weighting by the basal area
        '2' weighting by the volume
```

Notes

1. All the variables have the same weighting measure.

See also

MELA extensions
SMT_VARIABLES parameter
UPDATED_STAND_DATA_FILES parameter
Stratum data record
Updated stratum data record
Updated stratum data text files (**smt** type files)

Examples

Example 1: A definition of the SMT_WEIGHTS parameter.

```
SMT_WEIGHTS 2
```

The specified variables of the updated stratum data record will be weighted by the volume of the simulation trees.

SMU_EVENTS

Generic name in Finnish

SMU_TAPAHTUMAT

Functions

Parameter SMU_EVENTS transfers the user-supplied management prescriptions and implemented operations into the MELA events. Parameter is needed when the user wants to apply her/his event classification in the stand simulation instruction text files (**smu** type files).

Origin System parameter

Program **MELASIM/extensions**

Type Numerical

Number of items 1 - 200 groups of three elements

Default values None

Valid since MELA96

Legend

```
(1) - (n) event_identification forest_operation_category management_pre-
    scription
```

event_identification MELA event identification number

forest_operation_category user defined category for grouping management prescriptions

management_prescription identification number of the user-supplied management prescription or implemented operation

See also

MELA extensions
EVENT parameter
SMU_VARIABLES parameter
SMU_YEAR_CODES parameter
Stand simulation instructions text files (**smu** type files)
Stand simulation instruction record
Stand simulation instruction variables

Examples

Example 1: A definition of the SMU_EVENTS parameter.

```
SMU_EVENTS
  20 0 100
  30 0 200
  50 5  40
  70 5  20
  99 9   1
```

The MELA event identification number 70 is corresponding the user-supplied management prescription 20 at the management class 5.

SMU_VARIABLES

Generic name in Finnish

SMU_MUUTTUJAT

Functions

Parameter SMU_VARIABLES defines the variables of the stand simulation instruction record to be used in the **smu** type file for transferring management prescriptions and implemented operations to MELA system.

Origin System parameter

Program **MELASIM/extensions**

Type Numerical

Number of items 3 - 9

Default values 1 2 4 5 6 7 8 9

Valid since MELA96

Legend

```
(1) - (n) Identification number of the variable of the stand simulation
    instruction record.
```

Notes

1. The identification number of stand (variable (1)) and the identification number of management unit (variable (2)) are obligatory SMU_VARIABLES from the stand simulation instruction record.

2. In the **smu** file a management prescription and implemented operation has to refer either to MELA event identification number (variable 3) or forest operation category (4) and management prescription (5). Furthermore the event year has to be given as an absolute year (6) or using urgency classification (7).

See also

MELA extensions
EVENT parameter
SMU_EVENTS parameter
SMU_YEAR_CODES parameter
Stand simulation instruction text files (**smu** type files)
Stand simulation instruction record
Stand simulation instruction variables (smu variables)

Examples

Example 1: A definition of the SMU_VARIABLES parameter.

```
SMU_VARIABLES 1 2 3 6
```

Four stand simulation instruction variables are defined to be read from **smu** type files.

SMU_YEAR_CODES

Generic name in Finnish

SMU_VUODET

Functions

Parameter SMU_YEAR_CODES converts the year codes of user's management prescriptions into the MELA event years.

Origin

System parameter

Program

MELASIM/extensions

Type

Numerical

Number of items

1 - 25 groups of two elements

Default values

None

Valid since

MELA96

Legend

```
(1) - (n) urgency_class years
```

urgency_class according to the user's classification

years number of years between the first year and the event year of the management prescription

See also

MELA extensions
EVENT_YEARS parameter
SMU_EVENTS parameter
SMU_VARIABLES parameter

Stand simulation instruction text files (**smu** type files)
Stand simulation instruction record
Stand simulation instruction variables (smu variables)

Examples

Example 1: A definition of the SMU_YEAR_CODES parameter.

```
SMU_YEAR_CODES
 1 6
 2 16
 3 26
 4 36
```

The management prescriptions with the urgent class 1 will be simulated at the relative year 6 in the simulation.

STAND_MANAGEMENT_FILES

Generic name in Finnish

LASKENTAYKSIKKOPALAUTE

Functions

Parameter STAND_MANAGEMENT_FILES defines the format and the number of management report information (**mps/mpu** type) files to be written in a MELAOPT session. Either **mps** type (binary) or **mpu** type (text) files can be generated in one MELAOPT session.

Origin System parameter

Program **MELAOPT**

Type Numerical

Number of items 2

Default values 0 0

Valid since MELA96, changed MELA98

Legend

```
(1)     Format of the management report information files.

        '0' mps type file
        '1' mpu type file

(2)     Number of management report information files.

        '0' mpu/mps type files are written in accordance with rsd type
        files
        '1' mpu/mps type file is written into one forestry unit level
        file
```

Notes

1. The item (2) has substituted the earlier MPS_OUTPUT parameter.
2. User can override the default naming of the file with FILE_NAMING parameter.

See also

MPS_VARIABLES parameter
FILE_NAMING parameter
Stand management files (**mps** and **mpu** type files)
Management report record

Examples

Example 1: A definition of the STAND_MANAGEMENT_FILES parameter.

```
STAND_MANAGEMENT_FILES 1 1
```

The management report information will be written in one **mpu** type file.

STUMPAGE_PRICES

Generic name in Finnish

KANTOHINNAT

Functions

Parameter STUMPAGE_PRICES defines the stumpage prices by tree species and timber assortments. Stumpage prices are used to calculate the stumpage value of the growing stock and cutting revenues without taking the logging costs into account.

The parameter is provided by the sub-periods corresponding to the YEARS parameter. The number of the given sub-periods can be 1 to 9. If the first given sub-period is 'k', the default values are used for the sub-periods 1 to k-1 and for the sub-periods beyond the k, the values of the k are used until the next given sub-period.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 17 for each given sub-period, the maximum number of sub-periods is 9 and the maximum number of given items 153

Default values Example 1

Valid since MELA96, changed in MELA2007

Legend

(1) The ordinal number of the sub-period.

(2)- (17) Stumpage prices (€/m^3).

Categories:
- **timber assortment types: 2 (saw timber, pulpwood)**
- **tree species: 8**

Notes

1. The default values of the parameter have been changed in MELA2007.

See also

ROADSIDE_PRICES parameter
SILVICULTURAL COSTS parameter
STUMPAGE_LOG_PRICE_ADJUSTMENT parameter
YEARS parameter

Income/revenues/returns variable
Costs variable
Net present value variable
Value variable
Tree species variable

Examples

Example 1: A definition of the STUMPAGE_PRICES parameter.

```
STUMPAGE_PRICES
 1
*saw log prices by tree species
 50.05 46.70 47.95 47.95 15.05 15.05 15.40 15.05
 15.40 23.60 15.05 15.05 15.05 15.05 15.40 15.05
 5
 51.25 47.40 48.30 48.30 14.95 14.95 15.15 14.95
 15.15 24.00 14.95 14.95 14.95 14.95 15.15 14.95
```

For the sub-periods 1−4, the values of the given sub-period 1 are used, and for the 5th and the subsequent sub-periods the values of sub-period 5 are applied.
The values of the 1st sub-period are the default values of the MELA2009 calculated as arithmetic means of the actual Finnish stumpace prices realized during the years 1997−2006 (Metinfo 2007) deflated to the year 2006.

STUMPAGE_LOG_PRICE_ADJUSTMENT

Generic name in Finnish

KANTOHINNAN_JAREYSKORJAUS

Functions

Parameter STUMPAGE_LOG_PRICE_ADJUSTMENT adjusts the average saw log stumpage price on the basis of stem size trying to reflect the enduse value of different stem sizes. The parameter is a copy of the parameter ROADSIDE_LOG_PRICE_ADJUSTMENT and the adjustment coefficients are still further the same. However, the adjustment coefficients are not enabled by default. The average saw log prices are defined by the STUMPAGE_PRICES parameter.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	1 or 421
Default values	Example 1
Valid since	MELA2005

Legend

```
(1)     Adjustment of the average saw log stumpage price.

        '0' saw log price adjustment disabled
        '1' saw log price adjustment enabled. In absence of the items (2) -
        (421), default coefficients are applied

(2) - (421) Adjustment coefficients for average saw log stumpage prices.

        Categories:
        • tree species: 3 (pine, spruce, birch)
        • diameter classes: 14 (19, 21, 23, ..., 43, 45 cm)
        • height classes: 10 (11, 13, 15, ..., 27, 29 m)
```

See also

STUMPAGE_PRICES parameter
ROADSIDE_LOG_PRICE_ADJUSTMENT parameter

Examples

Example 1: A definition of the STUMPAGE_LOG_PRICE_ADJUSTMENT parameter.

```
STUMPAGE_LOG_PRICE_ADJUSTMENT 0
```

Saw log price adjustment is disabled.

Example 2: A definition of the STUMPAGE_LOG_PRICE_ADJUSTMENT parameter.

```
STUMPAGE_LOG_PRICE_ADJUSTMENT 1

* Adjustment coefficients for pine, spruce and birch
* Mean height (m)
*  11   13   15   17   19   21   23   25   27   29
*
* PINE, diameter classes 19, 21, 23, ..., 43, 45 cm
*   Diameter class 19 cm
 0.70 0.77 0.80 0.80 0.80 0.79 0.82 0.85 0.90 0.95
 0.73 0.82 0.86 0.87 0.87 0.87 0.90 0.94 1.00 1.06
 0.75 0.86 0.91 0.93 0.94 0.95 0.98 1.03 1.08 1.15
 0.78 0.89 0.96 0.99 1.01 1.02 1.06 1.11 1.17 1.24
 0.80 0.93 1.00 1.04 1.07 1.08 1.13 1.18 1.24 1.32
 0.82 0.96 1.04 1.09 1.12 1.14 1.19 1.24 1.31 1.39
 0.84 0.99 1.08 1.13 1.17 1.20 1.25 1.31 1.38 1.46
 0.86 1.02 1.11 1.18 1.22 1.25 1.30 1.36 1.44 1.53
 0.89 1.04 1.15 1.21 1.26 1.30 1.35 1.42 1.50 1.59
 0.91 1.07 1.18 1.25 1.30 1.34 1.40 1.47 1.55 1.64
 0.93 1.09 1.21 1.28 1.34 1.39 1.44 1.52 1.60 1.70
 0.96 1.12 1.23 1.32 1.38 1.43 1.49 1.56 1.65 1.75
 0.98 1.15 1.26 1.35 1.41 1.46 1.53 1.60 1.69 1.80
*   Diameter class 45 cm
 1.01 1.17 1.29 1.38 1.44 1.50 1.56 1.64 1.74 1.84
*
* SPRUCE, diameter classes 19, 21, 23, ..., 43, 45 cm
*   Diameter class 19 cm
 0.59 0.73 0.83 0.88 0.92 0.94 0.97 1.04 1.13 1.23
 0.59 0.75 0.85 0.92 0.96 0.99 1.02 1.06 1.15 1.25
 0.60 0.75 0.87 0.95 1.00 1.04 1.07 1.11 1.20 1.30
 0.60 0.75 0.88 0.97 1.03 1.07 1.11 1.14 1.20 1.30
 0.61 0.76 0.88 0.98 1.05 1.10 1.14 1.18 1.23 1.32
 0.63 0.76 0.88 0.99 1.06 1.12 1.17 1.21 1.25 1.32
 0.65 0.77 0.89 0.99 1.07 1.14 1.19 1.24 1.28 1.33
 0.67 0.79 0.89 0.99 1.08 1.15 1.21 1.26 1.31 1.37
```

```
 0.68 0.81 0.90 1.00 1.09 1.16 1.23 1.28 1.34 1.40
 0.68 0.84 0.92 1.00 1.09 1.17 1.24 1.30 1.36 1.42
 0.69 0.85 0.94 1.01 1.09 1.18 1.25 1.32 1.38 1.45
 0.70 0.85 0.96 1.03 1.10 1.18 1.26 1.33 1.40 1.47
 0.72 0.86 0.98 1.05 1.11 1.19 1.27 1.35 1.42 1.49
*   Diameter class 45 cm
 0.74 0.86 0.99 1.07 1.13 1.20 1.28 1.36 1.44 1.51
*
* BIRCH, diameter classes 19, 21, 23, ..., 43, 45 cm
*   Diameter class 19 cm
 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51
 0.51 0.51 0.51 0.89 0.87 0.88 0.84 0.82 0.91 0.87
 0.52 0.94 0.95 0.96 0.95 0.91 1.04 1.04 1.04 1.03
 1.01 1.01 1.02 0.99 0.98 1.14 1.14 1.15 1.15 1.15
 1.05 1.05 1.07 1.05 1.21 1.19 1.21 1.20 1.24 1.24
 1.12 1.08 1.10 1.08 1.27 1.27 1.26 1.30 1.31 1.29
 1.15 1.14 1.12 1.30 1.31 1.32 1.32 1.34 1.34 1.35
 1.18 1.16 1.17 1.33 1.34 1.35 1.34 1.39 1.40 1.38
 1.21 1.21 1.19 1.38 1.39 1.38 1.42 1.41 1.42 1.43
 1.26 1.23 1.41 1.42 1.41 1.42 1.44 1.45 1.44 1.45
 1.28 1.25 1.43 1.44 1.44 1.43 1.46 1.46 1.47 1.47
 1.31 1.28 1.47 1.47 1.47 1.46 1.48 1.48 1.47 1.48
 1.33 1.30 1.48 1.48 1.48 1.50 1.50 1.50 1.49 1.49
*   Diameter class 45 cm
 1.35 1.31 1.49 1.49 1.49 1.50 1.51 1.50 1.51 1.50
```

The saw log price adjustment is enabled. A stem with diameter 25 cm and height 18 m has the adjustment coefficient 1.00. The values of the parameter origin from the 1970's (Laasasenaho & Sevola 1971).

SUBS_AND_TAXES

Generic name in Finnish

TUET_JA_VEROT

Functions

Parameter SUBS_AND_TAXES controls the application of the taxes and subsidies in the profitability calculations. By the default the profitability is calculated without taxes and without considering the state grants (subsidies). However, the subsidies of the energy wood harvesting relating to the improvement of young stands are by the default in force.

The taxation of forest property is based on the net stumpage price revenues of the timber sales, thus before taxation the costs of silviculture and forest improvement are deducted in their full value.

The state grants of silviculture and forest improvement actions can be given using either relative or absolute values. The grants are tax-free.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 19

Default values Example 1

Valid since MELA2007, changed in MELA2009

Legend

```
(1)  Sales value tax (realized income tax)
     '0' disabled
     '1' enabled
(2)  Rate of sales value tax, %/100
(3)  Subsidies (not concerning the energy wood harvesting, see 17)
     '0' disabled
     '1' enabled
```

```
(4)  Maximum stumpage price income valid for subsidies, €/hectare.

     Subsidy:
(5)  clearing of regeneration area
(6)  soil preparation
(7)  '0' reserved for the system
(8)  regeneration material (seeds, seedlings)
(9)  regeneration work
(10) grass suppression
(11) tending of seedling stand
(12) improvement of young stand
(13) pruning
(14) ditch cleaning and supplementary ditching
(15) fertilization
(16) '0' reserved for the system.
(17) Subsidies relating to the energy wood harvesting from the young
     improvement stands
     '0' disabled
     '1' enabled
     Subsidy:
(18) logging and hauling
(19) chipping
```

Notes

1. The values of the arguments 5−6 and 8−15 can be relative (0 -1.0) or absolute (>1.0). The relative value defines the rate the subsidy covers the costs and the absolute value defines the amount of the grant.

2. In the current MELA-version it is not possible to sort out the young stand improvement cuttings from normal intermediate fellings

See also

SILVICULTURAL COSTS parameter
STUMPAGE_PRICES parameter
Income/revenues/returns variable
Costs variable
Net present value variable
Value variable
Tree species variable

Examples

Example 1: A definition of the SUBS_AND_TAXES parameter.

```
SUBS_AND_TAXES
 0 0.29 0 1820. 0.2 0.2 0. 1.0 0.2 0.2 0.5 0.5 0.5 0.4 0.4 0. 1 7.0
3.5
```

The subsidies and taxes are omitted (argument 1=0 and 3=0), except the subsidies of the energy wood harvesting (argument 17=1). MELA2009 default values.

Example 2: A definition of the SUBS_AND_TAXES parameter.

```
SUBS_AND_TAXES
 1 0.29 1 1820. 0.2 0.2 0. 1.0 0.2 0.2 0.5 0.5 0.5 0.4 0.4 0. 1 7.0
3.5
```

The subsidies and taxes are in force. The subsidies are given as relative values.

Example 3: A definition of the SUBS_AND_TAXES parameter.

```
SUBS_AND_TAXES
 1 0.29 1 1820. 0.2 0.2 0. 1.0 0.2 0.2 126.5 210.5 168.5 16.8 76.0
 0. 1 7.0 3.5.
```

The subsidies and taxes are in force. The subsidies are given as partly as relative and partly as absolute values.

TIMBER_PRODUCTION_LAND

Generic name in Finnish

PUUNTUOTANNON_MAA

Functions

Parameter TIMBER_PRODUCTION_LAND defines the upper bound value of the forest management categories belonging to the timber production land when collecting most of the decision data variables. The sample plot variable (30) of the initial data record defines the forest management category.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1

Default values 5.9999

Valid since MELA96

Legend

```
(1) Upper bound for the management categories belonging to the timber
    production land.
```

Notes

1. The TIMBER_PRODUCTION_LAND parameter is independent from the definition of the MANAGEMENT_CATEGORY_GROUPS parameter

See also

MANAGEMENT_CATEGORY_GROUPS parameter
Initial data record variables
Decision data variables (MSD variables)

Examples

Example 1: A definition of the TIMBER_PRODUCTION_LAND parameter.

```
TIMBER_PRODUCTION_LAND 5.4
```

The upper bound of the forest management categories belonging to the timber production land when collecting most of the decision data variables is defined to be 5.4.

TIME_EXPENDITURE_IN_LOGGING

Generic name in Finnish

KORJUUN_AJANMENEKKI

Functions

Parameter TIME_EXPENDITURE_IN_LOGGING defines the user-supplied time expenditure figures (h/m^3) of logging related operations. It is used to replace the respective values obtained from the built-in default time expenditure functions. The time expenditure functions are based on Finnish work studies of Kuitto et al. (1994), Rummukainen et al. (1995) and on the agreement of the manual felling work (Metsäpalkkarakenteen.. 1996).

Time expenditures are applied during the calculation of logging costs, which are in MELA outcomes of time expenditure, cutting removal (m^3) and unit prices (€/h) of logging operations.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 108

Default values None

Valid since MELA99

Legend

(1) - (108) Time expenditure, hours/m^3.

Categories:
- **logging operation types: 3 (manual felling, mechanized felling, forest haulage)**
- **tree species: 3 (pine, spruce, deciduous species)**
- **timber assortment types: 2 (saw timber, pulpwood)**

- **harvesting types: 6 (thinning based on basal area, clear cutting, thinning based on number of stems, over story removal, seed tree cutting, shelterwood cutting)**

See also

LOGGING_COSTS parameter

Examples

Example 1: A definition of the TIME_EXPENDITURE_IN_LOGGING parameter.

```
TIME_EXPENDITURE_IN_LOGGING

* Harvesting type
*   1    2    3    4    5    6
* MANUAL FELLING
* Pine saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Pine pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* Spruce saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Spruce pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* Deciduous sp. saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Deciduous sp. pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* MECHANIZED FELLING
* Pine saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Pine pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* Spruce saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Spruce pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* Deciduous sp. saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Deciduous sp. pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* FOREST HAULAGE
* Pine saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Pine pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* Spruce saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Spruce pulpwood
  1.0  1.0  1.0  1.0  1.0  1.0
* Deciduous sp. saw timber
  1.0  1.0  1.0  1.0  1.0  1.0
* Deciduous sp. pulpwood
```

```
  1.0  1.0  1.0  1.0  1.0  1.0
```

The time expenditures are defined to be 1.0 hour/m^3 regardless of the logging operation types, tree species, timber assortment types or harvesting types.

UNUSED_GROWTH_ESTIMATES

Generic name in Finnish

KASVUMUISTI

Functions

The generic time step of growth models in MELASIM is five years. The growth estimates for shorter steps are obtained from the annual averages of these five year estimates. The unused proportions of the growth estimates are stored for the next simulation step in order to avoid the bias due to the nonlinearities. The unused proportions are also stored in **smr** type files by default.

The UNUSED_GROWTH_ESTIMATES parameter controls the clearing of the unused growth estimate memory before storing simulation records into **smr** type files. The parameter decides whether the last unused growth estimates of the current simulation are available in the beginning of the further simulations based on the **smr** type files.

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

1

Default values

0

Valid since

MELA96

Legend

```
(1) Clearing the unused growth estimates before storing simulation
    records into smr type files.

        '0' unused growth estimates are not cleared
        '1' unused growth estimates are cleared
```

Notes

1. The growth estimates are always used in simulation if they are stored into the **smr** type files used as the forest resource data.

See also

Simulation record files (**smr** type files)
Simulation record

Examples

Example 1: A definition of the UNUSED_GROWTH_ESTIMATES parameter.

```
UNUSED_GROWTH_ESTIMATES 1
```

The unused growth estimates are cleared before storing simulation records into **smr** type files.

UPDATED_STAND_DATA_FILES

Generic name in Finnish

METSIKKOPALAUTE

Functions

Parameter UPDATED_STAND_DATA_FILES controls the generation of **smt** type files.

Origin

System parameter

Program

MELASIM/extensions

Type

Numerical

Number of items

5

Default values

0 0 0 0 0

Valid since

MELA96

Legend

```
(1)     Controlling the generation of a smt type file.

        '0' smt file is disabled
        '1' smt file is enabled

(2)     '0' reserved for system.

(3)     '0' reserved for system.

(4)     Calculation year (the first year for the calculation period of
        the growth).

(5)     The last year for the calculation period of the growth.
```

Notes

1. The calculation year (4) must be the same as the first year of the YEARS parameter, otherwise the **smt** type file will be empty.

2. The last year for the calculation of the growth (5) is needed only if the future net increment (SMT variable 102) or future net value increment (SMT variable 106) are reported in a **smt** type file. Further, the last year for the calculation of the growth must be the same as correponding year in the YEARS parameter and the last year must be greater than the first year, otherwise growth is not reported.

3. Growth and the value growth are reported correctly in a **smt** type file only if there are no other simulation events than natural processes.

See also

MELA extensions
SMT_VARIABLES parameter
YEARS parameter
Updated stratum data text files (**smt** type files)
YEAR variable
Updated stratum data variables (SMT variables)

Examples

Example 1: A definition of the UPDATED_STAND_DATA_FILES parameter.

```
UPDATED_STAND_DATA_FILES 1 0 0 2008 2013
```

The generation of the **smt** type file is enabled and the growth is calculated for the years 2008-2012.

VOLUME_CALIBRATION

Generic name in Finnish

TILAVUUDEN_TASOKORJAUS

Functions

Parameter VOLUME_CALIBRATION provides adjustment coefficients for tree level stem volumes by tree species. The parameter affects indirectly on timber assortments, too.

Origin

System parameter

Program

MELASIM

Type

Numerical

Number of items

4

Default values

1.0 1.0 1.0 1.0

Valid since

MELA96, changed in MELA2009

Legend

```
Adjustment coefficients for
(1)     pine
(2)     spruce
(3)     birch
(4)     other deciduous species
```

See also

Volume table files (**vol** type files)
LOG_VOLUME_CALIBRATION parameter
Volume variable

Examples

Example 1: A definition of the VOLUME_CALIBRATION parameter.

```
VOLUME_CALIBRATION

* (1) pine
* (2) spruce
* (3) birch
* (4) other deciduous species

* (1)  (2)  (3)  (4)
  1.05 1.05 0.95 1.00
```

YEARS

Generic name in Finnish

VUODET

Functions

Parameter YEARS defines the calculation period and its sub-periods that constitute the time framework of the MELA analysis. For example, decision variables are collected and reports are generated by sub-periods.

Time is usually expressed in MELA using relative years. True (absolute) years are used for the automatic updating (pre-simulation) of management unit data with natural processes (growth and mortality). Pre-simulation is made from the year of the initial data to the beginning of the calculation period (the first absolute year) before other MELA events are simulated. The year of the initial data may vary by management units. The pre-simulation of data with natural processes and the simulation of other MELA events can take place also in separate MELASIM sessions. In this case the item (9) of the OUTPUT parameter is used for the storing of the updated simulation data.

Origin	System parameter
Program	**MELASIM**
Type	Numerical
Number of items	1 - 9 (- 20)
Default values	1 11 21 31 41 51
Valid since	MELA96

Legend

(1) - (n) Year

year	A relative year starting from the year 1 (simulation begins from initial data as such) or a true (absolute) year

(simulation begins after the automated growth updating until the beginning of the first year provided).

Notes

1. The maximum number of sub-periods in MELASIM is limited to 20 and in MELAOPT to 9 due to the current report generation capabilities.

2. Absolute and relative years must not appear in the same definition of the YEARS parameter.

3. Years can be defined independently from the five-year intervals of the current models of natural processes. However, it is highly recommendable to apply the even number of years in the lengths of the sub-periods in oder to avoid potential biases in optimisation.

See also

Program MELASIM
EVENT parameter
OUTPUT parameter
SIMULATION_CONTROL parameter
SMU_YEAR_CODES parameter
UNUSED_GROWTH_ESTIMATES parameter
UPDATED_STAND_DATA_FILES parameter

Examples

Example 1: A definition of the YEARS parameter.

```
YEARS 1 3 11 21 31 41 51
```

The calculation period and the sub-periods are defined by relative years.

Example 2: A definition of the YEARS parameter.

```
YEARS 2008 2010 2018 2028 2038 2048 2058
```

The calculation period and the sub-periods are defined by absolute years. The automatic update of the management unit data with natural processes will be done to the year 2008.

YKJ_COORDINATES

Generic name in Finnish

YKJ_KOORDINAATIT

Functions

With this parameter it is defined in which coordinate system x and y coordinates are in stand data text file (RSU type file) or initial data file (RSD type file) and in ENERGYWOOD_USE_POINTS parameter.

MELA uses internally Finnish uniform coordinate (YKJ) system. Therefore default value for this parameter is 1.

Origin System parameter

Program **MELASIM**

Type Numerical

Number of items 1

Default values 1

Valid since MELA2009

Legend

```
x and y coordinates (in stand data text file (RSU type file),intial data
    file (RSD type file),ENERGYWOOD_USE_POINTS parameter)
    '0' coordinates are in EUREF-FIN (ETRS-TM35FIN) system (conversion
    needed)
    '1' coordinates are in FINNISH uniform coordinate (YKJ) system (default
    value)
```

Notes

1. Same coordinate system must been used through whole MELA programs. This means that same system must been used in stand data text files (RSU) or initial data files (RSD), and in ENERGYWOOD_USE_POINTS parameter (if defined).

2. If coordinates are taken out from MELA as result they are always in Finnish uniform coordinate (YKJ) system.

See also

ENERGYWOOD_USE_POINTS
Stand data text files (**rsu** type files)
Initial data files (**rsd** type files)
Stand data text file variables (RSU variables)
Initial data record variables (RSD variables)

Examples

Example 1: A definition of of the YKJ_COORDINATES parameter

```
YKJ_COORDINATES 0
```

Coordinates are in EUREF-FIN coordinate system and they are converted to Finnish uniform coordinate system (YKJ).

YOUNG_STAND

Generic name in Finnish

NUORI_METSA

Functions

Parameter YOUNG_STAND defines the use of the specieswise models of the diameter of the basal area median tree and the basal area for young stands.

In some inventory data the specieswise arithmetic mean diameter at breast height and the number of stems are measured instead of the specieswise diameter of the basal area median tree and specieswise basal area. This causes error in further processing of the inventory data because the MELASIM program assumes that the given diameter has been measured from the basal area median tree.

With the YOUNG_STAND parameter it is possible to estimate specieswise diameter of the breast height of the basal area median tree and specieswise basal area with the models used in MELASIM (Nissinen 2002). The user is allowed to specify the upper levels of the diameters at breast height as application limits of the models. The lower limit of the models is 5 centimetres. The application limits can be defined for soils and for peatlands.

Origin	System parameter
Program	**MELASIM/extensions**
Type	Numerical
Number of items	7
Default values	0 0 0 0 0 0 0
Valid since	MELA2002

Legend

(1)	**The use of the diameter models and the basal area models in young stands.**

```
          '0' models are not in use
          '1' models are applied

  (2)     Maximum diameter when models are applied, cm.

          Categories:
          • soil and peatland category: 2 (mineral soils, peatland)
          • tree species: 3 (pine, spruce, deciduous trees)
```

Notes

1. The maximum diameter of the application of the models is restricted into 15 centimetres.

2. The measured basal area is used instead of estimated basal area.

See also

MELA extensions

Examples

Example 1: A definition of the YOUNG_STAND parameter.

```
YOUNG_STAND 1 12 12 12 10 10 9
```

The diameter and basal area models of the young stands is applied. The upper limits of the diameter for the specieswise application limits are 12 centimetres for mineral soils for all tree species and 10 centimetres for pine and spruce on peatlands and 9 centimetres for deciduous trees on peatlands.

FILES

General information about MELA files

Introduction

File categories

MELA files fall into two categories:

1. **system files** (binary or text files) and
2. **user files** (binary or text files)

System files are generated by MELA programs, by MELA program commands or by specific MELA routines. System files are used by MELA programs or by user programs. MELA generates also some system files (reports) for user interpretation.

User files are generated by users programs or text editors. User files are used by MELA programs or by user programs (also text editors).

User files are described in this manual in details. System files are only shortly reviewed.

The MELA standard package contains default MELA system files, default parameter files, and some examples of initial data files and problem definition files. Users should generate their own task-specific files and use them instead of the default files.

All MELA files, both text and binary files, are processed by standard FORTRAN input/output operations in the MELA programs. Compressed system files should be processed only by MELA routines. Some of the files (mainly the text files produced by the MELA extensions) can be processed also by user programs.

Obligatory MELA files

Some MELA files are always required when using the MELA programs. If the necessary files do not exist, the MELA session will stop. The obligatory files for all MELA programs are

- **MELA_SET.PAR**
- **SYMBOL.SYM**.
- **USER.CFG**

There are also obligatory files specific to each MELA program (for further information, see program MELASIM and program MELAOPT).

Notes

1. The binary files can be read only by programs compiled using the same compiler as the program which has written the files.

2. MELA extensions are offered to assist the integration of MELA and stand information systems using text files.

See also

File naming
Program MELASIM
Program MELAOPT
MSB format
Initial parameter settings file (MELA_SET.PAR file)
Symbol definition file (SYMBOL.SYM file)
Session monitoring and troubleshooting

Examples

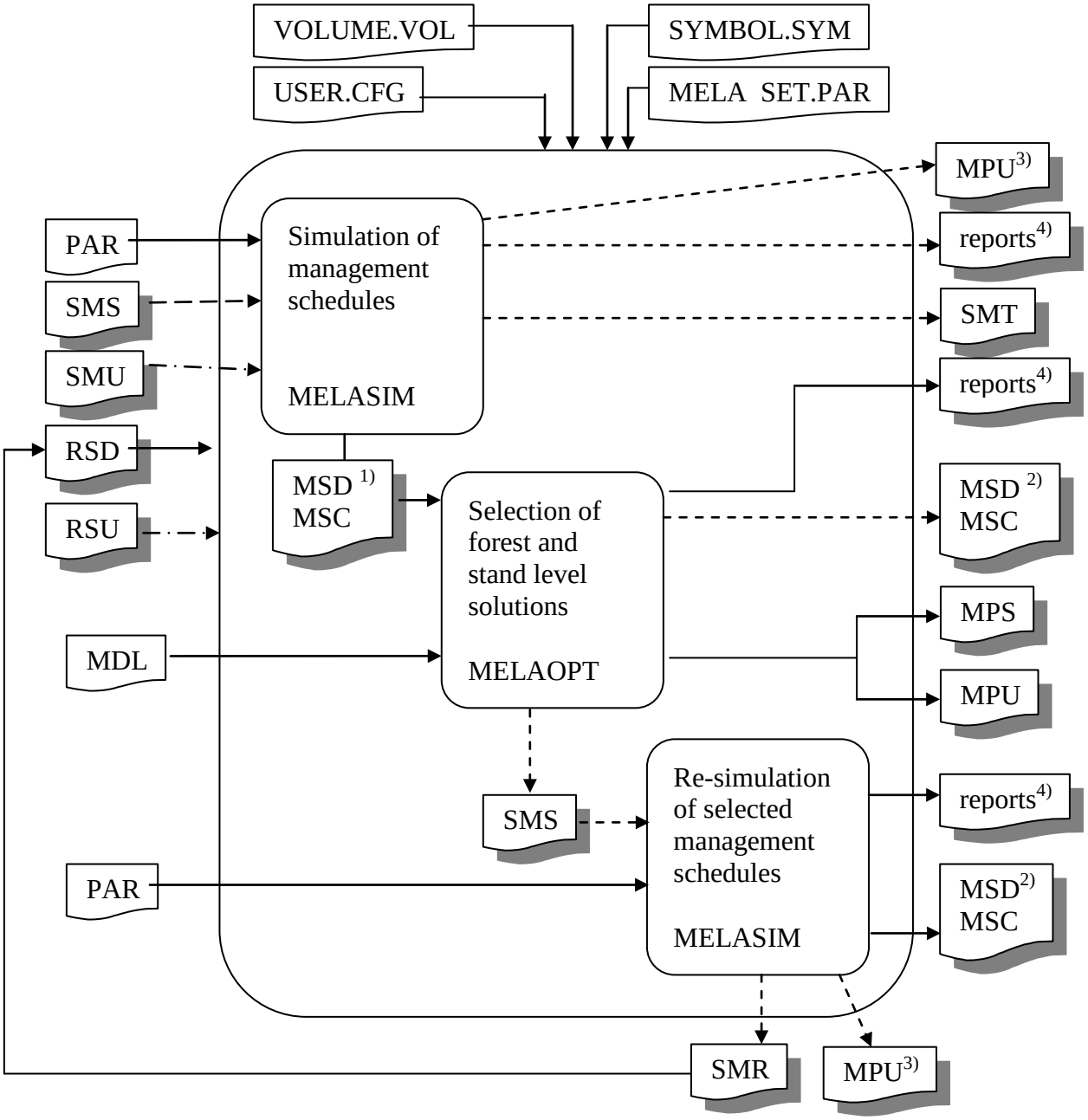
Example 1: The common parameter definition file (in English).

```
* MELA_SET.PAR *

* Default value for the FORESTRY_UNIT parameter

FORESTRY_UNIT#FX

* Names of the c variables in the demonstration data

C_VARIABLES#UNIT#AREA#SITE#MANAGEMENT#OWNER

* Remove following '*' signs for shorter file names than defaults
*
*FILE_NAMING
*#01 SUM _ FORESTRY_UNIT SUB_UNIT PROBLEM
*#20 MSC _ FORESTRY_UNIT SUB_UNIT PROBLEM
*#21 MSD _ FORESTRY_UNIT SUB_UNIT PROBLEM
```

MELA files

MELA files and their main features are shortly introduced here. Details are given later. See also figure 1.

File	File extension	Functions
Symbol definition file	**SYMBOL.SYM**	Symbol definitions
Initial parameter settings file	**MELA_SET.PAR**	Initial parameter settings
Problem definition files	**MDL**	Optimisation problems
Cost of change report files	**MRG**	Cost of change reports
Management schedule files	**MSC, MSD**	Stand level management schedules
Forest level summary files	**MSC, MSD**	Forest level summary data
Parameter definition files	**PAR**	MELA parameter definitions
Initial data files	**RSD**	Initial forest resource data
Management schedule report files	**SCH**	Management schedule reports
Shadow price report files	**SHP**	Shadow price reports
Simulation record files	**SMR**	Simulation records
Standwise simulation instruction files	**SMS**	Standwise simulation instructions
Solution report files	**SOL**	Solution reports
Summary report files	**SUM**	Forest level summary reports
Symbol definition files	**SYM**	Symbol definitions
Volume table files	**VOL**	Volume tables
Stand data text files	**RSU**	Standwise forest resource data
Stand simulation instruction text files	**SMU**	Standwise simulation instructions
Updated stratum data text files	**SMT**	Updated stand data
Stand management files	**MPS, MPU**	Stand manegement reports/schedules



1) Management schedules for management units
2) A forest level summary in the management schedule format
3) Stand management schedules from simulation
4) MELA programs generate following reports:
    a) Summary report files (**sum** type files)
    b) Solution report files (**sol** type files)
    c) Management schedule report files (**sch** type files)
    d) Shadow price report files (**shp** type files)
    e) Cost of change report files (**mrg** type files)

Figure 1: A schematic illustration of the MELA files and programs.

Symbol definition file

File name	**SYMBOL.SYM**
Functions	Symbol definitions
Program/Command	-
Parameters	-
File type	System file (obligatory)
Input for	**MELASIM, MELAOPT**
Format	Text
Records	Text rows (in English or Finnish)
MSB type	-

Initial parameter settings file

File name	**MELA_SET.PAR**
Functions	Initial parameter settings
Program/Command	-
Parameters	-
File type	System file (obligatory)
Input for	**MELASIM, MELAOPT**
Format	Text
Records	Text rows containing valid parameter definitions and general parameter definitions
MSB type	-

Problem definition files

Extension	**MDL**
Functions	Optimisation problems
Program/Command	Text editor (,user programs)
Parameters	-
File type	User file
Input for	**MELAOPT**
Format	Text
Records	Text rows containing valid JLP commands, definitions and comments
MSB type	-

Stand management files

Extension	**MPS,MPU**
Functions	Binary or text data for stand management report generation
Program/Command	**MELASIM** **MELAOPT** -> REPORT SUMMARY
Parameters	MPS_VARIABLES, STAND_MANAGEMENT_SCHEDULES, STAND_MANAGEMENT_FILES
File type	System file
Input for	User programs
Format	Binary (**MPS**), text (**MPU**)
Records	Management report records (binary or text)
MSB type	4 (Management report binary records in **MPS** type files)

Cost of change report files

Extension	**MRG**
Functions	Cost of change reports
Program/Command	**MELAOPT** -> REPORT MARGINALS
Parameters	-
File type	System file
Input for	User interpretation
Format	Text
Records	Text rows
MSB type	-

Management schedule files

Extension	**MSC, MSD**
Functions	Stand level management schedules
Program/Command	**MELASIM** -> SIMULATE
Parameters	MSD_VARIABLES, MSR_VARIABLES, OUTPUT
File type	System file
Input for	**MELAOPT**
Format	Binary
Records	Decision data records, Management schedule records, Simulation instruction records (in **msd** type files)
MSB type	-

Forest level summary files

Extension	**MSC, MSD**
Functions	Forest level summary data
Program/Command	**MELASIM** -> SIMULATE**, MELAOPT**
Parameters	MSD_VARIABLES, OUTPUT
File type	System file
Input for	**MELAOPT**
Format	Binary
Records	Forest level summary of management unit level decision data records
MSB type	-

Parameter definition files

Extension	**PAR**
Functions	MELA parameter definitions
Program/Command	Text editor (,user programs)
Parameters	-
File type	User file
Input for	**MELASIM, MELAOPT**
Format	Text
Records	Text rows containing valid parameter definitions
MSB type	-

Initial data files

Extension	**RSD**
Functions	Initial forest resource data
Program/Command	User programs
Parameters	-
File type	User file
Input for	**MELASIM, MELAOPT**
Format	Binary
Records	Initial data records, Management unit records
MSB type	1 (Initial data records), 2 (management unit records)

Management schedule report files

Extension	**SCH**
Functions	Management schedule reports
Program/Command	**MELAOPT** –> REPORT SCHEDULES
Parameters	-
File type	System file
Input for	User interpretation
Format	Text
Records	Text rows
MSB type	-

Shadow price report files

Extension	**SHP**
Functions	Shadow price reports
Program/Command	**MELAOPT** –> REPORT SHADOW_PRICES
Parameters	-
File type	System file
Input for	User interpretation
Format	Text
Records	Text rows
MSB type	-

Simulation record files

Extension	**SMR**
Functions	Simulation records
Program/Command	**MELASIM** -> SIMULATE
Parameters	OUTPUT
File type	System file
Input for	User programs, **MELASIM**
Format	Binary
Records	MELA simulation records
MSB type	3

Standwise simulation instruction files

Extension	**SMS**
Functions	Standwise simulation instructions
Program/Command	**MELAOPT** –> REPORT SUMMARY, User programs

Parameters	RE_SIMULATION_INSTRUCTIONS
File type	System file
Input for	**MELASIM**
Format	Binary
Records	Simulation instructions record
MSB type	5

Solution report files

Extension	**SOL**
Functions	Solution reports
Program/Command	**MELAOPT** –> REPORT SOLUTION
Parameters	-
File type	System file
Input for	User interpretation
Format	Text
Records	Text rows
MSB type	-

Summary report files

Extension	**SUM**
Functions	Forest level summary reports
Program/Command	**MELAOPT** –> REPORT SUMMARY, **MELASIM –>** SIMULATE
Parameters	OUTPUT (MELASIM), FOREST_REPORT
File type	System file
Input for	User interpretation
Format	Text
Records	Text rows
MSB type	-

Volume table files

Extension	**VOL**
Functions	Volume tables
Program/Command	Specific MELA routines
Parameters	-
File type	System file
Input for	**MELASIM**
Format	Binary
Records	Specific stem and timber assortment volume tables
MSB type	-

Stand data text file (MELA extensions)

Extension	**RSU**
Functions	Standwise forest resource data
Program/Command	User programs
Parameters	-
File type	User file
Input for	**MELASIM** (MELA extensions)
Format	Text

Records	Stand data record, Stratum data record, Tree data record, Management unit record
MSB type	-

Stand simulation instruction text file (MELA extensions)

Extension	**SMU**
Functions	Standwise simulation instructions
Program/Command	User programs
Parameters	-
File type	User file
Input for	**MELASIM** (MELA extensions)
Format	Text
Records	Standwise simulation instruction records
MSB type	-

Updated stratum data text file (MELA extensions)

Extension	**SMT**
Functions	Updated stand data
Program/Command	**MELASIM** (MELA extensions) –>SIMULATE
Parameters	-
File type	System file
Input for	User programs
Format	Text
Records	Updated stratum records
MSB type	-

File naming

General syntax of file naming

```
FILENAME.EXT
```

FILENAME A character string defining the file name.

EXT A string of three characters defining the file name extension.

File names must be given in upper case letters to avoid conflicts with MELA programs.

Basics

MELA generates automatically names as well as opens and closes the files needed by the MELA programs. File names are generated from the actual command arguments (see the MELASIM command SIMULATE and the MELAOPT command SOLVE) and parameter values. Missing files result an error message and the current task will stop.

Some MELA file names are constants (for example, **VOLUME.VOL**, where VOLUME is a file name and VOL is an extension). Most of the MELA file names are automatically generated from naming components typical to each file type. The naming components of the file names are

- values of command arguments,
- values of actual parameters,
- character constants, and
- delimiters.

Default values for naming components, their order in file names, and file name extensions are automatically set by the MELA System (see FILE_NAMING parameter).

The file names are generated and interpreted automatically. In order to avoid too long file names it is recommended to use short command arguments and parameter values.

Notes

1. Operating systems may limit the length and valid characters of file names. Usually at least eight characters can be used in file names, but national characters (such as Scandinavian Å, Ä and Ö) are not allowed by all operating systems. For details, see instructions of your operating system. See also the MELA parameter MAX_LENGTH_OF_FILENAME.

2. MELA deletes the old version of the output file when writing a new output file with the same name. Use your operating system commands for saving or renaming the old file version before the execution of the MELA programs, if necessary. Use also operating system commands to delete unnecessary files.

3. For changing default file naming instructions, see the FILE_NAMING parameter.

See also

MELASIM command SIMULATE
MELAOPT command SOLVE
MAX_LENGTH_OF_FILENAME parameter
FILE_NAMING parameter

Examples

Example 1: The components of the file name.

```
The automatically generated file name

     FX_F2_S4_S.SUM

consists of the following components:

     · 'FX', 'F2', 'S4'  values of command arguments
     · 'S'   character constant
     · 'SUM' extension
     · '_'   delimiter between file naming components
     · '.'   delimiter between the file name and the extension

in the case of the following file naming instructions:

     #65 SUM _ FORESTRY_UNIT SUB_UNIT PROBLEM S

denoting:

     <forestry_unit>_<sub_unit>_<problem>_S.SUM

(see also the naming instructions of sum type files)
```

File descriptions

Symbol definition file (SYMBOL.SYM file)

Functions

Names of commands and parameters as well as message texts in the MELA programs are provided in symbol definition file named SYMBOL.SYM.

File type System file (obligatory)

Default unit 25

Contents MELA symbol definitions

Input for **MELASIM, MELAOPT**

Generation

SYMBOL.SYM file is obligatory. The symbol definition file is provided with the MELA standard delivery.

Instructions

Symbol definitions are used to generate different language versions of the MELA software. Symbol definition file is in English or in Finnish depending on which language user has chosen. For changing language version of the MELA software, contact the MELA Team.

See also

MELA files

Initial parameter settings file (MELA_SET.PAR file)

Functions

MELA_SET.PAR is a file for initial parameter settings and general parameter definitions. MELA programs read this file by default.

File type System file (obligatory)

Default unit -

Contents Initial parameter settings and general parameter definitions

Input for **MELASIM, MELAOPT**

Generation

MELA_SET.PAR file is obligatory. This file is provided with the MELA standard delivery.

Instructions

MELA_SET.PAR file is in English or in Finnish depending on which language user has chosen. For changing language version of the MELA software, contact the MELA Team.

If required, the FILE_NAMING parameter must be defined in this file.

See also

MELA files
FILE_NAMING parameter

Problem definition files (mdl type files)

Functions

Optimisation problems for the program MELAOPT are provided via problem definition files (**mdl** type files).

Users prepare their own problem definitions according to their own analyses, preferences and goals for forestry.

File type	User file
Default naming	problem.**MDL**
Default unit	23
File parameters	Text file, sequential, variable length
Valid records	Text rows containing valid JLP commands, definitions and comments in the JLP syntax
Program/command	Text editor, (or user programs, if available)
Controlling parameter(s)	-
Input for	**MELAOPT**

Generation

Mdl type files are generated by text editors or by user programs. Previously defined problem definitions may prove useful starting points for the design of new problem definitions.

Instructions

An **mdl** type file may contain:

- JLP commands and definitions (in the JLP syntax), and
- JLP comments (lines beginning with the character '*').

See note 1 and note 4.

The JLP sections 'xvar' and 'prob' are always required in a valid **mdl** type file. For other JLP commands, see Lappi (1992).

Notice the different syntax in an 'xvar' section (the continuation of a line is expressed by the character '>' at the end of the line) and in a 'prob' section (instead of line continuation characters on problem definition lines, the character '/' finishes the whole 'prob' paragraph), see example 1.

The introduction and the use of MELA decision data variables in mdl **type files**

The MELA decision data variables describing management schedules in MELAOPT come from the management schedule (**msc** and **msd** type) files. In the stand-alone use of JLP, 'xdat' files are used instead. See note 2.

The task of the 'xvar' section in mdl type files is to introduce the MELA decision data variables available for consequent 'prob' sections, MELA solution reports and JLP reports. An 'xvar' section must contain at least all the variables used in the 'prob' definitions during the MELAOPT session. Only the program capacity limits the number of individual variables in the 'xvar' section.

Notice that faulty results without warning or unexplained errors will be obtained as a consequence of misinterpretation if all of the decision data variables referred in the 'prob' section are not correctly introduced in the 'xvar' section. See also JLP z variables below and in Lappi (1992)

In the 'prob' section of an **mdl** type file, a linear programming problem is provided using the JLP conventions. The MELA decision data variables introduced in the previous 'xvar' section and their linear combinations are used to define the objective function and the constraints.

In addition to variables in 'xvar' section new decision variables can be defined using transformations in 'xtran' section. Transformations describe construction of the new variables based on variables introduced in 'xvar' section. Transformations can also be applied to define criteria for rejecting schedules in the optimisation. See example 4.

For the details in the JLP 'xvar' and 'prob' paragraphs and other commands for JLP problem definitions in **mdl** type files, see Lappi (1992).

The naming of MELA variables in mdl **type files**

The sub-period elements of the selected MSD variables, and the sub-period elements of the user-defined collective variables are used compatibly in the formulation of the optimisation problem in **mdl** type files. In the following, both the general syntax (1) in referencing the MSD variables and collective variables and the traditional notation (2) (see note 8) in referencing MSD variables are explained.

1) General syntax for MSD variables

The syntax of the references to the sub-period elements of MSD variables as MELA decision variables in the 'xvar' and 'prob' sections is:

```
xnnn..sub-period
```

```
x195..1
x195..2
```

x 'x' (a lower case 'x' referring to JLP x type variables).

nnn The identification number of the MSD variable.

'..' The delimiter of time expression.

sub-period A time expression indicating the sub-period element, see the YEARS parameter in the current application.

2) Traditional notation for MSD variables

The traditional notation of the references to the sub-period elements of MSD variables as MELA decision variables in the 'xvar' and 'prob' sections is:

xPnnn

```
x1195
x2195
```

x 'x' (a lower case 'x' referring to JLP x type variables).

P An identification number of the sub-period in question, see the YEARS parameter of the current application.

nnn The identification number of the MSD variable.

Decision variables are available for all years (states) or sub-periods (events) defined by the YEARS parameter in the simulation.

The naming of decision variables in the case of four and five sub-periods defined by the YEARS parameter is as follows:

```
YEARS          2008     2018     2028     2038     2048
               decision variables describing states
               0nnn     1nnn     2nnn     3nnn     4nnn
               decision variables describing events
                    1nnn     2nnn     3nnn     4nnn

YEARS            1    3    7    11   21   31
               decision variables describing states
               0nnn 1nnn 2nnn  3nnn  4nnn  5nnn
               decision variables describing events
                  1nnn 2nnn 3nnn  4nnn 5nnn
```

For example, the variable name 'x0700' refers to the volume of the growing stock in the initial state, and 'x1700' refers to the volume of the growing stock at the end of the first

sub-period. Respectively, the variable name 'x1195' refers to the cutting removal on the first sub-period. Notice that the sub-periods may be of variable length.

Syntax for collective variables without category definitions

The syntax of the references to the sub-period elements of collective variables without category definitions as MELA decision variables in the 'xvar' and 'prob' sections is:

```
collectible..sub-period
```

```
RC..1
```

collectible	The name of the collectible variable.
'..'	The delimiter of time expression.
sub-period	A time expression indicating the sub-period element, see the YEARS parameter in the current application.

Use of collective variables with category definitions and references to Pmin and Pmax functions

Collective variables with category definitions and references to Pmin and Pmax functions cannot be used in problem definition as such because the brackets ([and]) are not allowed in variable names in 'prob' section. Therefore these variables as well as references to Pmin and Pmax functions are first renamed in 'xvar' section.

The syntax of the references to the sub-period elements of collective variables with category definitions as MELA decision variables in the 'xvar' section is

```
var_name = collectible [vr] [[vr]]..sub-period
```

```
RC_EV10_2 = RC[EV=10]..2
RL_EV10S1_1 = RL[EV=10][S=1]..1
```

var_name	User defined name for collective variable. This name is used in the definition of optimisation problem ('prob' section). Variable names start with a letter A-Z or a-z and cannot contain characters !"=,/:-%[]. Name can contain up to 256 characters.
collectible	The name of the collectible variable.
'[]'	The delimiter pair of a category expression.
v	The name of the category variable.
r	Relational expression (a list of single relations and ranges).

`'..'`	The delimiter of time expression.
`sub-period`	A time expression indicating the sub-period element, see the YEARS parameter in the current application.

The references to Pmin and Pmax functions are renamed respectively, furnishing all the function parameters with explicit time expressions for the calculation of the relevant values for sub-periods (see examples below). See note 9.

```
rc_pot..1 = Pmax(RC..1,RC..1,node..1)
rc_res..1 = Pmax(RC..1,RC..1,node..1)-RC..1
rc_pot_pine..1 = Pmax(RC[s=1]..1,RC..1,node,..1)
rc_pot_pine..1 = Pmax(RC[s=1]..1,RC..1,node..1)-RC[s=1]
```

In the problem definition ('prob' section) collective variables with category definitions and references to Pmin and Pmax functions are referred using names defined in 'xvar' section.

JLP domain definitions and c variables in mdl **type files**

The objective and the constraints can be provided in MELAOPT

- for the whole forestry unit,
- for any of the MELA decision hierarchy members, see example 2, and
- for any individual JLP domain defined by the user-supplied c variables, see example 3, Management unit record, and Lappi (1992).

According to the JLP convention, constraints before any external domain definitions are for the whole forestry unit. A domain definition is followed by one or several constraints for that domain. Several sequences of domain definitions and constraints may follow each other, each referring to the specified domain only. For further details, see Lappi (1992). See example 2 and example 4.

The JLP command 'show/domains' in an **mdl** type file can be used for the generation of additional domains for reporting in addition to the domains defined in the 'prob' section (for details, see Lappi 1992). See example 5.

JLP z variables in mdl **type files**

Z variables (or additional decision variables in JLP terms) are used to formulate conventional LP problems in JLP. They also make it possible to combine a MELA and conventional LP problem formulation. JLP interprets as z variables all the variables of the objective function and of the constraints, which were not introduced by the preceding 'xvar' command or by the 'xtran' transformations. For further details and potential applications (e.g. in goal programming), see Lappi (1992). See note 3.

The naming of mdl **type files**

For the convenience, the name of each **mdl** type file should refer to the optimisation problem described in the file. Analysis designs and their members should be named in a systematic way.

Notes

1. The JLP command 'solve' should not appear accidentally in an **mdl** type file. It is automatically executed in MELAOPT immediately after the **mdl** type file.

2. In the JLP terms, MELA decision variables are called x variables. For JLP x variables, see Lappi (1992).

3. The references (in the 'prob' section of a mdl type file) to the MELA decision variables not defined in the preceding 'xvar' section are also treated as z variables. If unintentionally used, unexpected results without warning will be obtained.

4. JLP commands must be in lower case letters, unlike MELA commands and parameters.

5. Only those MSD variables introduced in the MSD_VARIABLES parameter are stored into the **msc** and **msd** type files by MELASIM.

6. Collective variables referred in the **mdl** type file must be stored into the **msc** and **msd** type files by MELASIM. In MELASIM only those collective variables generated by data requests introduced in the FOREST_REPORT parameter are stored into the **msc** and **msd** type files.

7. The names of the collective variables can be printed by MELASIM at the ends of the data rows in the summary report by setting the TRAILING_NAME option of the parameter FOREST_REPORT enabled.

8. The traditional notation in referencing MSD variables in the formulation of the optimisation problem is available in MELA2002 for the compatibility with earlier MELA versions.

9. Explicit time expressions are (and must be) used in case of optimisation problems only (otherwise than forest reports).

See also

MELA files
MELAOPT command SOLVE
MELAOPT command JLP
JLP domain definitions
JLP user’s guide

Collective variables
Collectible and category variables
Pmin and Pmax functions for local extrema (and margins)

MSD-variables
Management unit record

Hierarchical forestry units
YEARS parameter
MSD_VARIABLES parameter
FOREST REPORT parameter

Examples

Example 1: A JLP problem definition for the cutting potential.

```
* P5.MDL *

* CUTTING POTENTIAL
* 'xvar' section is obligatory:
* at least variables of the 'prob' section have to be mentioned
* 'xvar' section defines also decision variables for SOLUTION report

xvar x0805,x0537>
,x0700,x1700,x2700,x3700,x4700>

,x0697,x1697,x2697,x3697,x4697>
,x1090,x2090,x3090,x4090>
,x1195,x2195,x3195,x4195>
,x1193,x2193,x3193,x4193>
,x1370,x2370,x3370,x4370>
,x0800,x4800,x0803,x4803

* 'prob' section is obligatory
prob P5 - CUTTING POTENTIAL - NPV 5 %

* maximize net present value using 5 % interest rate
x0805 max
/
```

Example 2: A JLP problem definition with constraints for domains.

```
* SD.MDL *

* MAXIMUM SUSTAINED YIELD
*  - with domain constraints

xvar x0804,x4804,x0537>
,x0700,x1700,x2700,x3700,x4700>
,x0697,x1697,x2697,x3697,x4697>
,x1090,x2090,x3090,x4090>
,x1002,x2002,x3002,x4002>
,x1195,x2195,x3195,x4195>
,x1193,x2193,x3193,x4193>
,x1370,x2370,x3370,x4370>
,x0800,x4800

prob SD - MAXIMUM SUSTAINED YIELD/SD, 4%
```

```
* maximize overall NPV (4 %)
x0804 max

* CONSTRAINTS FOR DOMAINS all: (i.e. FX) and DISTRICT=F2:

all: DISRICT=F2:

* non-declining cutting removals
x2195-x1195>0
x3195-x2195>0
x4195-x3195>0

* non-declining saw timber removals compared with first sub-period
x2193-x1193>0
x3193-x1193>0
x4193-x1193>0

* non-declining net revenues
x2370-x1370>0
x3370-x2370>0
x4370-x3370>0

* 20 % higher net present value at the end of the calculation period
* is assumed here to guarantee the sustainable yield level beyond
* the calculation period
x4804-1.2*x0804>0

* CONSTRAINTS FOR DOMAIN DISTRICT=F3:

DISTRICT=F3:

* minimum annual clear cutting area for sub-periods (0.5 %)
x1002-0.005*x0537>0
x2002-0.005*x0537>0
x3002-0.005*x0537>0
x4002-0.005*x0537>0

* maximum clear cutting area for whole calculation period (3.5 %)
x1002+x2002+x3002+x4002-0.035*x0537<0
/
```

Example 3: A MELAOPT solution report for the domains defined by the REPORT command.

```
* FX_SD.SOL *

 SD FX
================================================================
 <>MELA<>   FX  - DISTRICT=F2.or.DISTRICT=F3:
            SD-MAXIMUM SUSTAINED YIELD/SD,4%  solution is optimum
----------------------------------------------------------------
                           2008    2018    2028    2038    2048
----------------------------------------------------------------
804 NPV 4 %              854076                          1315680
 537 Forestry land area     46.1
```

```
 700 Volume, m3           4948.8  5412.6  6013.4  5745.0  6416.9
 697 -saw log             2382.1  2677.3  2968.5  2712.2  3312.4
 090 Increment, m3/a           229.0   249.1   249.6   260.7
 002 -clear cutting              0.3     0.1     0.2     0.2
 195 Cutting removal, m3/a     168.8   170.6   265.7   184.6
 193 -saw log                   97.0   112.3   146.7   112.2
 370 Net revenues, FIM/a     23048.3 28032.8 41802.4 30830.5
 800 Roadside value,FIM   942614                          1305496
-----------------------------------------------------------------
```

Example 4: A JLP problem definition for the maximum sustained yield with the prohibition of clear cuttings for one domain.

```
* cc.prb *

* MAXIMUM SUSTAINED YIELD - NO CLEAR CUTTINGS IF OWNER = 2
* exclude management schedules with clear cuttings if OWNER = 2

xtran
clearcut=x1002+x2002+x3002+x4002
if OWNER.eq.2.and.clearcut>0 then reject
/
prob CC - MAXIMUM SUSTAINED YIELD, 4%
x0804 max

* non-declining cutting removals
x2195-x1195>0
x3195-x2195>0
x4195-x3195>0

* non-declining saw timber removals compared with first sub-period
x2193-x1193>0
x3193-x1193>0
x4193-x1193>0

* non-declining net revenues
x2370-x1370>0
x3370-x2370>0
x4370-x3370>0

* 20 % higher net present value at the end of the calculation period
* is assumed here to guarantee the sustainable yield level
* after the calculation period
x4804-1.2*x0804>0
/

* domains for reporting
show/domain
OWNER=0:
OWNER=2:
/
```

Example 5: A JLP problem definition with a report request for domains.

```
* SQ.MDL *

* MAXIMUM SUSTAINED YIELD
*  - using domain definition for reporting
```

```
xvar   x0804,x4804,x0537>
,x0700,x1700,x2700,x3700,x4700>
,x0697,x1697,x2697,x3697,x4697>
,x1090,x2090,x3090,x4090>
,x1195,x2195,x3195,x4195>
,x1193,x2193,x3193,x4193>
,x1370,x2370,x3370,x4370>
,x0800,x4800

prob SQ - MAXIMUM SUSTAINED YIELD, 4%

x0804 max
* non-declining cutting removals
x2195-x1195>0
x3195-x2195>0
x4195-x3195>0

* non-declining saw timber removals compared to first sub-period
x2193-x1193>0
x3193-x1193>0
x4193-x1193>0

* non-declining net revenues
x2370-x1370>0
x3370-x2370>0
x4370-x3370>0

* 20 % higher net present value at the end of the calculation period
* is assumed here to guarantee the sustainable yield level beyond
* the calculation period
x4804-1.2*x0804>0
/

* domains for reporting
show/domain
REGION=WR:
DISTRICT=F2:
/
```

Example 6: A JLP problem definition with collective variables.

```
* PDC.MDL *

xvar    x0804, RC..1, RC..2, aspen=RC[S=5]..1>
        , sawntimber=RC[EV=28][S=1]..1
prob    Loghouse project
x0804 max
RC..2 - RC..1 > 0
aspen > 5 < 10
sawntimber ≥ 100
```

Example 7: A JLP problem definition with category definitions and references to Pmax functions.

```
xvar x0804>
,vb1=V[s=3,4]..1,vb2=V[s=3,4]..2>
,vb3=V[s=3,4]..3,vb4=V[s=3,4]..4>
,vb..1=Pmax(V[s=3,4]..1,V[s=3,4]..1,node..1)>
,vb..2=Pmax(V[s=3,4]..2,V[s=3,4]..2,node..2)>
,vb..3=Pmax(V[s=3,4]..3,V[s=3,4]..3,node..3)>
,vb..4=Pmax(V[s=3,4]..4,V[s=3,4]..4,node..4)

prob Volume margins of the spruce

x0804 max

* Volume of the spruce must be over
* 400 m3 in every period
vb..1-vb1>400
vb..2-vb2>400
vb..3-vb3>400
vb..4-vb4>400
/
```

Stand management files (mps and mpu type files)

Functions

In MELASIM: Stand management files (**mpu** type files) are used to store variables of the management schedules of the management units. With this file management schedules can be transferred to other programs or user's database. Notice that in MELASIM only **mpu** type file is available.

In MELAOPT: Stand management files (**mps** and **mpu** type files) are used to transfer management unit variables from MELASIM via/from MELAOPT to user programs, for example, for printing stand level management reports and for returning stand management proposals to user's forest database. Stand management files contain also information about the selected management schedules for management units in MELAOPT. Either **mps** type files or **mpu** type files can be generated in the same MELAOPT session.

File type	System file
Default naming	In MELASIM: MPU: forestry_unit_S.**MPU** In MELAOPT: MPS: forestry_unit_sub_unit_problem.**MPS** MPU: forestry_unit_sub_unit_problem.**MPU**
Default unit	In MELASIM: MPU: 17 In MELAOPT: MPS: 26 MPU: 70
File parameters	MPS: Binary file, sequential, fixed length MPU: Text file, sequential, fixed or user defined length
Valid records	MPS: Management report binary records (MSB format type 4) MPU: Management report text records
Program/command	**MELAOPT** → REPORT SUMMARY

Controlling parameter(s)

In MELASIM:
MPS_VARIABLES,
MPU_FORMAT

In MELAOPT:
MPS_VARIABLES,
STAND_MANAGEMENT_FILES,
MPU_FORMAT

Input for

User programs

Generation

In MELASIM: parameter MPS_VARIABLES is used to generate **mpu** type files. Notice that **mpu** file is always created if MPS_VARIABLE parameter is defined in simulation. This must be taken into account, because file size may grow very big. In simulation every simulated management schedule is written in to the file. User can adjust how many schedules he wants per calculation unit, this can be done two ways; 1) by adjusting item 8 of the SIMULATION_CONTROL parameter, or 2) by defining special event definition in which only natural processes are defined.

In MELAOPT: command REPORT SUMMARY is used to generate **mps** or **mpu** type files. For the control of generating **mps** and **mpu** type files in MELAOPT, see the STAND_MANAGEMENT_ FILES parameter.

The MPS_VARIABLES parameter selects the variables of management report records for storing into the **mps** or **mpu** type files.

See also the MSD_VARIABLES and MSR_VARIABLES parameters that control the storing of information in MELASIM from decision data records and simulation records into **msc** and **msd** type files.

It is also possible to store c-variables from management unit records (from **rsd/rsu** type files) (from MELA2005 version) and collective variables (from MELA2009 version) into the **mps** or **mpu** type files.

User defined design and layout of the text type stand management file (**mpu** type file) is defined by the MPU_FORMAT parameter (from MELA2005).

Instructions

For the processing of binary **mps** type files in user programs, see examples in the sections MELA Standard Binary Records (MSB). The order of the variables in management report records is defined by the MPS_VARIABLES parameter.

See also

MELA files

Management report record
MELA Standard Binary Records (MSB)

REPORT command

MPS_VARIABLES parameter
MSD_VARIABLES parameter
MSR_VARIABLES parameter
MPU_FORMAT parameter
SIMULATION_CONTROL parameter
STAND_MANAGEMENT_FILES parameter

Decision data variables (MSD variables)
Collective variables

Cost of change report files (mrg type files)

Functions

A cost of change (increase or decrease) report is generated from the JLP problem solved in a MELAOPT session and is stored by request in an **mrg** type file.

File type	System file
Default naming	forestry_unit_sub_unit_problem.**MRG**
Default unit	63
File parameters	Text file, sequential, variable length
Valid records	Text rows generated from the JLP cost of change information
Program/command	**MELAOPT** -> REPORT MARGINALS
Controlling parameter(s)	-
Input for	User interpretation

Generation

For the generation of cost of change reports into **mrg** type files in MELAOPT, see the REPORT MARGINALS command.

Instructions

For the potential use of cost of change information, see Lappi (1992). Cost of change reports are final documents for user interpretation. For example, print or display the cost of change report in another window during the analysis process. See example 1.

See also

MELA files
MELAOPT command REPORT MARGINALS

Examples

Example 1: A MELAOPT MARGINALS report.

```
 P3 KUVIO2
================================================================================
<>MELA<>   KUVIO2  - all:
           P3-CUTTING POTENTIAL-NPV 3 %     optimi (optimum solution)
--------------------------------------------------------------------------------
                                    1990    2000    2010    2020    2030    2040
--------------------------------------------------------------------------------
     - cost of incr.             ********                            0.295
803   NPV 3 %                     5174.1                           12745.5
    - cost of decr.               1.000                             0.018
----------------------------------------------------------------------
    - cost of incr.             ********
537   Forestry land area             2.0
    - cost of decr.             ********
----------------------------------------------------------------------
    - cost of incr.             ********   1.629   2.466   5.184   5.895
700   Volume, m3                   161.6   147.2   238.8   340.6   449.6
    - cost of decr.             ********** 113.940   1.805   0.427
----------------------------------------------------------------------
    - cost of incr.             ********  63.681  16.598  11.290  17.076
697   -saw log                       0.0     3.2    11.4    40.7    95.3
    - cost of decr.             ********************************   2.520
----------------------------------------------------------------------
    - cost of incr.                141.602 163.594 603.557 1741.24
090   Increment, m3/a                9.1     9.2    10.3    11.0
    - cost of decr.               ********** 147.141  41.773
----------------------------------------------------------------------
    - cost of incr.               ********  17.768  21.449   4.884
195   Cutting removal, m3/a            9.8     0.0     0.0     0.0
    - cost of decr.                19.122************************
----------------------------------------------------------------------
    - cost of incr.               ******** 655.894 371.148  33.395
193   -saw log                         0.1     0.0     0.0     0.0
    - cost of decr.                1497.46************************
----------------------------------------------------------------------
    - cost of incr.               ********   1.142   1.190   0.220
370   Net revenues, €/a             146.9     0.0     0.0     0.0
    - cost of decr.                  1.281************************
----------------------------------------------------------------------
    - cost of incr.             ********                            0.162
800   Roadside value,€          4062.9                           14406.1
    - cost of decr.             ********                            0.013
----------------------------------------------------------------------
```

Management schedule files (msc and msd type files)

Functions

Management schedule files (**msc** and **msd** type files) are used to store and transfer by request the selected decision data variables from MELASIM to MELAOPT.

msc type files contain the introduction of management schedule data and **msd** type files management schedule data. The management schedule files may optionally contain also:

- a collection of management unit or sample plot variables from simulation records at selected points of time for MELAOPT reports and for transmission to the user's database, and
- re-simulation instructions for management schedules (see also **sms** type files).

File type	System file
Default naming	Sub_unit.**MSC/MSD**
Default unit	10 (**msc** type files), 11 (**msd** type files)
Contents	Decision data, management schedules, simulation instructions
Program/command	**MELASIM**→SIMULATE
Controlling parameter(s)	MSD_VARIABLES, MSR_VARIABLES, FOREST_REPORT, OUTPUT
Input for	**MELAOPT**

Generation

For the generation of **msc** and **msd** type files in MELASIM, see the item (1) of the OUTPUT parameter.

Instructions

For the selection of decision data variables, see the MSD_VARIABLES and FOREST_REPORT parameters.

For the selection of management unit variables, see the MSR_VARIABLES parameter.

For the generation of re-simulation instructions, see the RE_SIMULATION_ INSTRUCTIONS parameter.

The decision data variables for storing should be selected in accordance with the optimisation problems and with the most urgent reporting needs in order to minimize the need of disk space. Consider re-simulation reports for the details not provided directly by decision variables and MELAOPT solutions.

Notes

1. **Msc** and **msd** type files should be processed with MELA routines only.

2. In the re-simulation, the generation of management schedule files is usually not necessary, see the item (1) of the OUTPUT parameter. Notice that the original (management unit level) management schedule files are overwritten in re-simulation. Rename the original management schedule files before re-simulation, if necessary.

3. For the storing of MELAOPT forest level solution summaries in the form of MELA management schedule files for further reports and analyses, see forest level summary files (**msc** and **msd** type files).

4. Due to the changes of MELA files the **msc** and **msd** type files produced using predecessors of MELA2002 cannot be used in MELA2009.

See also

MELA files

Decision data variables (MSD variables)

Forest level summary files (**msc** and **msd** type files)
Standwise simulation instruction files (**sms** type files)

Item (1) of the OUTPUT parameter
MSD_VARIABLES parameter
MSR_VARIABLES parameter
FOREST_REPORT parameter
OUTPUT parameter
RE_SIMULATION_ INSTRUCTIONS parameter

Forest level summary files (msc and msd type files)

Functions

The forest level summary of all decision data variables available in MELASIM and in MELAOPT is stored by request in forest level summary files (**msc** and **msd** type files). Forest level summary files are used for storing MELAOPT solutions in binary form for further processing.

Msc type files contain the introduction of summary data and **msd** type files contain the summary data in a comparable form with management schedule data.

File type	System file
Default naming	forestry_unit_sub_unit_problem**_S.MSC/MSD** (MELASIM) forestry_unit_sub_unit_problem**_O.MSC/MSD (MELAOPT)**
Default unit	20 **msc** type files, 21 **msd** type files (MELASIM) 22 **msc** type files**,** 23 **msd** type files (MELAOPT)
Contents	Forest level summary of management unit level decision data
Program/command	**MELASIM→** SIMULATE **MELAOPT→**REPORT SUMMARY
Controlling parameter(s)	MSD_VARIABLES, FOREST_REPORT, OUTPUT
Input for	**MELAOPT**

Generation

For the generation of forest level summary (**msc** and **msd** type) files in MELASIM, see the item (2) of the OUTPUT parameter, and in MELAOPT, see the REPORT SUMMARY command. See also the MSD_VARIABLES and FOREST_REPORT parameter.

Instructions

Forest level summary files have use, for example, in the comparisons of different solutions and in further reports and analyses.

Notes

1. **Msc** and **msd** type files should be processed with MELA routines only.

See also

MELA files

Item (2) of the OUTPUT parameter
MSD_VARIABLES parameter
FOREST_REPORT parameter

MELAOPT command REPORT SUMMARY

Decision data variables (MSD variables)
Management schedule files (**msc** and **msd** type files)

Parameter definition files (par type files)

Functions

MELA parameter definition files (**par** type files) are used to store user-defined sets of MELA parameter values (and, in general, any relevant input lines) for submission to the MELA programs. Actual parameter values control the options and the execution of the MELA programs.

There are several default parameter files in MELA that have default names (see MELA commands and command arguments). Usually, users need to make and use their own parameter files.

File type	User file
Default naming	filename.**PAR**
Default unit	Several ones, for example 24
File parameters	Text file, sequential, variable length
Valid records	MELA input lines
Program/command	Text editor (or user program, if available)
Controlling parameter(s)	-
Input for	**MELASIM, MELAOPT**

Generation

par type files can be generated by a text editor or user programs.

Instructions

Both the general syntax and the details of MELA parameters are described earlier in this manual. The most important parameters and parameter files are mentioned in conjunction with the MELA programs (MELASIM and MELAOPT).

- automatically, for example, **MELA_SET.PAR**, see example 1,
- via MELA command arguments, see for example, the arguments of the MELASIM command SIMULATE, or

- with the MELA command INCLUDE during a session or in a **par** type file.

There are parameters that belong together and are usually stored in groups in separate parameter files, for example

- parameters defining MELA applications, for example **MS.PAR** in example 2,
- parameters controlling the simulation of events in a MELA application, for example, **MS_EVENT2006.PAR** in example 3, and
- decision hierarchy description, see the forestry_unit parameter and the decision hierarchy definition in the **FX.PAR** file in example 4.
- parameters defining summary reports, for example **REPORT.PAR** in example5.

Notes

1. A **par** type file may have also a user-defined extension in the file name (instead of default file extension '**par**') if the **par** type file appears in a user-supplied command INCLUDE in another **par** type file.

2. In the current version, event definitions are parameter definitions and they are provided in **par** type files. The file extension '**tpd**' was used in the names of event definition files in the early versions of MELA.

See also

MELA files

Introduction to MELA parameters
Parameter definitions
General syntax of MELA parameters

General MELA command INCLUDE
SIMULATE command arguments
SOLVE command arguments

EVENT parameter
FORESTRY_UNIT parameter
FOREST_REPORT parameter
classification parameter

Examples

Example 1: The common parameter file.

```
* MELA_SET.PAR *

* Default value for the FORESTRY_UNIT parameter

FORESTRY_UNIT#FX

* Names of the c variables in the demonstration data

C_VARIABLES#UNIT#AREA#SITE#MANAGEMENT#OWNER

* Remove following '*' signs for shorter file names than defaults
*
*FILE_NAMING
*#01 SUM _ FORESTRY_UNIT SUB_UNIT PROBLEM
*#20 MSC _ FORESTRY_UNIT SUB_UNIT PROBLEM
*#21 MSD _ FORESTRY_UNIT SUB_UNIT PROBLEM
```

Example 2: A parameter definition file for the simulation of alternative management schedules.

```
* MS.PAR *

YEARS                1 11 21 31 41

OUTPUT               1 1 0 0 0 0 0 0 0 0

SIMULATION_CONTROL 41 50 0 0 1000 0 1 999 0 0 500 0 0 0 151 0 0

INCLUDE MS_EVENT2000.PAR
```

Example 3: An event definition file for the simulation of alternative management schedules.

```
* MS_EVENT2006.PAR *  (excerpts)

*=====================================================
* DEFAULT VALUES FOR THE EVENT PARAMETER
*=====================================================
EVENT_DEFAULTS
#EVENT_YEARS                      6 10
#EVENT_INTERVALS                  10
#EVENT_BRANCHING                  1
#FEASIBLE_PRECEDESSORS            99
#FOREST_CATEGORIES                0
#EVENT_PROBABILITY                1
```

```
*=========================================================
* EVENT DEFINITIONS
*=========================================================


EVENT
#10 FIRST THINNING - NUMBER OF STEMS/HA INSTRUCTIONS
*---------------------------------------------------------
#COMPARABLE_EVENTS       20 25 27 28 29 50
#FEASIBLE_PRECEDESSORS   70 71 99
#FOREST_CATEGORIES       3 30 0 -3.99999
#EVENT_CALL  2 1  3 1 0 800 800 8 12 0 1500 1 0.5 0 0 0 0

EVENT
#20 THINNING - BASAL AREA INSTRUCTIONS
*---------------------------------------------------------
*#EVENT_YEARS                      0
#COMPARABLE_EVENTS       10 20 25 27 28 29 30
#FEASIBLE_PRECEDESSORS   70 71 99
#FOREST_CATEGORIES       3 30 0 -3.99999
#EVENT_CALL  2 1  1 1 0 4 2 10 1.5 0 1.5 0.9 0.5 0 0 0 0
#>>               0 0 0 0 1 1 1 1 0 0

EVENT
#25 OVER STORY REMOVAL
*---------------------------------------------------------
#EVENT_BRANCHING         0
#COMPARABLE_EVENTS       20 30

<clip>... The rest of the file was cut out... <clip>

* For the complete MS_EVENT2000.PAR file, see the MELA delivery pack*
*age
```

Example 4: A simple decision hierarchy definition.

```
* FX.PAR *

* Decision hierarchy levels of the forestry unit FX

 FX_LEVELS
#FX
#REGION
#DISTRICT

* The names of the members of each level
* in the decision hierarchy.

* Region level sub-units of FX

 FX
#SR Southern Region
#NR Northern Region
#WR Western Region

* District level sub-units of SR

 SR
#F1 District F1
```

```
#F2 District F2
#F3 District F3

* District level sub-units of NR

 NR
#F4 District F4
#F5 District F5

* Notice that WR has no lower level members.
```

Example 5: A summary report definition.

```
* REPORT.PAR

* Summary report description

FOREST_REPORT
#=
#>
#=
#<
#-
#=
#/TRAILING_NAME 1
# RL[EV.cm][s.ts]'(f6.3)'
#=
# RP[EV.cm][s.ts]'(f8.2)'
#=
# Total volume - x900'(f4.3)'
# Cutting area - x007'(f4.3)'
#*

classification
** ***********

* tree species

*-------
 ts
*-------
#1,7     pine
#2       spruce
#3=4     birch
#5,6,8   other deciduous
#>0      total
```

Initial data files (rsd type files)

Functions

The MELA programs read forest resource data from initial data files (**rsd** type files). The initial data files may contain two types of records:

- initial (sample plot level) data records of management units and
- management unit (c variable) records.

File type	User file
Default naming	sub_unit.**RSD**
Default unit	9
File parameters	Binary, sequential, variable length
Valid records	Initial data records (MSB format type 1), Management unit (c variable) records (MSB format type 2)
Program/command	User programs
Controlling parameter(s)	-
Input for	**MELASIM, MELAOPT**

Generation

An **rsd** type file contains the initial (sample plot level) data of

- a single, one level forestry unit, or
- one lowest level member (sub-unit) of a hierarchical forestry unit.

The initial data files can be generated by user programs or by MELA stand data extensions. The MELA programs change the sample plot data records from **rsd** type files into simulation records in the beginning of the simulation.

See note 1.

Instructions

The MSB format records in initial data (**rsd** type) files may have several logical MELA records in one physical record. For the logical records, see the initial data record and the management unit (c variable) record. See also the structure of the physical (MSB format) record.

The initial data records belonging to the same management unit must follow each other. Management units should be in ascending order subject to the identification number of the management unit, see the sample plot variable (1) of the initial data record.

Notes

1. The number of management units in an **rsd** type file must not exceed the capacity of the MELA program version (usually 1 000 - 100 000). If the number of management units exceeds the capacity of the program, try hierarchical forestry units or change the program version.

2. Number of c variables in management unit records must be consistent with the number of variables in C_VARIABLES parameter definition in MELAOPT.

3. Management unit record is optional, but when used it must be provided for every management unit.

See also

MELA files

Initial data record
Initial data record variables (RSD variables)
Management unit record

Program MELASIM
Program MELAOPT
C_VARIABLES parameter

MELA Standard Binary Records (MSB)

Examples

Example 1: An example of the **rsd** type file.

```
# Management unit record
# user defined c-variables
1.000000 2.000000 3.000000
# Initial data record
34.000000 # number of sample plot variables
```

```
# sample plot variables
1.000000 1998.000000 0.298000 0.298000 6903.000000 280.000000
1.000000 110.000000
1154.000000 2.000000 1.000000 1.000000 2.000000 2.000000 1.000000
0.000000 0.000000
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
0.000000 0.000000 3.000000 860.000000 0.000000 0.000000 0.000000
0.000000
3.000000 # number of trees
17.000000 # number of tree variables
# tree data
10.393796 1.000000 35.000000 22.500000 70.000000 84.000000 0.000000
0.000000
0.000000 0.000000 1011.000000 0.000000 0.000000 0.000000 0.000000
1.000000 0.000000
19.441668 2.000000 34.221985 19.739126 70.000000 86.000000 0.000000
0.000000 0.000000
0.000000 2011.000000 0.000000 0.000000 0.000000 0.000000 1.000000
0.000000
15.592427 2.000000 36.665955 20.251345 70.000000 86.000000 0.000000
0.000000 0.000000
0.000000 2021.000000 0.000000 0.000000 0.000000 0.000000 1.000000
0.000000
```

Records in this example is converted into ASCII format and comments and line feeds are added to illustrate the meaning of some values. Normally **rsd** file is binary file and its contents cannot be viewed in this way.

Note that records in this example illustrates contents of records in **rsd** type files and are not in MSB format. See MELA Standard Binary records for same example in MSB format.

Management schedule report files (sch type files)

Functions

The report displaying the management schedules selected in the optimum solution in MELAOPT is stored by request in a Management schedule report file (**sch** type file).

File type System file

Default naming forestry_unit_sub_unit_problem**.SCH**

Default unit 64

File parameters Text file, sequential, variable length

Valid records Text rows displaying management schedules in an optimum solution

Program/command **MELAOPT** -> REPORT SCHEDULES

Controlling parameter(s) -

Input for User interpretation

Generation

For the generation of a management schedule report into an **sch** type file in MELAOPT, see the REPORT SCHEDULES command.

Instructions

Management schedule reports are documents for user interpretation. For example, print or display the management schedule report in another window during the analysis process. See example 1.

See also

MELA files
MELAOPT command REPORT SCHEDULES

Examples

Example 1: A MELAOPT SCHEDULES report.

```
* FX_S4.SCH * (excerpts)
-----------------------------------------------------
SCHEDULES OF OPTIMUM SOLUTION          98
                    #FU  #SU  #MU  #SS   S/M
               FX     1    1    1    6  1.00
               FX     1    1    2    9  1.00
               FX     1    1    3   23  1.00
               FX     1    1    4    1  1.00
               FX     1    1    5   10  1.00
               FX     1    1    6    1  1.00
               FX     1    1    7    5  1.00
               FX     1    1    8    2  1.00
               FX     1    1    9    1  1.00
               FX     1    1   10    1  1.00
               FX     1    1   11    8  1.00
               FX     1    1   12    1  1.00
               FX     1    1   13    5  1.00
               FX     1    1   14   10  1.00
               FX     1    1   15    1  1.00
               FX     1    1   16    1  1.00
               FX     1    2   17    5  1.00
               FX     1    2   18    1  1.00
               FX     1    2   19   21  1.00
               FX     1    2   20    5  1.00
* <clip>... Part of the report was cut out ... <clip>
               FX     1    5   77    1  1.00
               FX     1    5   78    2  1.00
               FX     1    6   79    1  1.00
               FX     1    6   80   13  1.00
               FX     1    6   81    3  1.00
               FX     1    6   82   17  1.00
               FX     1    6   83   25  1.00
               FX     1    6   84    9  1.00
               FX     1    6   85   27  1.00
               FX     1    6   86    1  0.66
               FX     1    6   86    4  0.34
               FX     1    6   87    1  1.00
               FX     1    6   88    4  1.00
               FX     1    6   89    1  1.00
               FX     1    6   90    2  1.00
               FX     1    6   91    5  1.00
               FX     1    6   92    3  1.00
-----------------------------------------------------
FU   =  name of the forestry unit
#FU  =  number of the forestry unit
#SU  =  number of the lowest level sub-unit
#MU  =  number of the management unit
#SS  =  number of the selected management schedule
S/M  =  proportion of the selected management schedule in the
solution
```

Shadow price report files (shp type files)

Functions

The report displaying the shadow prices of the constraints in the optimum solution in MELAOPT is stored by request in a Shadow price report file (**shp** type file).

File type	System file
Default naming	forestry_unit_sub_unit_problem**.SHP**
Default unit	62
File parameters	Text file, sequential, variable length
Valid records	Text rows displaying shadow prices of constraints in an optimum solution
Program/command	**MELAOPT** → REPORT SHADOW_PRICES
Controlling parameter(s)	-
Input for	User interpretation

Generation

For the generation of the shadow price report into an **shp** type file in MELAOPT, see the REPORT SHADOW_PRICES command.

Instructions

Shadow price reports are final documents for user interpretation. For example, print or display the shadow price report in another window during the analysis process. See example 1.

See also

MELA files
MELAOPT command REPORT SHADOW_PRICES

Examples

Example 1: A MELAOPT SHADOW_PRICES report.

```
T3_S4.SHP
MELA2005 01.08.2005 (ver-2005-p1) - Testaus - Digital - USB -
================================================================================
T3  - all:
=>  **  H50_KALIBROINTI ** GROWTH_CALIBRATION ** VOLUME_CALIBRATION **
S4-SUURIN KESTÄVÄ HAKKUUMÄÄRÄ-NTN 4% - optimi (optimum solution)
================================================================================
                                  2001    2011    2021    2031    2041    2051
--------------------------------------------------------------------------------
 537   Forestry land area          29.3
     - shadow price               0.000
--------------------------------------------------------------------------------
 090   Increment, m3/a                118.4   147.3   221.3   261.8
     - shadow price                 0.000   0.000   0.000   0.000
--------------------------------------------------------------------------------
 195   Cutting removal, m3/a           83.1   114.5   134.5   160.4
     - shadow price                 0.000   0.000   0.000   0.000
--------------------------------------------------------------------------------
 193   -saw log                        51.6    51.6    51.6    54.7
     - shadow price                -34.045  13.303  20.741   0.000
--------------------------------------------------------------------------------
 370   Net revenues, €/a            2171.8  3672.9  4128.0  4428.8
     - shadow price                 0.000   0.000   0.000   0.000
--------------------------------------------------------------------------------
 800   Roadside value,€        75685.0                          127224
     - shadow price               0.000                            0.000
--------------------------------------------------------------------------------
 804   NPV 4 %                  94714.1                            142885
     - shadow price               1.000                            0.000
--------------------------------------------------------------------------------


-------------------------------------------------------------------
                         row               value        shadow price
-------------------------------------------------------------------
                         OBJ           94714.106               1.000
                  x2195-x1195              31.377               0.000
                  x3195-x2195              20.058               0.000
                  x4195-x3195              25.846               0.000
                  x2193-x1193               0.000             -13.303
                  x3193-x1193               0.000             -20.741
                  x4193-x1193               3.027               0.000
                  x2370-x1370            1501.063               0.000
                  x3370-x2370             455.141               0.000
                  x4370-x3370             300.759               0.000
-------------------------------------------------------------------
```

Simulation record files (smr type files)

Functions

MELA simulation records from MELASIM can be stored by request in simulation record files (**smr** type files) in order to transfer them later to other programs. These records can be used as input data for simulation in MELASIM, e.g. in the case of pre-simulation when updating the initial data, or for further calculation with user programs.

File type System file

Default naming sub_unit.**SMR**

Default unit 16

File parameters Binary, sequential, variable length

Valid records MELA simulation records (MSB format type 3)

Program/command **MELASIM→** SIMULATE

Controlling parameter(s) OUTPUT

Input for User programs, **MELASIM**

Generation

See the item (9) of the OUTPUT parameter for the generation of **smr** type files.

Instructions

Simulation records can be stored in an **smr** type file from one or several points of time.

If **smr** type files are used as initial data for simulation, it is necessary to change the file extension 'SMR' to 'RSD' using the rename file command on your operating system.

Notes

1. The simple naming of **smr** type files implies that each file is renamed before the generation of the next one in the case of several overlapping **smr** type files for one sub-unit.

2. The size of **smr** type files may grow large if there are lots of management units and the simulation records are stored at several points of time.

3. Management unit records are currently not stored in **smr** type files, limiting the applicability of the **smr** type files as forest resource data.

See also

MELA files
MELA Standard Binary Records (MSB)
Simulation record
Simulation record variables (SMR variables)
Item (9) of the OUPUT parameter
Initial data files (**rsd** type files)

Standwise simulation instruction (sms type files)

Functions

In addition to the general event definitions in parameter definition files (**par** type files) for the automated simulation of events, several kinds of detailed simulation instructions for individual management units can be provided via Standwise simulation instruction files (**sms** type files) to MELASIM.

Standwise simulation instructions (**sms** type) files are used for two main purposes:

- to transmit the user-supplied management proposals specific to each management unit to MELASIM
- to transmit the re-simulation instructions of the selected management schedules from MELAOPT to MELASIM

Standwise simulation instructions are also needed for updating stand data by other events than natural processes only.

.

File type	System file
Default naming	sub_unit_proposals**.SMS** (management proposals)
Default unit	69 (management proposals)
File parameters	Binary, sequential, variable length
Valid records	Simulation instruction records (MSB format type 5)
Program/command	**MELAOPT** → REPORT SUMMARY, user program
Controlling parameter(s)	-
Input for	**MELASIM**

Generation

User-supplied management proposals specific to each management unit are generated by user routines. MELA extensions for stand data help users in processing management proposals with stand data. For more information, contact the MELA Team.

Instructions

It is possible to provide one or several simulation instruction records for each management unit. Simulation starts with the standwise simulation instructions and can continue with the automated simulation of management schedules. For further information, see simulation instruction record.

See also

MELA files
MELA Standard Binary Records (MSB)

Simulation instructions record

Program MELASIM
Program MELAOPT
MELAOPT command REPORT SUMMARY

MELA Extensions

Solution report files (sol type files)

Functions

The short MELA report displays a forest level optimum solution for all the domains referred in the problem definition. Solution report is stored in MELAOPT by request in a solution report file (**sol** type file). The variables of the report are determined at the 'xvar' section in an **mdl** type file.

File type	System file
Default naming	forestry_unit_sub_unit_problem**.SOL**
Default unit	61
File parameters	Text file, sequential, variable length
Valid records	Text rows displaying variables of optimisation problem over time.
Program/command	**MELAOPT** → REPORT SOLUTION
Controlling parameter(s)	-
Input for	User interpretation

Generation

For the generation of the solution report into a **sol** type file in MELAOPT, see the REPORT SOLUTION command.

Instructions

Solution reports are documents for user interpretation. For example, print or display the solution report in another window during the analysis process. See example 1.

Notice the specific exponential expressions in MELA solution and summary reports. Bigger values than 7 digits are expressed by the notation *a***n* where *a* is a numerical value and *n* is 3 to 9 referring to the number of zeros to be added to the value *a*. For example, 12345*4 should be interpreted as 123 450 000.

Notes

1. For a more comprehensive forest level summary report on the basis of the management schedules selected in a MELAOPT solution, see the REPORT SUMMARY command and Summary report files (**sum** type files).

See also

MELA files

MELAOPT command REPORT SOLUTION
MELAOPT command REPORT SUMMARY

Summary report files (**sum** type files)
Problem definition files (**mdl** type files)

Examples

Example 1: A MELAOPT solution report for the domain defined by the command 'REPORT SOLUTION REGION=SR:'.

```
* FX_SQ.SOL*

 SQ FX
================================================================
 <>MELA<>   FX  - REGION=SR:
            S4R-MAXIMUM SUSTAINED YIELD,4%     ratkaisu on optimi
----------------------------------------------------------------
                           1996    2006    2016    2026    2036
----------------------------------------------------------------
 804 NPV 4 %              375421                            386980
 537 Forestry land area     82.4
 700 Volume, m3          10066.0  8762.5  8486.4  7966.2  8395.2
 697 -saw log             5271.4  4311.5  3881.1  3399.5  3552.5
 090 Increment, m3/a           410.0   399.2   422.8   475.9
 195 Cutting removal, m3/a     509.0   395.9   455.2   418.0
 193 -saw log                  318.8   252.1   246.4   243.2
 370 Net revenues, €/a     16804.8 12898.8 14034.5 12795.7
 800 Roadside value, €  389610                             302304
----------------------------------------------------------------
```

Summary report files (sum type files)

Functions

Forest level summary reports from MELAOPT and MELASIM are stored by request in summary report files (**sum** type files).

File type	System file
Default naming	forestry_unit_sub_unit_problem_**O.SUM** (MELAOPT) forestry_unit_sub_unit_problem_**S.SUM** (MELASIM)
Default unit	1
File parameters	Text file, sequential, variable length
Valid records	Text rows generated from forest level summary of decision variables
Program/command	**MELAOPT** → REPORT SUMMARY **MELASIM** → SIMULATE (see note 3)
Controlling parameter(s)	OUTPUT (in program MELASIM), FOREST_REPORT
Input for	User interpretation

Generation

Sum type files are generated from the forest level summary of decision variables over the calculation period. The FOREST_REPORT parameter describes the design, contents and layouts of forest level summary reports line by line.

For the generation of summary reports into **sum** type files

- in program MELASIM, see the items (2) and (5) of the OUTPUT parameter, and
- in program MELAOPT, see the REPORT SUMMARY command.

Instructions

Forest level summary reports are documents for user interpretation. For example, print or display the forest level summary report in another window during the analysis process. See example 1.

In the optimisation and in the re-simulation, forest level summary reports are generated from the management schedules selected in MELAOPT solutions.

In the re-simulation, summary reports are generated from the management schedules selected in the corresponding optimum solution.

Notice the specific exponential expressions in MELA solution and summary reports. Bigger values than 7 digits are expressed by the notation *a*n* where *a* is a numerical value and *n* is 3 to 9 referring to the number of zeros to be added to the value *a*. For example, 12345*4 should be interpreted as 123 450 000. Not calculated (i.e. runwise missing) variables and expressions containing incompatible or missing variables are shown by '..'. For further details of expressions, print each variable separately.

Notes

1. In MELAOPT, it may take much time to generate summary reports due to the size of management schedule files.

2. For a short summary of a MELAOPT solution, see also **sol** type files.

3. In the simulation of management schedules, summary reports are produced if only one management schedule per calculation unit is simulated (in re-simulation, for example). Summary reports generated by selecting the management schedule yielding the highest net present value with 3 % discount rate for each management unit without forest level constraints are not applicable, any more (since MELA2005).

See also

MELA files
OUTPUT parameter
FOREST_REPORT parameter
MELAOPT command REPORT SUMMARY
Solution report files (**sol** type files)

Examples

Example 1: The MELAOPT summary report of the problem P3 for the forestry unit RSD100_D.

```
31.12.2003 - Test - 210302      0 - 210302      0
================================================================================
RSD100_D - P3-CUTTING POTENTIAL-NPV 3 % - all:
================================================================================
                                 1998     2008     2018     2028     2038     2048
--------------------------------------------------------------------------------
FORESTRY LAND AREA, ha          146.8    146.8    146.8    146.8    146.8    146.8  - x537

TOTAL VOLUME, m3               8215.0  11455.3  14981.9  16996.8  20113.5  22604.6  - x700
. Pine                         6489.8   9538.9  13094.7  15308.2  18146.2  20189.6  - x684
```

. Spruce	1115.3	1322.9	1336.4	1249.2	1567.3	2098.4	- x688
. Birch	589.4	574.1	539.6	437.9	399.1	315.8	- x692
. Other deciduous	20.5	19.4	11.2	1.5	0.9	0.8	- x696
. Saw log	2472.4	2582.1	2173.4	1977.0	2539.5	3287.8	- x697
. Pulpwood	4768.6	6610.4	9257.2	11042.2	13562.4	15748.8	- x698
VALUE (roadside prices), €	251029	308042	358892	396833	487083	583670	- x800
NET PRESENT VALUE (NPV) 1%	1037668	1100352	1139721	1175753	1252613	1342975	- x801
NET PRESENT VALUE (NPV) 2%	413029	455283	475411	492113	551404	629415	- x802
NET PRESENT VALUE (NPV) 3%	242856	275773	287060	294006	344216	417717	- x803
NET PRESENT VALUE (NPV) 4%	168513	196330	202925	204057	248632	320934	- x804
NET PRESENT VALUE (NPV) 5%	127543	152040	155669	152525	192406	263999	- x805

	1998	2008	2018	2028	2038	2048	
INCREMENT, m3/a	520.8	608.0	591.4	571.5	561.2		- x090
. Pine	457.6	536.4	526.6	514.4	490.7		- x086
. Spruce	50.7	60.1	53.2	47.7	60.6		- x087
. Birch	11.9	11.2	11.4	9.3	9.8		- x088
. Other deciduous	0.7	0.4	0.1	0.1	0.1		- x089
TOTAL DRAIN, m3/a	196.8	255.3	389.9	259.8	312.1		- x350
. Mortality	19.9	38.3	61.6	76.9	86.3		- x365
. Cutting drain	176.9	217.0	328.3	182.9	225.8		- x340
CUTTING REMOVAL, m3/a	165.7	209.5	310.7	171.6	199.5		- x195
. Shelterwood cuttings	0.0	84.8	66.8	20.1	20.0		- x270
. Thinnings	59.9	21.5	111.0	52.7	101.9		- x260
. Regeneration cuttings	105.9	103.2	132.9	98.8	77.6		- x265
. Pine	130.1	142.4	239.4	152.2	186.6		- x183
. Spruce	28.9	57.2	55.7	13.7	3.9		- x186
. Birch	5.9	9.0	14.6	5.6	9.0		- x189
. Other deciduous	0.8	0.8	0.9	0.1	0.0		- x192
. Saw log	85.9	129.9	106.1	57.4	42.4		- x193
. Pulpwood	79.9	79.6	204.5	114.2	157.0		- x194
TOTAL CUTTING AREA ha/a	2.9	2.5	3.6	1.7	3.0		- OC[EV>0]
. Thinnings	1.9	0.6	2.3	0.7	2.1		- OC[EV=10<=11,20<=21]
. Clear cuttings	0.0	0.0	0.1	0.1	0.5		- OC[EV=30]
. Over story cuttings	0.0	1.3	0.7	0.3	0.4		- OC[EV=25]
. Seed tree cuttings	1.0	0.7	0.5	0.5	0.0		- OC[EV=27<=28]
. Shelterwood cuttings	0.0	0.0	0.1	0.0	0.0		- OC[EV=29]
COMMERCIAL CUTTING REMOVALS	165.7	209.5	310.7	171.6	199.5		- RC[EV>0][s>0]
. Thinnings	59.9	21.5	111.0	52.7	101.9		- RC[EV=10<=11,20<=21]
. Clear cuttings	0.0	0.0	7.7	0.0	77.6		- RC[EV=30]
. Over story cuttings	0.0	84.8	66.8	20.1	20.0		- RC[EV=25]
. Seed tree cuttings	105.9	103.2	107.4	98.8	0.0		- RC[EV=27<=28]
. Shelterwood cuttings	0.0	0.0	17.7	0.0	0.0		- RC[EV=29]
. Pine	130.1	142.4	239.4	152.2	186.6		- RC[s=1,7]
. Spruce	28.9	57.2	55.7	13.7	3.9		- RC[s=2]
. Birch	5.9	9.0	14.6	5.6	9.0		- RC[s=3=4]
. Other ceciduous	0.8	0.8	0.9	0.1	0.0		- RC[s=5,6,8]
SAW LOG REMOVALS	85.9	129.9	106.1	57.4	42.4		- RL[EV>0][s>0]
. Thinnings	21.9	4.9	14.6	8.2	14.1		- RL[EV=10<=11,20<=21]
. Clear cuttings	0.0	0.0	0.2	0.0	13.8		- RL[EV=30]
. Over story cuttings	0.0	62.6	53.4	12.6	14.5		- RL[EV=25]
. Seed tree cuttings	63.9	62.4	28.7	36.7	0.0		- RL[EV=27<=28]
. Shelterwood cuttings	0.0	0.0	9.2	0.0	0.0		- RL[EV=29]
. Pine	64.4	85.9	66.3	45.4	41.6		- RL[s=1,7]
. Spruce	19.6	42.3	37.5	11.2	0.8		- RL[s=2]
. Birch	1.7	1.4	2.1	0.8	0.1		- RL[s=3=4]
. Other ceciduous	0.3	0.3	0.2	0.0	0.0		- RL[s=5,6,8]
PULP WOOD REMOVALS	79.9	79.6	204.5	114.2	157.0		- RP[EV>0][s>0]
. Thinnings	37.9	16.6	96.4	44.5	87.8		- RP[EV=10<=11,20<=21]
. Clear cuttings	0.0	0.0	7.4	0.0	63.8		- RP[EV=30]
. Over story cuttings	0.0	22.2	13.4	7.5	5.5		- RP[EV=25]
. Seed tree cuttings	41.9	40.8	78.7	62.1	0.0		- RP[EV=27<=28]
. Shelterwood cuttings	0.0	0.0	8.6	0.0	0.0		- RP[EV=29]
. Pine	65.7	56.6	173.1	106.8	145.0		- RP[s=1,7]
. Spruce	9.4	14.9	18.3	2.4	3.1		- RP[s=2]
. Birch	4.3	7.6	12.5	4.9	8.9		- RP[s=3=4]
. Other ceciduous	0.5	0.5	0.7	0.1	0.0		- RP[s=5,6,8]
LOGGING COSTS	1560.1	1730.4	3116.3	1592.0	2201.9		- WC[EV>0]
. Thinnings	751.1	355.2	1614.9	687.4	1300.2		- WC[EV=10<=11,20<=21]
. Clear cuttings	0.0	0.0	82.1	0.0	746.9		- WC[EV=30]
. Over story cuttings	0.0	571.8	427.6	150.9	154.8		- WC[EV=25]
. Seed tree cuttings	809.0	803.4	865.3	753.7	0.0		- WC[EV=27<=28]
. Shelterwood cuttings	0.0	0.0	126.5	0.0	0.0		- WC[EV=29]
REGENERATION AREA, ha/a	1.0	0.7	0.6	0.5	0.2		- x035
. Artificial regeneration	0.0	0.0	0.0	0.0	0.2		- x015
. Natural regeneration	1.0	0.7	0.6	0.5	0.0		- x030
TENDING YOUNG STANDS, ha/a	1.0	1.3	0.7	0.5	0.8		- x008
GROSS REVENUES, €/a	6233.0	9056.8	11144.9	6100.9	6410.0		- x499
TOTAL COSTS, €/a	1867.7	1849.2	3227.9	1710.0	2538.6		- x474
NET REVENUES, €/a	4365.3	7207.5	7917.0	4390.9	3871.4		- x370

Volume table files (vol type files)

Functions

Volume table files (**vol** type files) contain the binary tables for stem volume and timber assortment calculations in MELASIM. The default tables are only applicable for the Finnish conditions.

File type System file

Default naming VOLUME.VOL

Default unit 71

Contents Specific stem and timber assortment volume tables

Controlling parameter(s) -

Input for **MELASIM**

Generation

The default volume table file **VOLUME.VOL** is provided with the MELA standard delivery.

The following estimates are found in the volume table on the basis of Finnish taper curve models and volume functions (Laasasenaho 1982):

- total volume of stem from stump height to top,
- volume of saw log section of stem,
- volume of pulpwood section of stem, and
- volume of residual section of stem above pulpwood section

for the tree species or species categories as a function of tree diameter and height.

The sum of saw log, pulpwood and residual sections always equals to the total volume of stem.

For changing the parameters of Finnish stem volume models, such as minimum log size, and for the generation of user-supplied stem volume tables, contact the MELA Team.

Notes

1. The stem volume calculation in MELASIM is based on volume tables because of the speed of execution, however resulting minor accuracy losses in interpolation.

See also

MELA files
LOG_VOLUME_REDUCTION parameter
VOLUME_CALIBRATION parameter
Tree species variable

Stand data text files (rsu type files)

Functions

Initial data text file (**rsu** type file) contains standwise forest resource data. This file is an input file for MELASIM program. Each management unit e.g. stand is described by a group of stand sample plot, stratum- and/or treewise information.

On the basis of the stand-, stratum- and/or tree data records, the simulation record (**smr**-record) including simulation tree data is generated.

FOREST_DATA_FILES parameter controls the reading of **rsu** and **smu** type files in MELASIM program.

File type	User created file
Default naming	Sub_unit.**RSU**
Default unit	66
File parameters	Text file, sequential access, variable length
Valid records	Management unit text record, stand data record, stratum data record, tree data record
Program/command	User routines.
Controlling parameter(s)	FOREST_DATA_FILES parameter
Input for	**MELASIM,** MELA extensions for the initial data conversion

Generation

Initial data text file is generated by user routines.

Instructions

In the initial data text file management unit may be one stand or stand represented by several (max. 10) sample plots. Same record types are used for both stand data and sample plot data.

Each management unit is represented by
1) optional management unit text record (variables, see note 1 and note 2)

followed either by one stand represented by
or by 1-10 sample plots, each represented by
2) 1 stand data records, and
3) either
   0-9 stratum data records
   or
   0-90 tree data records

See note 3, note 4, note 5, note 6 and note 7.

Notes

1. Management unit text record is optional, but when used, it has to be provided for every calculation unit.

2. Number of c variables in management unit text records must be consistent with the number of variables in C_VARIABLES parameter definition in MELAOPT

3. All records belonging to the same management unit have the same unit identification number.

4. Records belonging to the same management unit must follow each other.

5. All sample plots in the same management unit have the same unit identification number and contents of stand data record except land area (stand data record variable 9). Total land area of the management unit is the sum of the sample plot areas.

6. Data records are separated with line breaks. Variables within a record are separated with one or more spaces.

7. Stratum data records and tree data records should not be used in the same sample plot. One sample plot should contain either stratum data records or tree data records, never both of them. If sample plot contains stratum data records and tree data records, the program may work, but the results are unreliable.

See also

MELA files

Management unit text record
Stand data record

Stratum data record
Tree data record
Variables in stand data text file (RSU-variables)

Stand simulation instructions text files (**smu** type files)
Simulation record files (**smr** files)

FOREST_DATA_FILES parameter
C_VARIABLES parameter

MELA Extensions

Examples

Example 1: Management unit record, one stand data record and three tree data records.

```
123451234 4 3 1 2 3
123451234 1 13  4. 0 5 936 10.05.1996 2.510 6911650 3229510 0 1000 1 1 3 0 0 1.0 0 0 0 0 0 0 0 0 0 0 0 0 -1 -1
123451234 3 2 12 1 29.0  20.9  98.0 0.0  0.0  0.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  2   -1
123451234 3 2 6 1 28.0  22.9  98.0 0.0  0.0  0.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  2   -1
123451234 3 2 1 1 29.0  21.9  98.0 0.0  0.0  0.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  2   -1
```

Example 2: Management unit record and two sample plots.

```
123451234 4 3 1 2 3
123451234 1 13  4. 0 5 936 10.05.1996 1.255 6911650 3229510 0 1000 1 1 3 0 0 1.0 0 0 0 0 0 0 0 0 0 0 0 0 -1 -1
123451234 2 1  1  0.0 1650  1.0  1.0  10 0 -1 1 1 -1.0
123451234 2 2  2  0.0  700  1.0  2.0   6 0 -1 1 1 -1.0
123451234 1 13  4. 0 5 936 10.05.1996 1.255 6911650 3229510 0 1000 1 1 3 0 0 1.0 0 0 0 0 0 0 0 0 0 0 0 0 -1 -1
123451234 2 1  1  0.0 1350  1.0  1.0  10 0 -1 1 1 -1.0
123451234 2 2  2  0.0  800  1.0  2.0   6 0 -1 1 1 -1.0
```

Stand simulation instructions text files (smu type files)

Functions

Standwise instructions text file (**smu** type file) contains standwise simulation instructions. This file in an input file for the MELASIM program.

Simulation instructions control the simulation of events in MELASIM. The events can be:

- real treatments made after the date of the field inventory.
- recommended future treatments for the stands.

Treatments before the field inventory must be recorded in the **rsu** or **rsd** type file.

FOREST_DATA_FILES parameter controls the reading of **smu-** and **rsu**-type files in MELASIM-program.

File type	User file
Default naming	Sub_unit.**SMU**
Default unit	67
File parameters	Text file, sequential access, variable length
Valid records	Standwise simulation instruction records
Program/command	User routines
Controlling parameter(s)	FOREST_DATA_FILES, SMU_VARIABLES
Input for	**MELASIM,** MELA extensions for the simulation instruction conversion

Generation

Standwise instructions text file is generated with user routines.

Instructions

In the standwise instructions text file, each record defines a treatment for a stand at the given time. There can be 0 – 200 treatments for the same stand. The defined treatments must be given at the order of execution.

This standwise instructions file is a text file. Instruction records are separated with line breaks. Variables within a record are separated with one or more spaces.

See also

MELA files

Stand simulation instructions record
Stand simulation instructions variables (SMU variables)

FOREST DATA FILES parameter
SMU VARIABLES parameter

Stand data text files (**rsu** type files)
Initial data files (**rsd** type files)

MELA Extensions

Examples

Example 1: Standwise simulation instructions for three stands. There is one record for the first stand, three records for the second stands and one record for the third stand. The variables in these records correspond to the default value of the SMU_VARIABLES parameter.

```
123456789 11 0   0 2010 2 0 0
222222222 12 0   6 2005 0 0 0
222222222 12 5  11 2005 0 0 0
222222222 12 5  21 2005 0 0 0
123451234 13 5 100 2013 4 0 0
```

Updated stratum data text files (smt type files)

Functions

Forest resource data can be updated with MELASIM from the year of the field inventory to the desired year (usually the present year). Updated forest resource data can be written to the updated stand data text file (**smt** file), from which the data can be transferred to user's forest information system (data base).

Updated stand data are returned as updated stratum data records. Updating is done only to those strata, which can be found in **rsu** file. If all simulation trees of a stratum are removed in simulated cutting, no record of that stratum is returned. If new trees are born in updating simulation, information of those trees is not written to the **smt** file.

UPDATED_STAND_DATA_FILES parameter controls output to the **smt** file in MELASIM simulator.

File type System file

Default naming Sub_unit.**SMT**

Default unit 68

File parameters Text file, sequential access, variable length

Valid records Updated stratum records

Program/command **MELASIM**→SIMULATE,
MELA extensions for updating of stand data

Controlling parameter(s) UPDATED_STAND_DATA_FILES parameter
SMT_VARIABLES parameter
SMT_WEIGHTS parameter

Input for User programs

Generation

This file is generated by MELASIM extensions for updating of the forest resource data

Instructions

Updated stand data text file contains updated stratum records. One record has the variables of one tree stratum of a stand. There can be 0-9 records for one stand.

The records are separated with line breaks. Variables within a record are separated with one or more spaces.

See also

MELA files

Updated stratum data records
Updated stratum data variables (SMT variables)

UPDATED_STAND_DATA_FILES parameter
SMT_VARIABLES parameter
SMT_WEIGHTS parameter

Stand data text files (**rsu** type files)
MELA Extensions

Examples

Example 1: Updated stand data text file with tree stratum records for two stands, three records for each stand.

```
51845000500  1   43.00   23.00    1.13  313.27    8.29    5.65    3.73    1.89    0.00    0.20 2001.00
51845000500  2   43.00   23.00    6.30 1901.63    7.31    6.21   23.32   10.06    0.00    0.56 2001.00
51845000500  3   43.00   23.00    9.75 3655.71    6.58    6.31   33.46    7.58    0.00   -0.03 2001.00
51845005600  1   16.00    4.00    1.05   89.99   14.43   10.48    5.42    5.01    0.00    0.13 2001.00
51845005600  2  113.00   93.00   16.77  426.93   23.49   17.14  139.20  137.95   86.77    2.82 2001.00
51845005600  3   16.30    4.00    1.02   85.35   13.36   10.06    4.87    4.49    0.00    0.06 2001.00
```

Unit identifier (first variable) and stratum number (second variable) are stored automatically, other variables are selected with parameter SMT_VARIABLES. Variables in records correspond to default value of parameter SMT_VARIABLES.

RECORDS

MELA Standard Binary records (MSB format)

Introduction

MELA standard binary (MSB) records provide the standardized structure for binary MELA records in sequential MELA files (user and system files).

MSB format makes it possible to store several logical records in one physical record of the file as well as to store several types of records in the same file.

Generation

User programs or MELA programs generate files that contain MSB records. Input binary files for MELA programs must be Fortran-compatible (compiled using the same compiler as the MELA programs).

Unique management unit identifier (UID)

The unique management unit identifier (UID) is a user-supplied double precision number. UID can be used, for example, as a management unit level linkage to user's forest database when transporting data between MELA and user programs. See note 1.

Each of the physical MSB type records in the MELA system files has attached a UID.

Notice that a management unit may consist of several physical records – each having the same UID value.

Structure of MSB records

MSB records have the following general structure (lines with ”#”- mark are comments):

```
# header info
UID : double precision
total length of the physical record : integer
        # repeated part(s)
        logical record type : floating point
        length of the logical record : floating point
        # logical record(s)
        logical record(1..length of the logical record) : floating point
```

Notice that a logical record may correspond any of the MSB type records.

Notice that each physical record (with unique UID and total length of the physical record) can contain several repeated parts (logical records). One physical record may contain several types of logical records.

Total length of the physical record is calculated by the following principle (if the logical records are same type):

```
Total length of the physical record =
Total length of the all logical records + 2 * number of the logical
records
```

Records and files in MSB format

The following table shows MELA records that use MSB format, their logical record types and files in which they appear.

Logical record	Type	File types
Initial data record	1	Initial data files (**rsd** type files)
Management unit record	2	Initial data files (**rsd** type files)
Simulation record	3	Simulation record files (**smr** type files)
Management report record	4	Stand management files (binary) (**mps** type files)
Simulation instruction record	5	Standwise simulation instruction files (**sms** type files)

Instructions

MSB records should be written and read by user routines according to the principles shown in examples. Examples are written with Fortran95 language, but do not take examples as straight programming instructions, the main principle is more important to understand. Example 1 shows how to write MSB record into the file. Example 2 shows how to read MSB records from a binary file and write them into the text file. Example 3 shows an example of the **rsd** type file which is converted to the ASCII format to illustrate the structure of the MSB records.

Notes

1. Notice UID:s data type is double precision. In some programming and computer environments data type real*8 is exactly the same as double precision.

2. Users (users programs) must define right values for the UID:s, lengths of the physical records, lengths of the logical records, and the logical record types.

3. Unique management unit identifiers (UID:s) must always be in ascending order in the records.

See also

Identification number variable (UID)
Initial data record
Management unit record
Simulation record
Management report record
Simulation instruction record
Initial data files (**rsd** type files)
Simulation record files (**smr** type files)
Stand management files (**mps** and **mpu** type files)
Standwise simulation instruction files (**sms** type files)

Examples

Example 1: An example how to write MSB record into the binary file.

```
! Max length of the data vectors
     integer, parameter :: MAX_ITEMS = 1000

! Unique identifier of the physical record
     double precision :: UID

! Total length of the physical record
     integer :: nwp

! Logical record = vector that hold data
     real :: data1(MAX_ITEMS)

! Logical record type. In this example it is
! initial data record
     real, parameter :: R_IDR = 1

! Length of the logical record
     real :: len1

! Output filenames
     character(len=20) :: outfile

!    *****
! In this part values are given to the filename
! (outfile1), output channel (IO_1),
! data vector (data1) and length to the
! data vector (len1)
!    *****

! Open file for writing
     open(IO_1, file=outfile, status='NEW', format='UNFORMATTED')
! Calculate the length of the physical record
     nwp = len1 + 2
! Write one logical record into one physical record
```

```
     write(IO_1) UID,nwp,R_IDR,len1,(data1(i),i=1,len1)
```

Example 2: An example how to read MSB records from binary file and write them back to the text file.

```
! Max length of the data vectors
     integer, parameter :: MAX_ITEMS = 1000

! Unique identifier of the physical record
     double precision :: UID

! Total length of the physical record
     integer :: nwp

! Logical record = vector that hold data
     real :: data(MAX_ITEMS)

! Input and output filenames
     character(len=20) :: infile, outfile

!    *****
! In this part values are given to the filenames
! (infile, outfile), output and input channels (IO_1, IO_2)
! and data vector (data)
!    *****

! Open file for reading
     open(IO_1, file=infile, status='OLD', format='UNFORMATTED')
! Open new text file for writing
     open(IO_2, file=outfile, status='NEW', format='FORMATTED')

! Read all physical records from binary file
! and write them back into textfile
     do while (.true.)
                read(IO_1,end=1000)UID,nwp, &
                   (data(i),i=1,nwp))
                write(IO_2,*),UID,nwp, &
                    (data(i),i=1,nwp))
     end do

 1000           end
```

Notice that in this example the whole data read from the binary file is written back to the text file. This means that the written data includes UID:s of the physical records, lengths of the physical and logical records and types of the logical records.

Example 3: Example of the **rsd** type file that contains two physical records.

```
# 1. physical record
1.000000 # UID
13 # total length of the physical record
```

```
# now begins the repeated parts
2.000000 # logical record type (Management unit record)
11.000000 # length of the logical record
# => logical record (in this case user defined c-variables)
1.000000 1.000000 91.000000 5.000000 1.000000 0.000000 860.000000
1.000000 1.000000 2.000000 3.000000

# 2. physical record
1.000000 # UID (same management unit as in the 1. record)
90 # total length of the physical record
# now begins the repeated parts
1.000000 # logical record type (Initial data record)
88.000000 # length of the logical record
# => logical record (in this case Initial data record)
34.000000 # number of sample plot variables
# sample plot variables
1.000000 1998.000000 0.298000 0.298000 6903.000000 280.000000
1.000000 110.000000 1154.000000 2.000000 1.000000 1.000000 2.000000
2.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 3.000000 860.000000 0.000000 0.000000 0.000000 0.000000
3.000000 # number of trees
17.000000 # number of tree variables
# tree data (3 trees)
10.393796 1.000000 35.000000 22.500000 70.000000 84.000000 0.000000
0.000000 0.000000 0.000000 1011.000000 0.000000 0.000000 0.000000
0.000000 1.000000 0.000000
19.441668 2.000000 34.221985 19.739126 70.000000 86.000000 0.000000
0.000000 0.000000 0.000000 2011.000000 0.000000 0.000000 0.000000
0.000000 1.000000 0.000000
15.592427 2.000000 36.665955 20.251345 70.000000 86.000000 0.000000
0.000000 0.000000 0.000000 2021.000000 0.000000 0.000000 0.000000
0.000000 1.000000 0.000000
```

File in this example is converted into ASCII format and comments and line feeds are added to illustrate the meaning of some values. Normally **rsd** file is binary file and its contents cannot be viewed in this way. Type of the first physical record is 2 (management unit record) and type of the second physical record is 1 (initial data record). Notice that there is one logical record in both of the physical records.

Initial data record
(sample plots in **rsd** type files)

Functions

The initial data records are used to transfer user's forest resource data of sample plot form in **rsd** type file to simulation and to optimisation.

Structure

The initial data record is a floating-point vector with a following structure:

number_of_sample_plot_variables **sample_plot_data** [1..number_of_sample_plot_variables] number_of_trees number_of_tree_variables **tree_data**[1.. number_of_trees]

where **tree_data** is a repetitive part with a following structure:

data_of_current_tree[1.. number_of_tree_variables]

The logical record type for the binary initial data record (**rsd** type file) in MSB format is 1.

Variables

See variables of the initial data record.

Generation

Initial data records are created by user routines or by MELASIM-program (when **rsu** type files are used for forest resource data).

Instructions

The records in **rsd** type files are stored in the MSB format. Each initial data record in an **rsd** type file must contain the data of one sample plot. The sample plots belonging to the same management unit must follow each other, and the management units should be in ascending order according to the identification number (sample plot variable (1)) of the management unit.

Notes

1. The number and order of variables in the initial data record is fixed. The number of sample plot variables is 34 and the number of tree variables is 17. For more details see initial data record variables.

See also

Initial data record variables (RSD variables)
Initial data file (**rsd** type files)
Stand data text file (**rsu** type files)
MELA Standard Binary Records (MSB)

Examples

Example 1: Example of the initial data record.

```
# Initial data record
34.000000 # number of sample plot variables
# sample plot variables
1.000000 1998.000000 0.298000 0.298000 6903.000000 280.000000
1.000000 110.000000
1154.000000 2.000000 1.000000 1.000000 2.000000 2.000000 1.000000
0.000000 0.000000
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000
0.000000 0.000000 3.000000 860.000000 0.000000 0.000000 0.000000
0.000000
3.000000 # number of trees
17.000000 # number of tree variables
# tree data
10.393796 1.000000 35.000000 22.500000 70.000000 84.000000 0.000000
0.000000
0.000000 0.000000 1011.000000 0.000000 0.000000 0.000000 0.000000
1.000000 0.000000
19.441668 2.000000 34.221985 19.739126 70.000000 86.000000 0.000000
0.000000 0.000000
0.000000 2011.000000 0.000000 0.000000 0.000000 0.000000 1.000000
0.000000
15.592427 2.000000 36.665955 20.251345 70.000000 86.000000 0.000000
0.000000 0.000000
0.000000 2021.000000 0.000000 0.000000 0.000000 0.000000 1.000000
0.000000
```

Record in this example is converted into ASCII format and comments and line feeds are added to illustrate the meaning of some values. Normally initial data record is binary data and its contents cannot be viewed in this way.

Management unit record
(c variables in **rsd** type files)

Functions

Management unit records transfer management unit level classifications (c variables) to be used in optimisation, for example, in JLP domains and transformations. For more details on using c variables in optimisation, see Lappi (1992).

Since MELA2005 it has ben possible to use c variables in stand management files (**mps** and **mpu** type files).

Structure

The management unit record is a floating-point vector consisting of user-supplied management unit variables (c variables). The amount of the variables is optional.

management_unit_data (1...number_of_variables)

In the binary type initial data file (**rsd** type file) the management unit record is in MSB format and its logical record type is 2.

Variables

User provides the variables of management unit records. C_VARIABLES parameter is used to define the names of the c variables.

Generation

Management unit records are created and written to the files by user routines.

Instructions

Management unit records are provided in initial data file (**rsd** type files) one record for each management unit. Each management unit record must appear immediately before the initial data record of the management unit in question.

See also

Initial data file (**rsd** type files)
Problem definition files (**mdl** type files)
Stand management files (**mps** and **mpu** type files)

C_VARIABLES parameter
MELA Standard Binary Records (MSB)

Examples

Example 1: Example of the management unit data record. Values of the c-variables correspond to parameter definition 'C_VARIABLES#LAND_COVER#SITE#OWNER'.

```
# Management unit record
# user defined c-variables
1.000000 2.000000 3.000000
```

Record in this example is converted into ASCII format and comments and line feeds are added to illustrate the meaning of some values. Normally management unit record is binary data and its contents cannot be viewed in this way.

Simulation record

(management units in simulation and in **smr** type files)

Functions

The simulation record is the internal presentation of the management unit information. All sample plots belonging to the same management unit are collected from the initial data into a simulation record. Besides initial data variables, it contains summarized variables of the sample plot and management unit levels calculated from the sample tree and sample plot information. The simulation record changes dynamically over time in the simulation.

Structure

The simulation record is a floating-point vector with a following structure:

total_length_of_vector number_of_management_unit_variables **management_unit_data**[1..number_of_management_unit_variables] number_of_sample_plots **sample_plots**[1.. number_of_sample_plots]

where **sample_plots** is a repetitive part with a following structure:

number_of_sample_plot_variables (on current sample plot) **current_sample_plots_data**[1.. number_of_sample_plot_variables] number_of_trees (on current sample plot) number_of_tree_variables **tree_data**[1.. number_of_trees]

where **tree_data** is a repetitive part with a following structure:

data_of_current_tree[1.. number_of_tree_variables]

The logical record type for the binary simulation record (**smr** type file) in MSB format is 3.

Variables

See simulation record variables.

Generation

Simulation records are created by MELA routines.

Instructions

If necessary, simulation records can be stored in **smr** type files for further processing by other programs. The simulation data in **smr** type files may also be used as forest resource data for simulation, instead of initial data. However, the extension **smr** in the filename needs to be manually changed to the extension **rsd**. See note 1.

Notes

1. Management unit records are currently not stored in **smr** type files, limiting the applicability of the **smr** type files as forest resource data.

2. The number and order of variables in the simulation data record is fixed. The number of management unit and sample plot variables is 90 and the number of tree variables is 30. For more details see simulation record variables.

3. If one sample plot per logical record is stoud (see OUTPUT parameter item 9), only the parts related to sample plots and trees are written.

See also

Simulation record variables
Initial data record

Simulation record file (**smr** type files)
Initial data file (**rsd** type files)

MELA Standard Binary Records (MSB)

OUTPUT parameter
SIMULATION CONTROL parameter
YEARS parameter

Management report record
(management unit variables in **mps** or **mpu** type files)

Functions

The management report record is a collection of variables from the decision data record and from the management schedule record concerning the selected management schedules of a MELAOPT solution. The management report records are stored by the request either in binary (**mps**) or in text (**mpu**) type files for further processing in user routines, for example for transferring into the forest database.

Structure

The management report record is a fixed-length floating-point vector, either in binary or text format. Management report binary record in **mps** type files is in MSB format. Management report text record in **mpu** type files is simply text record as shown in figure 1. The logical record type for the binary type management report records in **mps** type files is 4.

```
   management_report_data
(UID,1...number_of_variables,proportion_of_schedule)
```

Figure 1. The structure of the management report record.

Variables

A management report record consists of user-defined selection (MPS_VARIABLES) of simulation (MSR_VARIABLES), user-defined selection (MPS_VARIABLES) of c-variables (C_VARIABLES) and decision (MSD_VARIABLES) variables. The first variable **'UID'** and last variable **`'proportion_of_schedule'`** is automatically reported.

Generation

Management report records are generated and stored in the MELAOPT program into either binary **mps** or text **mpu** type files.

Instructions

The MELAOPT command REPORT SUMMARY invokes the storing of the management report records if the MPS_VARIABLES parameter is defined in the run. The parameter STAND_MANAGEMENT_FILES directs the output either into **mps** or **mpu** type file.

Notes

1. All the values in the management schedule records are collected in the beginning of each year in question (before any events).

2. The variables in the management schedule records are expressed in per hectare values while the variables in the decision data records are expressed in absolute values for each management unit.

See also

REPORT SUMMARY command

MPS VARIABLES parameter
MSD VARIABLES parameter
MSR VARIABLES parameter
C_VARIABLES parameter
STAND MANAGEMENT FILES parameter

Stand management files (**mps** and **mpu** type files)
MELA Standard Binary Records (MSB)

Simulation instruction record

(for individual management units in **sms** type files)

Functions

Several kinds of detailed simulation instructions can be provided for each individual management unit in MELASIM, besides the general event definitions for simulation, either by using binary (**sms**) or text (**smu**) files. Binary type instructions are stored in the simulation instruction records of **sms** type files.

The general event definitions in **par** type files control the automated simulation of management schedules. Where found, the simulation instructions are obeyed instead or before the general event definitions. By means of the simulation instructions, the user can also control how the simulation instructions and general event definitions are combined.

Simulation instructions for individual management units are needed

- to simulate the management proposals provided in the field inventory, and
- to control the re-simulation of the selected management schedules.

Structure

The MELA simulation instruction record is a variable-length floating-point vector. The logical record type of simulation instruction records in MSB format files is 5.

```
simulation_instruction_data (1...number_of_variables)
(1) validity of the instruction record
'0' temporary, instructions are valid for the actual management unit only
'1' continuous, instructions are valid for all the following management
    units until a new simulation instruction record is found
(2) instruction category '0'
(3) record type '0'
repeated section(s) for each event to be simulated
(1) number of the items in this section (this item excluded)
(2) event_identification code
(3) branching instruction for this event
  '-1' branching or options are not not allowed
   '0' branching instruction from actual event definition is followed
   '1' branching or options are allowed
(4) relative or absolute year until which the simulation of natural
    processes continues (valid for natural processes or the basic event
    type 1 only)
```

Figure 1: The structure of the simulation instruction record.

Variables

Simulation instruction records for each management unit consist of user-defined information (figure 1).

Generation

Re-simulation instructions
In the simulation of management schedules, the simulation instructions for each management schedule are automatically generated and stored in **msd** type files by the request of the RE_SIMULATION_INSTRUCTIONS parameter. The simulation instructions for the selected management schedules in each MELAOPT solution are transferred using the REPORT SUMMARY command into **sms** type files and further for the re-simulation in MELASIM.

Instructions to simulate standwise management proposals
The binary (**sms**) instructions to simulate the management proposals provided in the field inventory have to be generated using auxiliary routines (contact the MELA Team for more information).

Instructions

Simulation instruction records can be provided also for some of the management units only. The order of the simulation instruction records in a **sms** type file must follow the order of the management units in a **rsd** type file.

In simulation instruction records, all the events appearing in the actual event definitions can be called, also those temporarily excluded from the automatically controlled simulation. As well, users may define dedicated events available via simulation instruction records, for example, specific management operations for user-specified management units.

Notes

1. Text type simulation instructions are provided with **smu** type files.

See also

Standwise simulation instruction files (**sms** type files)
Management schedule files (**msc** and **msd** type files)
REPORT SUMMARY command
SIMULATE instructions command
EVENT parameter
RE SIMULATION INSTRUCTIONS parameter
MELA Standard Binary Records (MSB)

Management unit text record
(c variables in **rsu** type files)

Functions

Management unit text records transfer management unit level classifications (c variables) to be used in optimisation, for example, in JLP domains and transformations. For more details on using c variables in optimisation, see Lappi (1992).

It is also possible to use c variables in stand management files (**mps** and **mpu** type files) (from MELA2005 version).

Structure

The optional management unit text record consists of header information (identifier, record type, number of c variables) and user-supplied management unit variables (c variables). The amount of the variables is optional.

unique_unit_identifier record_type '4' number_of_variables management_unit_data (1...number_of_variables)

The record type for management unit text record in stand data text file is **4**.

The management unit text record is a free format text record. Variables within a record are separated with one or more spaces.

Variables

User provides the variables of management text unit records. C_VARIABLES parameter is used to define the names of the c variables.

Generation

Management unit text records are created and written to the files by user routines.

Instructions

Management unit text record is optional. When used, management unit text records are provided in stand data text file (**rsu** type files) one record for each management unit. Each management unit text record must appear immediately before the stand, stratum and tree data records of the management unit in question.

Notes

1. The management unit text record correponds the management unit record in rsd type file.

2. Decimal point in real number variables is dot ('.').

See also

Stand data text file (**rsu** type files)
Problem definition files (**mdl** type files)
Stand management files (**mps** and **mpu** type files)

C_VARIABLES parameter
JLP Domain definitions

Examples

Example 1: Example of the management unit text data record.

```
123451234 4 3 1 2 3
```

First element is identifier for management unit, second element defines record type (4, management unit text record), and third element tells the number of the following c-variables. Last four elements are values of c-variables (of the management unit in question) corresponding to the C_VARIABLES#LAND_COVER#SITE#OWNER definition.

Stand data record
(stand data in **rsu** type files)

Functions

The stand data records are used to transfer user's forest resource data in initial data text file (**rsu** type file) to simulation. Stand data record contains general site information and treatment history variables of stands. No data of the trees is stored in this record.

Data of trees is stored in stratum data records and/or tree data records.

Structure

The stand data record is a free format text record with 32 variables in fixed order. Variables within a record are separated with one or more spaces.

stand_data[1..number_of_variables]

Variables

See stand data variables in the stand data record (RSU-variables).

Generation

Stand data records are created by user routines.

Instructions

In the initial data text file, each stand or sample plot is represented by
1) one stand data record
2) 0-9 stratum data records
3) 0-90 tree data records

There may be several samples for one stand (max 10 sample plots). All sample plots in the same stand have the same unit identification number and contents of stand data record except land area (stand data record variable 9). Total land area of the unit is the sum of the sample plot areas.

Initial data file is a text file. Data records are separated with line breaks. Variables within a record are separated with one or more spaces.

Notes

1. Decimal point in real number variables is dot ('.').

See also

Stand data text file (**rsu** type files)
Stand data record variables in the stand data text file (**rsu** type file)

Management unit text record
Stratum data record
Tree data record

Examples

Example 1: Stand data record in initial data text (**rsu** type) file.

```
123451234 1 13  4. 0 5 936 10.05.1996 1.255 6911650 3229510 0 1000 1 1 3 0 0 1.0 0 0 0 0 0 0 0
0 0 0 0 -1 -1
```

First element is identifier for the management unit and second element defines record type (1, stand data record). Last 30 elements are values for stand data.

Stratum data record
(stratum data in **rsu** type files)

Functions

The stratum data records are used to transfer user's forest resource data in initial data text file (**rsu** type file) to simulation. Stratum data record contains data from tree strata, i.e. variables describing a group of trees of same species and story.

Data from general site information and treatment history of stands is stored in stand data records.

Data of single trees is stored in tree data records.

Structure

The stratum data record is a free format text record with 14 variables in fixed order.

stratum_data[1..number_of_variables]

Variables

See stratum data variables in the stand data record (RSU-variables).

Generation

Stratum data records are generated by user routines.

Instructions

Initial data file is a text file. Data records are separated with line breaks.

In the initial data text file, each stand or sample plot is represented by
1) one stand data record, and
2) either
0-9 stratum data records
or
0-90 tree data records

See note 2.
One stratum data record contains variables for one tree stratum, i.e. variables for a group of trees belonging to the same tree species and story.

Initial data file is a text file. Data records are separated with line breaks. Variables within a record are separated with one or more spaces.

Notes

1. Decimal point in real number variables is dot ('.').

2. Stratum data records and tree data records should not be used in the same sample plot.

See also

Stand data text file (**rsu** type files)
Stratum data variables in the stand data text file (**rsu** type file)

Management unit text record
Stand data record
Tree data record

Examples

Example 1: Initial data text file with one stand data record and two stratum data records.

```
123451234 1 13  4. 0 5 936 10.05.1996 2.510 6911650 3229510 0 1000 1 1 3 0 0 1.0 0 0 0 0 0 0 0 0 0 0 0 -1 -1
123451234 2 1  1  0.0 1500  0.0  1.0  10 0 -1 1 1 -1.0
123451234 2 2  2  0.0  750  1.0  2.0   6 0 -1 1 1 -1.0
```

In each line first element is identifier for the management unit and second element defines record type (1 = stand data record, 2 = stratum data record). Last elements in each line are values for stand data record (first line) and stratum data record variables (last two lines).

Tree data record
(tree data in **rsu** type files)

Functions

The tree data records are used to transfer user's forest resource data in initial data text file (**rsu** type file) to simulation. Tree data record contains data for single trees provided by the user.

Data from general site information and treatment history of stands is stored in stand data records.

Data of tree stratums is stored in stratum data records.

Structure

The tree data record is a free format text record with 20 variables in fixed order.

tree_data[1..number_of_variables]

Variables

See tree data variables in the stand data record (RSU-variables).

Generation

Stratum data records are generated by user routines.

Instructions

In the initial data text file, each stand or sample plot is represented by
1) one stand data record, and
2) either
0-9 stratum data records
or
0-90 tree data records
See note 2.

One tree data record contains variables for one simulation tree. A tree represents a given number of stems/ha (see variable nr 4).

Initial data file is a text file. Data records are separated with line breaks. Variables within a record are separated with one or more spaces.

Notes

1. Decimal point in real number variables is dot ('.').

2. Tree data records and stratum data records should not be used in the same sample plot.

See also

Stand data text file (**rsu** type files)
Tree data variables in the stand data text file (**rsu** type file)

Management unit text record
Stand data record
Stratum data record

Examples

Example 1: Initial data text file with one stand data record and three tree data records.

```
123451234 1 13  4. 0 5 936 10.05.1996 2.510 6911650 3229510 0 1000 1 1 3 0 0 1.0 0 0 0 0 0 0 0 0 0 0 0 -1 -1
123451234 3 3 12 3 29.0  20.9  98.0 0.0  0.0  0.0  0.0  1.0  -1.0  0.0  0.0  0.0  0.0  2   -1
123451234 3 3  6 3 28.0  22.9  98.0 0.0  0.0  0.0  0.0  1.0  -1.0  0.0  0.0  0.0  0.0  2   -1
123451234 3 3  1 3 29.0  21.9  98.0 0.0  0.0  0.0  0.0  1.0  -1.0  0.0  0.0  0.0  0.0  2   -1
```

In each line first element is identifier for the management unit and second element defines record type (1 = stand data record, 3 = tree data record). Last elements in each line are values for stand data record (first line) and tree data record variables (last three lines).

Stand simulation instruction record
(simulation instructions in **smu** type files)

Functions

Stand simulation instruction records are used to transfer instructions of the events to be simulated as an input for MELASIM.

Events to be simulated can be:
- treatments made after field inventory and/or
- treatments suggested at the field inventory.

Events are used to control the progress of the simulation in MELASIM. If the data from the field inventory is not updated after completed forest management operations after the date of inventory, instructions to simulate the operations can be given in this record.

Treatments before the date of inventory must be recorded in forest resource data (**rsu** and **rsd** type files).

Structure

Stand simulation instruction record is a free format text record. Number of variables and the order of variables can be defined with SMU_VARIABLES parameter. The defaults value is 8 variables in order of the variables list.

stand_data[1..number_of_variables]

Variables

See stand simulation instruction variables (SMU-variables).

Generation

Stand data records are created by user routines.

Instructions

Each record contains simulation instructions for one event in one stand at the given year. Possible events are those described in event definitions (EVENT parameter).

There can be 0-200 records for one stand. Records (simulations instructions) must be given in order of execution.

Stand simulation instruction file is a text file. Data records are separated with line breaks. Variables within a record are separated with one or more spaces.

Notes

1. The use of extension for updating of stand data is limited when stand simulation instructions are provided.

See also

Stand simulation instruction text file (**smu** type files)
Stand simulation instructions variables (SMT variables)

SMU_VARIABLES parameter
SMU_EVENTS parameter
SMU_YEAR_CODES parameter
EVENT parameter

Initial data files (**rsd** type files)
Stand data text files (**rsu** files)

MELA Extension

Examples

Example 1: Stand simulation instructions for two stands**.** Variables in records correspond to default value of parameter SMU_VARIABLES.

```
222222222 12 0   6 2005 0 0 0
222222222 12 5  11 2005 0 0 0
222222222 12 5  21 2005 0 0 0
123451234 13 5 100 2013 4 0 0
```

Updated stratum data record
(Updated stratum data in **smt** type files)

Functions

Forest resource data can be updated with MELA-programs from the year of inventory to the desired year, which usually is the present year. Updated forest resource data can be written to the export file (**smt** type file), which can be read into the user's forest information system.

Forest resource data is updated only for those strata that can be found in the initial data text file (**rsu** type file). If all simulation trees from a stratum are removed in updating simulation because of cutting or natural mortality, no information from the stratum in question is written to the **smt** type file. No information is written from the trees born in the simulation either.

UPDATED_STAND_DATA_FILES parameter controls the output of **smt** type files in MELASIM.

Structure

Updated stand data record is a free format text record. MELASIM automatically stores unit identifier and stratum number as first and second variables in record. Number and order of other variables is defined with SMT_VARIABLES parameter. If the parameter is not given, the record contains 13 variables including 2 identification variables stored automatically and 11 variables according the default value of the SMT_VARIABLES parameter.

updated_stratum_data[1..number_of_variables]

Variables

See updated stratum data variables (SMT-variables).

Generation

Updated stand data records are generated by MELA routines

Instructions

Updated stand data record contains updated data for strata. One record contains data for one stratum in one stand. There can be 0-9 strata for one stand.

Updated stand data file is a text file. Data records are separated with line breaks. Variables within a record are separated with one or more spaces.

Notes

1. Number of the stratum refers to the respective stratum number in stratum data record in **rsu**-type files.

2. Values for some variables are weighted as defined in SMT_WEIGHTS – parameter.

See also

Updated stratum data text file (**smt** type files)
Updated stratum data variables (SMT variables)

SMT_VARIABLES parameter
SMT_WEIGHTS parameter
UPDATED_STAND_DATA_FILES parameter

Stand data text file (**rsu** type files)
Stand data record variables in the stand data text file (**rsu** type file)

Examples

Example 1: Tree stratum records for two stands, three records for each stand.

```
51845000500  1   43.00   23.00    1.13  313.27    8.29    5.65    3.73    1.89    0.00    0.20 2001.00
51845000500  2   43.00   23.00    6.30 1901.63    7.31    6.21   23.32   10.06    0.00    0.56 2001.00
51845000500  3   43.00   23.00    9.75 3655.71    6.58    6.31   33.46    7.58    0.00   -0.03 2001.00
51845005600  1   16.00    4.00    1.05   89.99   14.43   10.48    5.42    5.01    0.00    0.13 2001.00
51845005600  2  113.00   93.00   16.77  426.93   23.49   17.14  139.20  137.95   86.77    2.82 2001.00
51845005600  3   16.30    4.00    1.02   85.35   13.36   10.06    4.87    4.49    0.00    0.06 2001.00
```

Variables in records are unit identifier, stratum number, biological age, age at breast height, basal area, number of stems, mean diameter, mean height, current volume, volume of commercial timber, volume of saw timber, future increment and year of calculation**.** Unit identifier and stratum number are stored automatically, other variables are selected with parameter SMT_VARIABLES. Variables in records correspond to default value of parameter SMT_VARIABLES.

VARIABLES

General information

Variables may be categorized according to their role and function. First, there are *initial forest variables* that are read into MELASIM to compute a set of *simulation data variables*. Simulation data variables comprise a set of state and event variables related to natural processes, economy and technology. Second, there are *decision data variables* that are needed in the formulation of the optimisation problem and in the compilation of reports and summary tables.

The data storage model of MELA is built upon various types of MELA files. The variables are stored in system files (e.g. simulation records) and user files (e.g. stand simulation instructions). The contents of some files is controlled using parameter values.

Abbreviations for the different variable groups based on the MELA file types or parameter names in MELA are used to show the background of the variables in each group. For example, RSD variables and RSU variables refer to the initial forest variables in the **rsd** and **rsu** type files respectively. MSD variables refer to the list of decision data variables that can be further selected with MSD_VARIABLES parameter. MSR variables are the management unit variables of the simulation record controlled using MSR_VARIABLES parameter. The other groups are SMT variables (corresponding parameter SMT_VARIABLES), MPS variables (MPS_VARIABLES), SMU variables (SMU_VARIABLES), SMR variables (variables in the simulation record) and c variables (C_VARIABLES).

Parameterised data collection (PDC) is a feature introduced in MELA2002 including data collection requests for aggregated values of *collectible variables* resulting to a set of ***collective variables***. *Category variables* are used in the relational category expressions of these data collection requests. PDC enables the users to incorporate their own decision data variables to MELA. In the simulation, the data collection requests given in the FOREST_REPORT or COLLECTIVES parameter result in a set of collective variables available to be used as decision data variables, together with the conventional MSD variables requested using MSD_VARIABLES parameter. MSD variables are built-in and the list of variables is fixed. Collective variables are user-defined. Each collective variable contains a similar type of sub-period element structure as MSD variables. The Reference Manual lists a set of collectible variables, which can be tabulated multi-dimensionally in respect to the category variables given. Furthermore, the FOREST_REPORT parameter setting defines the information contents of the summary report concerning the optimum solution from MELAOPT. PDC is aimed to serve the user especially at optimisation and reporting phases.

Decision variables are divided in two gategory:

Collective variables
Decision data variables

Contents of the variable groups below are described:

Stand data text file variables (RSU variables)

Stand simulation instruction variables (SMU variables)
Initial data record variables (RSD variables)
Simulation record variables (SMR variables)
Updated stratum data variables (SMT variables)
Decision data variables (MSD variables)

Other variables are described by organizing them in following categories:

Natural process variables
Economy and technology variables
Enumerated variables
Miscellaneous variables

Notes

1. Decision data variables (also referred to as: MELA decision variables, decision variables) are called x variables in JLP terms. See Lappi (1992).

2. When the option TRAILING_NAME in the FOREST_REPORT parameter definition is enabled, the names of collective variables are printed at the ends of the data rows in the summary report.

3. The MSD variables that are needed in optimisation, reporting or as MPS variables, must be selected using parameter MSD_VARIABLES in the simulation.

4. Collective variables and their sub-period elements can be used as MPS variables (in MELA2009). In this case, collective variables must be selected using parameter FOREST_REPORT or/and COLLECTIVES in the simulation.

See also

Collective variables
MELA files
classification parameter
COLLECTIVES parameter
FOREST_REPORT parameter
MSD_VARIABLES parameter
MSR_VARIABLES parameter
MPS_VARIABLES parameter
SMT_VARIABLES parameter
SMU_VARIABLES parameter
C_VARIABLES parameter
OUTPUT parameter
STAND_MANAGEMENT_FILES parameter
UPDATED_STAND_DATA_FILES parameter
STAND_MANAGEMENT_FILES parameter
Problem definition files (mdl type files)

MELA variables

Variables introduced in this manual

Natural process variables	Age Basal area Diameter Height Height above sea level Increment Mortality Number of stems Temperature sum Total yield Volume
Economy and technology variables	Costs Cutting removal Drain Income/revenues/return Land value Logging residue Manpower Net present value Reduction of saw log volume Value Value increment
Enumerated variables	Drainage category Finnish forest taxation class or site fertility category Forest management category Land-use category Management category of the tree Method of last cutting Municipality code Origin Owner category Reduction of forest taxation class Simulated development class Simulated story Site type category Soil and peatland category Tree species
Miscellaneous variables	Area Branching instructions for a event Date Event identification code

Event identification number
Feasibility for drainage
Feasibility for natural regeneration
Identification number
Proportion
Random number
Type of instruction
Urgency category of management proposal
Validity of instruction record
Year

Decision variables

Collective variables

Function

Collective variables are results from the user-defined data collection requests in the FOREST_REPORT and/or COLLECTIVES parameter setting that has been included in the simulation and they have a similar type of sub-period element structure as MSD variables. Collective variables are available as decision data variables for the formulation of the optimisation problem, for reporting the optimum solution in MELAOPT and for reporting management schedules in MELASIM. The classifications in category expressions enable the generation of a set of many collective variables by a single data collection request.

General syntax of the data collection requests

The general syntax of the data collection requests is:

```
Collectible{[[category]]}
```

or formally:

```
A{[[c]]}
```

```
RC
RC[s=3,5]
```

A - collectible -	The name of the collectible variable in question, (see: Collectible variables).
'[]'	The delimiter pair of a category expression (implicitly denoting logical AND operation in case of multiple category expressions)
c - category -	A relational category expression, either:

- a reference to a classification, resulting (one or) multiple collective variables,

```
v.e
```

```
s.speciesI
s.speciesII
for the user-defined classifications speciesI and speciesII
```

v	The name of the category variable in question, (see: Category variables).
'.'	The delimiter of classification name.

e An existing classification name, see the actual classification parameters of your application.

or

- a category definition (cf. classification items), resulting a single collective variable

vr

```
EV=1
denotes EV.eq.1

s=3<=6,8
denotes s.ge.3.and.s.le.6 .or. s.eq.8
if expressed in conventional programming language (Fortran) style
```

v The name of the category variable in question, (see: Category variables).

r A relational expression (a list of single relations and ranges).

The two types of relational category expressions, category definitions and references to classifications, may appear intermingled. 0 to 20 relational category expressions in total are allowed for each data collection request. Category expressions are processed in the user-supplied order. This order tells the order of rows for the resulting collective variables and their verbal default explanations in the summary report, (see example 3 of the FOREST_REPORT parameter).

Names of the collective variables

Collective variables are established, named and stored to **msc** and **msd** type files automatically by MELASIM according the then active FOREST_REPORT and/or COLLECTIVES parameter definition. The name of each collective variable is determined by the respective data collection request. The classifications appearing in the data collection requests are automatically compiled into the respective collective variable names defined by the category combinations of the classification items. The name - and actually the definition - of a single collective variable is the respective data collection request itself, when expressed in a form that does not contain references to any classifications. The resulted names must be known for those collective variables, that are used in the formulation of the optimisation problem for MELAOPT (see note 1).

The naming of collective variable is similar to data collection request – expect that category expressions of type ‘`v.e`‘(category expressions with references to classifications) are not allowed.

The general syntax of the data collection requests is:

`Collectible{[[vr]]}`

or formally:

```
A{[[vr]]}
```

```
RC
RC[s=3,5]
```

A - collectible -	The name of the collectible variable in question, (see: Collectible variables).
'[]'	The delimiter pair of a category expression (implicitly denoting logical AND operation in case of multiple category expressions).
v	The name of the category variable in question, (see: Category variables)
r	A relational expression (a list of single relations and ranges).

Collectible variables

Collectible variables are the variables whose aggregated values are requested using data collection requests. The data collection requests are expressed using the necessary FOREST_REPORT and/or COLLECTIVES parameter value settings for simulation and for the reporting of the optimum solution. In MELA2009 collectible variables are divided in two main categories:

- **state variables** are total figures at the beginning and end of the calculation period at the intermittent points of the sub-periods
- **event variables** are annual average figures for sub-periods

The collectible variables and the valid category variables for each of them are listed below. New collectible variables in MELA2009 are marked with '2009' and new variables in MELA2009 2nd edition are marked with '2011'.

State Variables

Collectible variable	Valid category variables	Explanation
G 2011	s,d,LU,SO,ST,FM	Basal area of growing stock, m^2
N 2011	s,d,LU,SO,ST,FM	Number of stems
P	s,LU,SO,ST,FM	Roadside price value, €
PS	s,LU,SO,ST,FM	Stumpage price value, €
O	Sp1,Dp1,Ap1,LU,SO,ST, FM	Land area, ha
V	s,d,LU,SO,ST,FM	Volume of crowing stock, m^3
VC	s,d,LU,SO,ST,FM	Commercial volume, m^3
VL	s,d,LU,SO,ST,FM	Saw log volume, m^3
VP	s,d,LU,SO,ST,FM	Pulpwood volume, m^3
VR	s,d,LU,SO,ST,FM	Cutting residue volume, m^3
LDV'%' 2011		Land value of management unit,

		'%' = 1..5, €
Biomasses of the growing stock (tons):		
BMst	s,LU,SO,ST,FM	Stem (total)
BMsr	s,LU,SO,ST,FM	Stump and roots
BMcr	s,LU,SO,ST,FM	Crown
Carbon masses of the growing stock (tons):		
BMCst [2009]	s,LU,SO,ST,FM	Stem (total)
BMCsr [2009]	s,LU,SO,ST,FM	Stump and roots
BMCcr[2009]	s,LU,SO,ST,FM	Crown
Heating energies of the growing stock (GJ):		
BMJst [2009]	s,LU,SO,ST,FM	Stem (total)
BMJsr [2009]	s,LU,SO,ST,FM	Stump and roots
BMJcr [2009]	s,LU,SO,ST,FM	Crown

Event Variables

Collectible variable	Valid category variables	Explanation
Increment (m³/a):		
IV [2011]	s,EV,LU,SO,ST,FM	Volume increment
IP	s,EV,LU,SO,ST,FM	Roadside price value increment
IPS	s,EV,LU,SO,ST,FM	Stumpage price value increment
WP'%' [2011]		Indicating percent for management unit, '%' = 1..5
Total drain, mortality, removals (m³/a):		
DR [2011]	s,LU,SO,ST,FM	Total drain
MR [2011]	s,LU,SO,ST,FM	Mortality
PMR	s,EV,LU,SO,ST,FM	Roadside price of mortality
PSMR	s,EV,LU,SO,ST,FM	Stumpage price of mortality
R	s,d,EV,MC,LU,SO,ST,FM	Cutting drain
RR	s,d,EV,MC,LU,SO,ST,FM	Cutting residue
RC	s,d,EV,MC,LU,SO,ST,FM	Commercial cutting removals, see note 3.
RL	s,d,EV,MC,LU,SO,ST,FM	Saw log removals
RP	s,d,EV,MC,LU,SO,ST,FM	Pulp wood removals
RE [2009]	s,d,EV,MC,LU,SO,ST,FM	Total energy wood removal
REst [2009]	s,d,EV,MC,LU,SO,ST,FM	Energy wood removal of stem wood
REsr [2009]	s,d,EV,MC,LU,SO,ST,FM	Energy wood removal of stumps and roots
REcr [2009]	s,d,EV,MC,LU,SO,ST,FM	Energy wood removal of crown
Labour force (days/a):		
L	EV,MC,LU,SO,ST,FM	Total working time (manpower)
LC	EV,MC,LU,SO,ST,FM	Working time of logging (felling and forest haulage)

LE 2009	EV,MC,LU,SO,ST,FM	Working time of energy wood logging (felling, forest haulage, chipping, long-distance transportation)
LRA 2011	EV,LU,SO,ST,FM	Working time of artificial regeneration
LSR 2011	EV,LU,SO,ST,FM	Working time of soil surface preparation
LCA 2011	EV,LU,SO,ST,FM	Working time of clearing
LCY 2011	EV,LU,SO,ST,FM	Working time of tending of a young stand
Event areas (ha/a):		
OC	EV,MC,LU,SO,ST,FM	Cutting area of rounwood logging
OE 2009	EV,MC,LU,SO,ST,FM	Energy wood logging area
ORA 2011	EV,LU,SO,ST,FM	Area of artificial regeneration
ORN 2011	EV,LU,SO,ST,FM	Area of natural regeneration
OSR 2011	EV,LU,SO,ST,FM	Area of soil surface preparation
OCA 2011	EV,MC,LU,SO,ST,FM	Clearing area
OCY 2011	EV,LU,SO,ST,FM	Area of tending of young stand
Costs (€/a):		
W	EV,MC,LU,SO,ST,FM	Total cost
WC	EV,MC,LU,SO,ST,FM	Logging costs (felling and forest haulage)
WE 2009	EV,MC,LU,SO,ST,FM	Energy wood logging costs (felling, forest haulage, chipping, long-distance transportation)
WRA 2011	EV,MC,LU,SO,ST,FM	Artificial regeneration
WSR 2011	EV,LU,SO,ST,FM	Soil surface preparation
WCA 2011	EV,LU,SO,ST,FM	Clearing
WCY 2011	EV,LU,SO,ST,FM	Tending of young stand
Incomes (€/a):		
U	s,EV,MC,LU,SO,ST,FM	Gross income as roadside/factory gate prices
US	s,EV,MC,LU,SO,ST,FM	Gross income as stumpage prices
NU	EV,MC,LU,SO,ST,FM	Net income as roadside/factory gate prices
NUS	EV,MC,LU,SO,ST,FM	Net income as stumpage prices
UC	s,EV,MC,LU,SO,ST,FM	Rounwood logging income as roadside prices
UCS	s,EV,MC,LU,SO,ST,FM	Rounwood logging income as stumpage prices
UE 2009	s,EV,MC,LU,SO,ST,FM	Logging income of energy wood as factory gate prices
UES 2009	s,EV,MC,LU,SO,ST,FM	Logging income of energy wood as stumpage prices
BU 2009	s,EV,MC,LU,SO,ST,FM	Total gross income of rounwood and energy wood cuttings as roadside/factory gate prices
BUS 2009	s,EV,MC,LU,SO,ST,FM	Total gross income of rounwood and energy wood cuttings as stumpage

		prices
Biomasses of the natural removal (tons):		
MBst	s,EV,LU,SO,ST,FM	Stem (total)
MBsr	s,EV,LU,SO,ST,FM	Stump and roots
MBcr	s,EV,LU,SO,ST,FM	Crown
Carbon masses of the natural removal (tons):		
MBCst ^{2009}	s,EV,LU,SO,ST,FM	Stem (total)
MBCsr ^{2009}	s,EV,LU,SO,ST,FM	Stump and roots
MBCcr ^{2009}	s,EV,LU,SO,ST,FM	Crown
Heating energies of the natural removal (GJ):		
MBJst ^{2009}	s,EV,LU,SO,ST,FM	Stem (total)
MBJsr ^{2009}	s,EV,LU,SO,ST,FM	Stump and roots
MBJcr ^{2009}	s,EV,LU,SO,ST,FM	Crown
Biomasses of the commercial roundwood cutting removal (tons):		
RCBsw	s,EV,MC,LU,SO,ST,FM	Stem (total)
RCBsb	s,EV,MC,LU,SO,ST,FM	Stump and roots
RCBst ^{2009}	s,EV,MC,LU,SO,ST,FM	Crown
Carbon masses of the commercial roundwood cutting removal (tons):		
RCCsw ^{2009}	s,EV,MC,LU,SO,ST,FM	Wood
RCCsb ^{2009}	s,EV,MC,LU,SO,ST,FM	Bark
RCCst ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total: wood and park)
Heating energies of the commercial roundwood cutting removal (GJ):		
RCJsw ^{2009}	s,EV,MC,LU,SO,ST,FM	Wood
RCJsb ^{2009}	s,EV,MC,LU,SO,ST,FM	Bark
RCJst ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total: wood and park)
Biomasses of the commercial energy wood removal (tons):		
REBst ^{2009}	s,EV,MC,LU,SO,ST,FM	Wood
REBsr ^{2009}	s,EV,MC,LU,SO,ST,FM	Bark
REBcr ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total: wood and park)
Carbon masses of the commercial energy wood removal (tons):		
RECst ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total)
RECsr ^{2009}	s,EV,MC,LU,SO,ST,FM	Stump and roots
RECcr ^{2009}	s,EV,MC,LU,SO,ST,FM	Crown
Heating energies of the commercial energy wood removal (GJ):		
REJst ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total)
REJsr ^{2009}	s,EV,MC,LU,SO,ST,FM	Stump and roots
REJcr ^{2009}	s,EV,MC,LU,SO,ST,FM	Crown
Biomasses of the cutting drain (tons):		
RBst	s,EV,MC,LU,SO,ST,FM	Stem (total)
RBsr	s,EV,MC,LU,SO,ST,FM	Stump and roots
RBcr	s,EV,MC,LU,SO,ST,FM	Crown
Carbon masses of the cutting drain (tons):		
RBCst ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total)
RBCsr ^{2009}	s,EV,MC,LU,SO,ST,FM	Stump and roots
RBCcr ^{2009}	s,EV,MC,LU,SO,ST,FM	Crown
Heating energies of the cutting drain (GJ):		
RBJst ^{2009}	s,EV,MC,LU,SO,ST,FM	Stem (total)
RBJsr ^{2009}	EV,s,LU,SO,ST,FM	Stump and roots
RBJcr ^{2009}	EV,s,LU,SO,ST,FM	Crown

Biomasses of the cutting residue (tons):		
RRBst	s,EV,MC,LU,SO,ST,FM	Stem (total)
RRBsr	s,EV,MC,LU,SO,ST,FM	Stump and roots
RRBcr	s,EV,MC,LU,SO,ST,FM	Crown
Carbon masses of the cutting residue (tons):		
RRCst 2009	s,EV,MC,LU,SO,ST,FM	Stem (total)
RRCsr 2009	s,EV,MC,LU,SO,ST,FM	Stump and roots
RRCcr 2009	s,EV,MC,LU,SO,ST,FM	Crown
Heating energies of the cutting residue (GJ):		
RRJst 2009	s,EV,MC,LU,SO,ST,FM	Stem (total)
RRJsr 2009	s,EV,MC,LU,SO,ST,FM	Stump and roots
RRJcr 2009	s,EV,MC,LU,SO,ST,FM	Crown

Category variables

Category variables are used in the relational category expressions of the data collection requests, that are necessary in establishing the collective variables for the application and in reporting. Category variables are listed below.

Category variable	Explanation
MC 2011	Cutting method, valid values: 1 thinning based on basal area recommendations 2 clear cutting for artificialk regeneration 3 thinning based on number of trees recommendations 4 over story removal 5 seed tree cutting for natural regeneration of pine 6 shelterwood cutting for natural regeneration of spruce 7 tending of young stands
EV	Event identification number (from the actual event definitions)
s	Tree species code (see the tree variables of the initial data record, variable (2))
d	Diameter at 1.3 m height, cm
SO	Soil and peatland category (see the initial data record, variable (12))
ST	Site type category (see the initial data record, variable (13))
FM	Forest management category (see the initial data record, variable (30))
LU	Land-use category (see the initial data record, variable (11))
Sp1	Dominant tree species (dominant story)
Dp1	Mean diameter (dominant story)
Ap1	Mean age (dominant story)

Relational expressions for category definitions

The categories and classifications required for the naming and processing of collective variables are indicated by specific relational expressions. The concise, even though slightly cryptic relational expressions make a deeply detailed, self-explanatory,

computationally constructible, unambiguous and still readable naming of the collective variables possible, all by one and same expression.

The relational expressions consists of an intermingled list of single relations and ranges defined by a pair of adjacent relations.

The general syntax of the relational expressions is:

```
⇔c⇔c[,⇔c⇔c]
```

```
=1
1
=40<=80,>100,90
40<=80,>100,90
```

⇔ One of the following relational operators:

Relational operator	Meaning
=	equal (default operation in case of missing operator, if applicable)
<	less than
=< <=	less or equal
>	greater
=> >=	greater or equal

c A numerical (integer of floating point) value.

‘,’ The separator of the items of a list of single relations and ranges (implicitly denoting logical OR operation of the list items).

⇔c	is a single relation
⇔c⇔c	is a range defined by a pair of adjacent single relations
⇔c,c⇔c	is a list consisting of two items, a single relation and a range, separated by ‘,’

For purposefully omitting ‘=’ as the first relational operator of a single relation or a range, in classifications see classification parameter, and from the second list item on in general.

Notes

1. The names of the collective variables can be printed at the ends of the data rows in the summary report by setting the TRAILING_NAME option of the parameter FOREST_REPORT enabled.

2. Value of the tree variable (2) does not change in simulation from its initial value.

3. Commercial cutting removals: RC = RL + RP
   Total energy wood removal RE = REst + REsr + REcr
   Total commercial removal of stem wood = RC + REst
   Total commercial removal = RC + RE

See also

FOREST_REPORT parameter
classification parameter
COLLECTIVES_parameter
MPS_VARIABLES_parameter

MELA variables in FOREST REPORT parameter definitions
Tree species variable
Event identification number variable
Site type category variable
Soil and peatland category variable

Problem definition files (**mdl** type files)

Examples

Example 1: Data collection requests including no references to classifications, i.e., the data collection request itself is the name of the resulting single collective variable. The event identification numbers in this explanatory example are assumed to be EV(first thinning)=10; EV(clear cutting)=30.

Data collection request	Explanation
`OC`	Cutting area
`OC[EV=10]`	Cutting area, first thinning
`RL[s=1]`	Saw log removals, tree species 1
`RL[EV=30][s=1]`	Saw log removals, clear cuttings, tree species 1
`RP[s=3,4]`	Pulp wood removals, tree species 3 and 4

Example 2: The automatically generated collective variables on the basis of a data collection request including references to a classification.

The classifications for this example are assumed to be defined as:

```
* tree species
 sp
#1,7   pine
#2     spruce
#3=4   birch
#5,6,8 other deciduous
#>0    total

* cutting method
 cm
#10,11  first thinning
#20,21  thinning
#25     over story removal
```

```
#27,28  seed tree cutting
#29     shelterwood cutting
#30     clear cutting
#27<=30 regeneration cuttings
#>0     total
```

Data collection request	Generated collective variables
OC[EV.cm]	OC[EV=10,11]
	OC[EV=20,21]
	OC[EV=25]
	OC[EV=27,28]
	OC[EV=29]
	OC[EV=30]
	OC[EV=27<=30]
	OC[EV>0]
RC[EV.cm][s.sp]	RC[EV=10,11][s=1,7]
	RC[EV=20,21][s=1,7]
	RC[EV=25][s=1,7]
	RC[EV=27,28][s=1,7]
	RC[EV=29][s=1,7]
	RC[EV=30][s=1,7]
	RC[EV=27<=30][s=1,7]
	RC[EV>0][s=1,7]
	RC[EV=10,11][s=2]
	RC[EV=20,21][s=2]
	RC[EV=25][s=2]
	RC[EV=27,28][s=2]
	RC[EV=29][s=2]
	RC[EV=30][s=2]
	RC[EV=27<=30][s=2]
	RC[EV>0][s=2]
	RC[EV=10,11][s=3=4]
	RC[EV=20,21][s=3=4]
	RC[EV=25][s=3=4]
	RC[EV=27,28][s=3=4]
	RC[EV=29][s=3=4]
	RC[EV=30][s=3=4]
	RC[EV=27<=30][s=3=4]
	RC[EV>0][s=3=4]
	RC[EV=10,11][s=5,6,8]
	RC[EV=20,21][s=5,6,8]
	RC[EV=25][s=5,6,8]
	RC[EV=27,28][s=5,6,8]
	RC[EV=29][s=5,6,8]
	RC[EV=30][s=5,6,8]
	RC[EV=27<=30][s=5,6,8]
	RC[EV>0][s=5,6,8]
	RC[EV=10,11][s>0]
	RC[EV=20,21][s>0]
	RC[EV=25][s>0]
	RC[EV=27,28][s>0]
	RC[EV=29][s>0]
	RC[EV=30][s>0]
	RC[EV=27<=30][s>0]
	RC[EV>0][s>0]

Pmin and Pmax functions for local extrema (and margins)

Functions

The Pmin and Pmax functions make the *local (sub-period level) extrema (and possibly arising margins)* of conventional decision variables available for use as operational decision criteria in MELA, together with access to all the other decision variables of the respective management schedules or forest level solutions. References to local extrema and margins can be used as decision variables in forest reports and optimisation problems.

The sub-period level extrema (*minima* or *maxima*) constitute the local limit values of respective decision variables for each specific MELA solution, as well in stands (or calculation units in MELA) as summarised at forest level. The extrema figures are independent of each others, but conditional to (or taking into account) the developments preceding each sub-period.

Further on, the differences of extrema (or limit valuea) and the corresponding decision variables for each sub-period of each specific forest-level solution, or of a given management schedule of a stand, reveal the particular *margins* possibly left over. Cutting potential and cutting reserve by sub-periods exemplify typical local extrema and margins.

Local extrema and margins are based on the management potential included in the underlying management schedules. In the current implementation in MELA, local extrema are calculated from the management schedules that are simulated in accordance with actual forest management recommendations. Hence, the local extrema and margins concerning managament activities, such as cuttings, represent amounts within the limits of recommendations, manifesting recommendably feasible management potential only.

Local extrema values and derivatives calculable have specific interpretations of interest for forestry and forestry decisions, dealing with the allocation, the visualisation and the perception of the expected production potentials and possible margins, especially if multiple temporal goals are present. For example, cutting potentials and/or reserves may be shown simulateously with the actual cutting figures over the whole calculation period, allowing also new what-ifs and analysis designs.

Legend

The general syntax of the references to the local extrema functions is (see note 4):

```
Pmax(result,criterion,node)
```

```
Pmin(result,criterion,node)
```

```
Pmax(RC,RC,node)
Pmax(V,RC,node)
```

```
Pmax(RC,RC,node)-RC
```

`Pmax()´	The reference to (the calculation of) a local maximum.
`Pmin()´	The reference to (the calculation of) a node minimum.
result	The name of the collective variable being requested.
criterion	The name of the collective variable used as the criterion of the actual search for the local extremum in question.
`node´	A constant character string always required.

Instructions

Basically, the references to the Pmin and Pmax functions represent the values for the local (or sub-period level) extrema (minima or maxima, respectively) of decision variables at stand, stratum/domain or forest level, depending on the context.

Any local extremum as such manifests the respective (production or decision) potential attainable on a sub-period, independent of else but the preceding developments in the underlying management schedule(s). When, for example, conditions for production over time (forestry as closed entity here) are introduced, such as sustainability requirements, or when marked changes in the production or in the demand of the forests products appear, the actual production potentials may not fully comply with the new future views (or with the management recommendations being obeyed, either). Instead, situation-specific leftovers (or margins) may arise or be required for adapting to the future needs assumed. As well, such "technical" reasons as the scarcity of management schedules and less successful optimisation formulations may serve as the source of margins.

First, when learning the actual decision situation, a set of decision criteria directly or indirectly manifesting potential utility, including potentials and margins of relevant decision variables, can be taken into analysis reports for observing or inspection. For example, sustainability constraints, if any, are directly (deterministically) taken into account in MELA optimisation.

On the other hand, one may also wish to intentionally maintain extra reserves for such reasons as liquidity in terms of wood, safety margins for various future uncertainties, or for increasing future potentials. Such aims are expressed by adding respective reserve requirements (in terms of potentials and/or margins) as decision criteria (usually constraints) into optimisation problem in question.

References to Pmin and Pmax functions are used as such in forest reports and optimisation problems for local extrema information. Margins are expressed by respective subtractions of extrema and actual values, see example 1 and example 2.

Notes

1. Collective variables only do apply for use as the result and criterion of the Pmin and Pmax functions (but not the MSD variables).

2. The references to the Pmin and Pmax functions must be introduced in the FOREST_REPORT or COLLECTIVES definition of the preceding simulation, before use in any consecutive optimisation.

3. Careful definition of references and evaluation of results is emphasised in the use of Pmin and Pmax functions, since they open a multitude of optional definitions (with possibly less known results).

4. Explicit time expressions must be used in optimisation problems when using Pmin and Pmax functions (in xvar –section). See example 2.

See also

COLLECTIVES parameter
FOREST_REPORT parameter
Collectible and category variables
Problem definition files (mdl type files)

Examples

Example 1: FOREST_REPORT definition for simulation (and optimisation) with Pmax function calls.

```
FOREST_REPORT
#/TRAILING_NAME 1
#/FIELD_DELIMITER ' '
#
#=
#>
#=
#<
#-
# VOLUME, m3                V
# . spruce                  V[s=3,4]
# . vol reserve of spruce   Pmax(V[s=3,4],V[s=3,4],node)-V[s=3,4]
# . max. volume of spruce   Pmax(V[s=3,4],V[s=3,4],node)
#-
```

Example 2: Optimisation problem definition for optimisation.

```
xvar x0804>
,vb1=V[s=3,4]..1,vb2=V[s=3,4]..2>
,vb3=V[s=3,4]..3,vb4=V[s=3,4]..4>
,vb..1=Pmax(V[s=3,4]..1,V[s=3,4]..1,node..1)>
,vb..2=Pmax(V[s=3,4]..2,V[s=3,4]..2,node..2)>
```

```
,vb..3=Pmax(V[s=3,4]..3,V[s=3,4]..3,node..3)>
,vb..4=Pmax(V[s=3,4]..4,V[s=3,4]..4,node..4)

prob Volume margins of the spruce

x0804 max

* Volume of the spruce must be over
* 400 m3 in every period
vb..1-vb1>400
vb..2-vb2>400
vb..3-vb3>400
vb..4-vb4>400
/
```

Decision data variables
(MSD variables)

Variables

Decision data variables, see note 3.

001-007 Cutting area by cutting method (7), ha/a

001	thinnings, total
002	clear cutting
003	(first) thinning (number of stems/ha instructions)
004	over story removal
005	seed tree cutting (natural regeneration for pine, birch and alder)
006	shelterwood cutting (natural regeneration for spruce)
007	TOTAL

008 Tending of young stands, ha/a
009 Clearing of regeneration areas, ha/a
010 Soil surface preparation, ha/a
011-015 Artificial regeneration area by tree species categories (5), ha/a

011	pine
012	spruce
013	birch
014	other deciduous
015	TOTAL

016-020 Seeding area by tree species categories (5), ha/a

016	pine
017	spruce
018	birch
019	other deciduous
020	TOTAL

021-025 Planting area by tree species categories (5), ha/a

021	pine
022	spruce
023	birch
024	other deciduous
025	TOTAL

026 Supplementary planting area, ha/a
027 Pruning area, ha/a
028 Reserved for system
029 Fertilization area, ha/a
030 Natural regeneration area, ha/a

031-035 Regeneration area by tree species categories (5), ha/a

031	pine
032	spruce
033	birch
034	other deciduous
035	TOTAL

036-038 Drainage area, ha/a

036	new drainage
037	re-drainage
038	TOTAL

039 Increment of the dominant story, m^3/a

040-047 Costs by owner categories (4) and cutting methods (2), €/a

private	company	state	TOTAL	
040	041	042	043	thinnings
044	045	046	047	regeneration cuttings

048-055 Manpower by owner categories (4) and cutting methods (2), d/a

private	company	state	TOTAL	
048	049	050	051	thinnings
052	053	054	055	regeneration cuttings

056-060 Increment of trees generated during simulation by tree species categories (5), m^3/a

056	pine
057	spruce
058	birch
059	other deciduous
060	TOTAL

061-065 Removal of trees generated during simulation by tree species categories (5), m^3/a

061	pine
062	spruce
063	birch
064	other deciduous
065	TOTAL

066-090 Increment by diameter classes (5) and tree species categories (5), m^3/a

diameter, cm	-10	11-20	21-30	31-	TOTAL	
	066	071	076	081	086	pine
	067	072	077	082	087	spruce
	068	073	078	083	088	birch
	069	074	079	084	089	other deciduous
	070	075	080	085	090	TOTAL

091-100 Increment on forest land by age classes (10), m^3/a

	age, a
091	0
092	1-20
093	21-40
094	41-60
095	61-80
096	81-100
097	101-120
098	121-140
099	141-
100	TOTAL

101-110 Total drain by forest management categories (see the MANAGEMENT_CATEGORY_GROUPS parameter and the sample plot variable (30) of the simulation record) (10), m^3/a

111-120 Cutting removal by forest management categories (see the MANAGEMENT_CATEGORY_GROUPS parameter and the sample plot variable (30) of the simulation record) (10), m^3/a

121-195 Cutting removal by diameter classes (5), timber assortments (3) and tree species categories (5), m^3/a (see the D_CLASSES_IN_REMOVAL parameter)

diameter,cm -10	11-20	21-30	31-	TOTAL	
121	136	151	166	181	saw log, pine
122	137	152	167	182	pulpwood, pine
123	138	153	168	183	TOTAL, pine
124	139	154	169	184	saw log, spruce
125	140	155	170	185	pulpwood, spruce
126	141	156	171	186	TOTAL, spruce
127	142	157	172	187	saw log, birch
128	143	158	173	188	pulpwood, birch
129	144	159	174	189	TOTAL, birch
130	145	160	175	190	saw log, other deciduous
131	146	161	176	191	pulpwood, other deciduous
132	147	162	177	192	TOTAL, other deciduous
133	148	163	178	193	saw log
134	149	164	179	194	pulpwood
135	150	165	180	195	TOTAL

196-255 Cutting removal by owner categories (4), timber assortments (3) and tree species categories (5), m^3/a

private	company	state	TOTAL	
196	211	226	241	saw log, pine
197	212	227	242	pulpwood, pine
198	213	228	243	TOTAL, pine
199	214	229	244	saw log, spruce
200	215	230	245	pulpwood, spruce
201	216	231	246	TOTAL, spruce
202	217	232	247	saw log, birch
203	218	233	248	pulpwood, birch
204	219	234	249	TOTAL, birch

205	220	235	250	saw log, other deciduous
206	221	236	251	pulpwood, other deciduous
207	222	237	252	TOTAL, other deciduous
208	223	238	253	saw log
209	224	239	254	pulpwood
210	225	240	255	TOTAL

256-275 Cutting removal by tree species categories (5) and cutting methods (4), m^3/a

thinning	regeneration cutting	over story removal	TOTAL	
256	261	266	271	pine
257	262	267	272	spruce
258	263	268	273	birch
259	264	269	274	other deciduous
260	265	270	275	TOTAL

276-285 Cutting removal by tree species categories (5) and soil types (2), m^3/a

mineral soil	peatland	
276	281	pine
277	282	spruce
278	283	birch
279	284	other deciduous
280	285	TOTAL

286-290 Total drain on forestry land by tree species categories (5), m^3/a

286	pine
287	spruce
288	birch
289	other deciduous
290	TOTAL

291-325 Cutting removal by tree species categories (5) and soil fertility categories (7) (see the sample plot variable (15) of the simulation record), m^3/a

very rich or rich sites	damp sites	sub-dry sites	dry sites	barren sites	scrub land	TOTAL	
291	296	301	306	311	316	321	pine
292	297	302	307	312	317	322	spruce
293	298	303	308	313	318	323	birch
294	299	304	309	314	319	324	other deciduous
295	300	305	310	315	320	325	TOTAL

326 Increment of saw log volume, m^3/a
327 Increment of pulpwood volume, m^3/a
328 Increment of logging residue, m^3/a
329 Increment of commercial timber, m^3/a
330 Increment of basal area, m^2/a

331-335 Logging residue by tree species categories (5), m^3/a

331	pine
332	spruce
333	birch
334	other deciduous
335	TOTAL

336-340 Cutting drain by tree species categories (5), m^3/a

336	pine
337	spruce
338	birch
339	other deciduous
340	TOTAL

341-345 Waste wood by tree species categories (5), m^3/a

341	pine
342	spruce
343	birch
344	other deciduous
345	TOTAL

346-350 Total drain by tree species categories (5), m^3/a

346	pine
347	spruce
348	birch
349	other deciduous
350	TOTAL

351-360 Mortality by forest management categories (see the MANAGEMENT_CATEGORY_GROUPS parameter and the sample plot variable (30) of the simulation record) (10), m^3/a

361-365 Mortality by tree species categories (5), m3/a

361	pine
362	spruce
363	birch
364	other deciduous
365	TOTAL

366 Silviculture costs, €/a
367 Forest improvement costs, €/a
368 Silviculture manpower, d/a
369 Forest improvement manpower, d/a
370 Net revenues, €/a
371-380 Increment by forest management categories (see the MANAGEMENT_CATEGORY_GROUPS parameter and the sample plot variable (30) of the simulation record) (10), m^3/a

381-384 Increment by owner categories (4), m^3/a

381	private

382	company
383	state
384	TOTAL

385 Increment of secondary story, m^3/a

386-390 Net increment by tree species categories (5), m^3/a

386	pine
387	spruce
388	birch
389	other deciduous
390	TOTAL

391-400 Increment by tree species categories (5) and soil types (2), m^3/a

mineral soil	peatland	
391	396	pine
392	397	spruce
393	398	birch
394	399	other deciduous
395	400	TOTAL

401-405 Total increment on forestry land by tree species categories (5), m^3/a

401	pine
402	spruce
403	birch
404	other deciduous
405	TOTAL

406-440 Increment by tree species categories (5) and soil fertility categories (7) (see the sample plot variable (15) of the simulation record), m^3/a

very rich or rich sites	damp sites	sub-dry sites	dry sites	barren sites	scrub land	TOTAL	
406	411	416	421	426	431	436	pine
407	412	417	422	427	432	437	spruce
408	413	418	423	428	433	438	birch
409	414	419	424	429	434	439	other deciduous
410	415	420	425	430	435	440	TOTAL

441-445 Saw log removal of the trees generated during simulation by tree species categories (5), m^3/a

441	pine
442	spruce
443	birch
444	other deciduous
445	TOTAL

446-450 Net value increment by tree species categories (5), €/a

446	pine

447	spruce
448	birch
449	other deciduous
450	TOTAL

451-474 Costs by owner categories (4) and forest management activities (6), €/a

private	company	state	TOTAL	
451	452	453	454	logging
455	456	457	458	regeneration
459	460	461	462	tending and pruning
463	464	465	466	drainage
467	468	469	470	fertilization
471	472	473	474	TOTAL

475-494 Manpower by owner categories (4) and forest management activities (6), d/a

private	company	state	TOTAL	
475	476	477	478	logging
479	480	481	482	regeneration
483	484	485	486	tending and pruning
487	488	489	490	drainage
491	492	493	494	fertilization
495	496	497	498	TOTAL

499 Gross income (roadside prices), €/a
500 Gross income (stumpage prices), €/a

501-510 Forest land area by age classes (10), ha

	age, a
501	0
502	1-20
503	21-40
504	41-60
505	61-80
506	81-100
507	101-120
508	121-140
509	141-
510	TOTAL

511-516 Area by owner categories (6), ha

511	private persons
512	enterprises
513	state
514	municipality etc.
515	communities
516	TOTAL

517-537 Area by soil fertility categories (7) (see the sample plot variable (15) of the simulation record) and soil types (3), ha

mineral soil	peatland	TOTAL	
517	524	531	very rich or rich sites
518	525	532	damp sites
519	526	533	sub-dry sites
520	527	534	dry sites
521	528	535	barren sites
522	529	536	scrub land
523	530	537	TOTAL

538-540 Reserved for system

541-550 Forestry land area by forest management categories (see the MANAGEMENT_CATEGORY_GROUPS parameter and the sample plot variable (30) of the simulation record) (10), ha

551-555 Total volume on forestry land by tree species categories (5), m^3

551	pine
552	spruce
553	birch
554	other deciduous
555	TOTAL

556-565 Reserved for system

566-570 Total volume of retained trees by tree species categories (5), m^3

566	pine
567	spruce
568	birch
569	other deciduous
570	TOTAL

571-575 Total value of retained trees by tree species categories (5), €

571	pine
572	spruce
573	birch
574	other deciduous
575	TOTAL

576-577 Total volume of retained trees by timber assortments (2), m^3

576	saw logs
577	pulpwood

578 Area of selecting of retained trees, ha/a

579-583 Volume of selected retained trees by tree species categories (5), m^3/a

579	pine
580	spruce
581	birch
582	other deciduous
583	TOTAL

584-588 Increment of retained trees by tree species categories (5), m^3/a

584	pine
585	spruce
586	birch
587	other deciduous
588	TOTAL

589-593 Mortality of retained trees by tree species categories (5), m^3/a

589	pine
590	spruce
591	birch
592	other deciduous
593	TOTAL

594-599 Area by dominant tree species categories (6), ha

594	open area
595	pine
596	spruce
597	birch
598	other deciduous
599	TOTAL

600 Area of stands generated during simulation, ha

601-700 Volume by diameter classes (5), timber assortments (4) and tree species categories (5), m^3

diameter, cm -10	11-20	21-30	31-	TOTAL	
601	621	641	661	681	saw log, pine
602	622	642	662	682	pulpwood, pine
603	623	643	663	683	waste wood, pine
604	624	644	664	684	TOTAL, pine
605	625	645	665	685	saw log, spruce
606	626	646	666	686	pulpwood, spruce
607	627	647	667	687	waste wood, spruce
608	628	648	668	688	TOTAL, spruce
609	629	649	669	689	saw log, birch
610	630	650	670	690	pulpwood, birch
611	631	651	671	691	waste wood, birch
612	632	652	672	692	TOTAL, birch
613	633	653	673	693	saw log, other deciduous
614	634	654	674	694	pulpwood, other deciduous
615	635	655	675	695	waste wood, other deciduous
616	636	656	676	696	TOTAL, other deciduous
617	637	657	677	697	saw log
618	638	658	678	698	pulpwood
619	639	659	679	699	waste wood
620	640	660	680	700	TOTAL

701-730 Volume by tree species categories (5) and owner categories (6), m^3

private persons	enterprises	state	municipilaty etc.	communities	TOTAL	
701	706	711	716	721	726	pine
702	707	712	717	722	727	spruce
703	708	713	718	723	728	birch
704	709	714	719	724	729	other deciduous
705	710	715	720	725	730	TOTAL

731-765 Volume by site types (7) and tree species categories (5), m^3

very rich or rich sites	damp sites	sub-dry sites	dry sites	barren sites	scrub land	TOTAL	
731	736	741	746	751	756	761	pine
732	737	742	747	752	757	762	spruce
733	738	743	748	753	758	763	birch
734	739	744	749	754	759	764	other deciduous
735	740	745	750	755	760	765	TOTAL

766-770 Reserved for system

771-785 Volume by soil types (3) and tree species categories (5), m^3

mineral soil	peatland	TOTAL	
771	776	781	pine
772	777	782	spruce
773	778	783	birch
774	779	784	other deciduous
775	780	785	TOTAL

786-795 Volume by forest management categories (see the MANAGEMENT_ CATEGORY_GROUPS parameter and the sample plot variable (30) of the simulation record) (10), m^3

796-800 Value of the growing stock (roadside prices) by tree species categories (5), €

796	pine
797	spruce
798	birch
799	other deciduous
800	TOTAL

801-805 Net present value from actual subperiod by discount factors (5) (based on roadside prices), € (see note 4)

801	1 %
802	2 %
803	3 %
804	4 %
805	5 %

806-810 Discounted net income on each subperiod by discount factors (5) (based on roadside prices), € (see note 5)

806	1 %
807	2 %
808	3 %
809	4 %
810	5 %

811-815 Land value by discount factors (5), € (in specific applications only, see the item (17) of the SIMULATION_CONTROL parameter)

811	1 %
812	2 %
813	3 %
814	4 %
815	5 %

816 Total yield, m^3
817 Total returns, €
818 Summarized costs over the calculation period, €
819 Summarized net revenues over the calculation period, €
820 Summarized revenues (stumpage prices) over the calculation period, €
821 Summarized manpower over the calculation period, d
822 Returns per sub-period, €
823 Cutting value of the growing stock, €
824-830 Reserved for system

831-835 Basal area by tree species categories (5), m^2

831	pine
832	spruce
833	birch
834	other deciduous
835	TOTAL

836-840 Summarized saw log removal over calculation period by tree species categories (5), m^3

836	pine
837	spruce
838	birch
839	other deciduous
840	TOTAL

841-845 Saw log volume of trees generated during simulation by tree species categories (5), m^3

841	pine
842	spruce
843	birch
844	other deciduous
845	TOTAL

846-850 Stumpage price value of the growing stock by tree species categories (5), €

846	pine
847	spruce
848	birch
849	other deciduous
850	TOTAL

851-900 Volume on forest land by tree species categories (5) and age classes (10), m^3

pine	spruce	birch	other deciduous	TOTAL	age, a
851	852	853	854	855	0
856	857	858	859	860	1-20
861	862	863	864	865	21-40
866	867	868	869	870	41-60
871	872	873	874	875	61-80
876	877	878	879	880	81-100
881	882	883	884	885	101-120
886	887	888	889	890	121-140
891	892	893	894	895	141-
896	897	898	899	900	TOTAL

901-905 Initial volume of trees existing in initial data by tree species categories (5) , m^3

901	pine
902	spruce
903	birch
904	other deciduous
905	TOTAL

906-910 Actual volume of trees existing in initial data by tree species categories (5) , m^3

906	pine
907	spruce
908	birch
909	other deciduous
910	TOTAL

911-915 Summarized increment over the calculation period by tree species categories (5), m^3

911	pine
912	spruce
913	birch
914	other deciduous
915	TOTAL

916-920 Summarized total drain over the calculation period by tree species categories (5), m^3

916	pine
917	spruce
918	birch
919	other deciduous

920	TOTAL

921-925 Summarized cutting removal over the calculation period by tree species categories (5), m^3

921	pine
922	spruce
923	birch
924	other deciduous
925	TOTAL

926-930 Summarized value increment over the calculation period by tree species categories (5), €

926	pine
927	spruce
928	birch
929	other deciduous
930	TOTAL

931-935 Summarized gross income over the calculation period by tree species categories (5), €

931	pine
932	spruce
933	birch
934	other deciduous
935	TOTAL

936-940 Volume of the trees generated during simulation by tree species categories (5), m^3

936	pine
937	spruce
938	birch
939	other deciduous
940	TOTAL

941-950 Reserved for system

951-955 Net present value from actual subperiod by discount factors (5) (based on stumpage prices), € (see note 4)

951	1 %
952	2 %
953	3 %
954	4 %
955	5 %

956-960 Discounted net income on each subperiod by discount factors (5) (based on stumpage prices), € (see note 5)

956	1 %
957	2 %
958	3 %
959	4 %

960	5 %

961-970 Reserved for system

971-975 Volume of dominant story by tree species categories (5), m^3

971	pine
972	spruce
973	birch
974	other deciduous
975	TOTAL

976-980 Volume of secondary story by tree species categories (5), m^3

976	pine
977	spruce
978	birch
979	other deciduous
980	TOTAL

981-985 Saw log volume of dominant story by tree species category (5), m^3

981	pine
982	spruce
983	birch
984	other deciduous
985	TOTAL

986-990 Saw log volume of secondary story by tree species category (5), m^3

986	pine
987	spruce
988	birch
989	other deciduous
990	TOTAL

991-1000 Random numbers from even distribution (values 0.0 - 1.0)

Generation

The variables of the decision data records are generated by MELA routines.

Instructions

The variables of decision data records represent the whole management units. They are not per hectare values. In further processing, the variables are as such summarized over the whole forestry unit.

Only a limited number of decision variables can be usually stored in **msd** type files. Users should select the variables of their MELA applications according to the actual analysis and reporting needs

Notes

1. The values of the decision variables represent the whole management units, not per hectare values.

2. The variables of the decision data record are called x variables in JLP terms. For JLP x variables, see Lappi (1992).

3. The variables are for timberland if not mentioned otherwise (see the TIMBER_PRODUCTION_LAND parameter).

4. Net present values (variables 801, 802, etc. (roadside prices), and 951, 952, etc. (stumpage prices)) can be calculated only if the variables (801) and (806), (802) and (807), etc. (roadside prices) and (951) and (956), (952) and (957), etc. (stumpage prices) are pair wise present for each desired discount factor in a decision data record. The default discount factors are 1, 2, 3, 4 and 5 %. For user-supplied discount factors, see the DISCOUNT_RATES parameter.

5. The variables (806) - (810) and (951) – (960) are auxiliary information only for the calculation of the net present value, see note 4. They are not intended for direct user purposes.

See also

Management schedule files (**msd** and **msc** type files)
Problem definition files (**mdl** type files)

Simulation record

D_CLASSES_IN_REMOVAL parameter
DISCOUNT_RATES parameter
MANAGEMENT_CATEGORY_GROUPS parameter
MSD_VARIABLES parameter
SIMULATION_CONTROL parameter
TIMBER_PRODUCTION_LAND parameter
YEARS parameter

MELA variables

MELA variable groups

Stand data text file variables
(RSU variables)

Variables

Variables of the stand data record, 1-32

(1) Unique unit identifier (integer, length must not override 11 digits)
(2) Record type '1' (constant)
(3) Number of calculation unit (numbers in rising order)
(4) Number of stand
(5) Owner category (see note 1), (10)

0 private persons 1 enterprises (forest industries, etc.) 2 state (Forest and Park Service, etc.) 3 municipalities etc. 4 communities

(6) Forestry centre (see note 1 and note 2), (29)

1 Rannikko 2 Lounais-Suomi 3 Häme-Uusimaa 4 Kymi 5 Pirkanmaa 6 Etelä-Savo 7 Etelä-Pohjanmaa 8 Keski-Suomi 9 Pohjois-Savo 10 Pohjois-Karjala 11 Kainuu 12 Pohjois-Pohjanmaa 13 Lappi

(7) Municipality (codes by Statistics Finland)
(8) Date of inventory (in format dd.mm.yyyy)
(9) Area, ha
(10) North, X coordinate, m (Finnish uniform coordinate system (YKJ) or EUREF-FIN (ETRS-TM35FIN)) (see note 13)
(11) East, Y coordinate, m (EUREF-FIN (Finnish uniform coordinate system (YKJ) or ETRS-TM35FIN)) (see note 13)
(12) Height above sea level, m (see note 3)
(13) '-1' constant, reserved for system
(14) Land use category (see note 1 and note 4), (11)

1 forest land 2 scrub land 3 waste land 4 other forestry land than 1-3 5 agricultural land 6 built-up land

7 roads, electric lines, etc.
8 lakes and rivers
9 sea

(15) Soil and peatland category (see note 1), (12)

1 mineral soils
2 peatland, spruce mires (korpi in Finnish)
3 peatland, pine mires (räme in Finnish)
4 peatland, barren treeless mires (neva in Finnish)
5 peatland, rich treeless mires (letto in Finnish)

(16) Site type (see note 1), (13)

1 very rich sites (OMaT in South Finland)
2 rich sites (OMT in South Finland)
3 damp sites (MT in South Finland)
4 sub-dry sites (VT in South Finland)
5 dry sites (CT in South Finland)
6 barren sites (ClT in South Finland)
7 rocky or sandy areas
8 open mountains

(17) Reduction of forest taxation class (see note 1), (14)

0 no reduction
1 stony soils
2 wet soils
3 thick moss layer expressing low soil productivity (kunttaisuus in Finnish)
4 unfavourable location (coastal areas, mountains)

(18) Drainage category (see note 1), (16)

0 undrained mineral soils
1 ditched mineral soils
2 undrained mires
3 ditched mires (unchanged productivity), (ojikko in Finnish)
4 transforming mire (improved productivity), (muuttuma in Finnish)
5 transformed mire (productivity comparable to mineral soils), (turvekangas in Finnish)

(19) Forest management categories (see note 1 and note 5), (30)

1 forest land, no restrictions for timber production
2 forest land, administrational restrictions for timber production
3 scrub land, no restrictions or administrational restrictions for timber production
6 waste land, no restrictions or administrational restrictions for timber production
7 forest, scrub and waste land, no timber production allowed

(20) Year of the last drainage, a (in format yyyy) (see note 6)
(21) Year of the last fertilization, a (in format yyyy) (see note 6)
(22) Year of the last soil surface preparation, a (in format yyyy) (see note 6)
(23) Year of the last cleaning of regeneration area, a (in format yyyy) (see note 6)
(24) Year of the last artificial regeneration, a (in format yyyy) (see note 6)
(25) Year of the last tending of young stands, a (in format yyyy) (see note 6)
(26) Year of the last pruning, a (in format yyyy) (see note 6)
(27) Year of the last cutting, a (in format yyyy) (see note 6 and note 7)
(28) Method of the last cutting (see note 1 and note 7), (31)

0 no cutting
1 thinning (basal area instructions)
2 clear cutting
3 (first) thinning (number of stems/ha instructions)
4 over story removal
5 seed-tree cutting (natural regeneration for Scotch pine)
6 shelterwood cutting (natural regeneration for Norway spruce)

(29) Feasibility for drainage (see note 1), (17)

0 drainage feasible and allowed
1 drainage not feasible or not allowed

(30) Feasibility for natural regeneration (see note 1), (22)

0 natural regeneration feasible
1 natural regeneration not feasible

(31) '-1' constant, reserved for system
(32) '-1' constant, reserved for system

Variables of the stratum data record , 1-14 (see note 8)

(1) Unique unit identifier (the same as in stand data record)
(2) Record type '2' (constant)
(3) Number of stratum (numbers in rising order 1-)
(4) Tree species (see note 9), (2)

1 Scotch pine (Pinus silvestris)
2 Norway spruce (Picea abies)
3 Silver birch (Betula pendula)
4 Downy birch (Betula pubescens)
5 Aspen (Populus tremula)
6 Alder (Alnus incana, Alnus glutinosa)
7 other coniferous species than 1 or 2
8 other deciduous species than 3 - 6

(5) Basal area, m^2/ha (see note 10)
(6) Number of stems, stem/ha (see note 10)
(7) Mean diameter, cm
(8) Mean height, m
(9) Biological age, a (see note 11)
(10) Age at breast height, a (see note 11)
(11) Log volume reduction (relative value 0.0 – 1.0) or log percentage (%,1 > % ≤ 100) (see note 12)
(12) Origin

1 natural
2 planted
3 seeded
4 supplementary planted

(13) Management category of the tree

1 no restrictions in forest management operations
2 preserved (untouched in forest management operations)

(14) The height of lowest living branch (see note 12)

Variables of the tree data record, 1-20 (see note 8)

(1) Unique unit identifier (the same as in stand data record)
(2) Record type '3' (constant)
(3) Number of stratum (the same as in the related stratum data record)
(4) Number of stems, stems/ha
(5) Tree species (see note 9), (2)

1 Scotch pine (Pinus silvestris) 2 Norway spruce (Picea abies) 3 Silver birch (Betula pendula) 4 Downy birch (Betula pubescens) 5 Aspen (Populus tremula) 6 Alder (Alnus incana, Alnus glutinosa) 7 other coniferous species than 1 or 2 8 other deciduous species than 3 - 6

(6) Diameter at breast height, cm
(7) Height, m
(8) Age at breast height, a (see note 11)
(9) Biological age, a (see note 11)
(10) Log volume reduction (relative value 0.0 – 1.0) or log percentage (%,1 > % ≤ 100) (see note 12)
(11) Year of the artificial regeneration, a (in format yyyy) (0 = naturally regerated)
(12) Age at 1.3 m height when reached 10 cm diameter at breast height, a
(13) Origin

1 natural 2 planted 3 seeded 4 supplementary planted

(14) Number of the tree (default: number of order)
(15) Direction of the tree from the origo of the sample plot, in degrees
(16) Distance of the tree from the origo of the sample plot, m
(17) Height difference of the tree from the origo of the sample plot, m
(18) Height of the lowest living branch, m
(19) Management category of the tree

1 no restrictions in forest management operations 2 preserved (untouched in forest management operations)

(20) Reserved for system

Generation

Variables of the stand data text file (**rsu** type file) are created by user routines.

Notes

1. Categories are similar to the categories in MELA initial data record. The number in parenthesis refers to the number of the sample plot variable in MELA initial data record (in **rsd** type files).

2. In conversion of the standwise data into MELA input data the Forestry Board District is determined merely by the national municipality code.

3. User can give accurate value to then height above sea level variable (value derived from the base map). When the accurate height above sea level is not known, it is better to give value zero (0) to the variable. Height above sea level is then concluded in the MELA from the coordinates.

4. Calculation units in categories 4-9 are not simulated.

5. Forest management categories are application dependent.

6. If the year of the event is not known, the value for missing year is zero(0).

7. If the last cutting is known, the year of the last cutting (27) and method of the last cutting (28) should be provided.

8. In stratum and tree data records missing values are registered as zeros (0), if not mentioned otherwise.

9. Categories are similar to the categories in MELA initial data record. The number in parenthesis refers to the number of the tree variable in MELA initial data record (in **rsd** type files).

10. Either basal area (5) or number of stems (6) must be provided. Number of stems is recommended for strata with mean diameter lesser than 5 cm and basal area for strata with mean diameter 5 cm or greater.

11. Either biological age or age at breast height must be provided.

12. Value is not obligatory. If the information is missing, the value –1 should be provided.

13. Default coordinate system in MELA2009 is Finnish uniform coordinate system (YKJ). If EUREF-FIN coordinates are used, YKJ_COORDINATES parameter must be declared with value 0. Coordinate values must be inside Finland borders.

See also

Stand data text file (**rsu** type files)

Stratum data record
Stand data record
Tree data record

Initial data record variables (RSD variables)
MELA variables

YKJ_COORDINATES parameter

Stand simulation instruction variables
(SMU variables)

Variables

(0) Reserved for system
(1) Unique unit identifier, obligatory (integer, length must not override 11 digits) (see note 1)
(2) Number of calculation unit, obligatory (integer, rising order, length must not override 7 digits) (see note 1)
(3) Event identification number (see note 2 and note 3)
(4) Forest operation category (see note 2 and note 4)
(5) Management prescription (see note 2 and note 4)
(6) Year of management prescription, a (in format 'yyyy') (see note 5 , note 6 and note 9)
(7) Urgency category of management prescription (see note 6, note 7 and note 8)
(8) Reserved for system
(9) Type of management prescription (see note 7 and note 9)

0 proposal 1 implemented operation

Generation

Variables of the stand simulation instruction text file (**smu** type file) are created by user routines.

Notes

1. The unique unit identifier and the number of calculation unit are always obligatory. The order of units in stand simulation text file (**smu** type file) must be the same as the order of units in the corresponding stand data text file (**rsu** type file). Both the unique unit identifier and the number of calculation unit in stand simulation text file (**smu** type file) must be identical with the corresponding values of the same unit in the stand data text file (**rsu** type file).

2. Either event identification number (3) or forest operation category (4) and management prescription (5) must be provided in a stand simulation record. In case all three variables are provided event identification is used.

3. Event identification in stand simulation record corresponds to event identification number in the definition of EVENT parameter.

4. User defined forest operation category and management prescriptions are introduced in SMU_EVENTS parameter.

5. Year of management prescription relates either to proposal or implemented operation depending on the type of instruction. It must be greater than or equal to year in inventory date in the corresponding stand data record in the stand data text file (**rsu** type file).

6. Either year of management prescription (6) or urgency category of management prescription must be provided. In case both variables are provided year of management prescription (6) is used. If the year of management prescription has value zero (0) , urgency category (7) is used.

7. If urgency category (7) is used, the type of instruction (9) must be proposal, i.e. must have value zero.

8. User defined urgency categories are introduced in SMU_YEAR_CODES parameter.

9. Type of management prescription (9) determines whether management prescription (4,5) (or event (3)) is operation implemented after inventory or proposal given during inventory. If variable (9) is not provided, the type of management prescription is determined on the basis of year of management prescription (6) and of the year of inventory given in corresponding stand data text file (**rsu** type file).

See also

Stand simulation instructions text file (**smu** type file)
Stand simulation instruction record

Stand data text file (**rsu** type file)
Stand data text file variables (RSU variables)

EVENT parameter
SMU_EVENTS parameter
SMU_VARIABLES parameter
SMU_YEAR_CODES parameter

MELA variables

Initial data record variables
(RSD variables)

Variables

Sample plot variables of initial data, 1-34 (see note 1)

(1) Identification number of the management unit (unique id in ascending order in each **rsd** type file; length must not override 7 digits)
(2) Year, a (that the sample plot data represents for example, 1996)
(3) Actual area, ha (or 1000 ha on large areas)
(4) Area weight for growing stock, same value as (3) (except FNFI data)
(5) North, X coordinate, m (Finnish uniform coordinate system (YKJ) or EUREF-FIN (ETRS-TM35FIN)) (see note 10)
(6) East, Y coordinate, m (Finnish uniform coordinate system (YKJ) or EUREF-FIN (ETRS-TM35FIN) or). If YKJ, then 3000 km must be subtracted (appropriate values in Finland from 0 to 800 km after the 3000 km subtraction). (see note 10)
-(7) Identification number of the stand (if stands are equal to management units, the variable (1) can be used as a unique stand id, and the variable (7) can then be used for other purposes; length must not override 7 digits)
(8) Height of the sample plot above sea level, m
(9) Actual temperature sum, dd (appropriate values in Finland 500 - 1 350 dd)
(10) Owner category

0 private persons 1 enterprises (forest industries, etc.) 2 state (Forest and Park Service, etc.) 3 municipalities etc. 4 communities

(11) Land-use category, see note2

1 forest land 2 scrub land 3 waste land 4 other forestry land than 1-3 5 agricultural land 6 built-up land 7 roads, electric lines, etc. 8 lakes and rivers 9 sea

(12) Soil and peatland category

1 mineral soils 2 peatland, spruce mires (korpi in Finnish) 3 peatland, pine mires (räme in Finnish) 4 peatland, barren treeless mires (neva in Finnish) 5 peatland, rich treeless mires (letto in Finnish)

(13) Site type category

1 very rich sites (OMaT in South Finland)

	2 rich sites (OMT in South Finland) 3 damp sites (MT in South Finland) 4 sub-dry sites (VT in South Finland) 5 dry sites (CT in South Finland) 6 barren sites (ClT in South Finland) 7 rocky or sandy areas 8 open mountains
(14)	Reduction of forest taxation class
	0 no reduction 1 stony soils 2 wet soils 3 thick moss layer expressing low soil productivity (kunttaisuus in Finnish) 4 unfavourable location (coastal areas, mountains)
(15)	Finnish forest taxation class or site fertility category, see note 3
	1 IA respective to very rich or rich sites 2 IB respective to damp sites 3 II respective to sub-dry sites 4 III respective to dry sites 5 IV respective to barren sites or lower, if forest land 6 scrub land 7 waste land
(16)	Drainage category
	0 undrained mineral soils 1 ditched mineral soils 2 undrained mires 3 ditched mires (unchanged productivity), (ojikko in Finnish) 4 transforming mire (improved productivity), (muuttuma in Finnish) 5 transformed mire (productivity comparable to mineral soils), (turvekangas in Finnish)
(17)	Feasibility for drainage
	0 drainage feasible and allowed 1 drainage not feasible or not allowed
-(18)	'0'
(19)	Year of the last drainage, a
(20)	Year of the last fertilization, a
(21)	Year of the last soil surface preparation, a
(22)	Feasibility for natural regeneration
	0 natural regeneration feasible 1 natural regeneration not feasible
(23)	Year of the last cleaning of regeneration area, a
-(24)	(development class - not used as input data)
(25)	Year of the last artificial regeneration, a
(26)	Year of the last tending of young stand, a
(27)	Year of the last pruning, a
(28)	Year of the last cutting, a
(29)	Forestry Board District (default values in Finland)
	0 Ahvenanmaa 1 Helsinki 2 Lounais-Suomi

3 Satakunta 4 Uusimaa-Häme 5 Pirkka-Häme 6 Itä-Häme 7 Etelä-Savo 8 Etelä-Karjala 9 Itä-Savo 10 Pohjois-Karjala 11 Pohjois-Savo 12 Keski-Suomi 13 Etelä-Pohjanmaa 14 Pohjanmaa 15 Keski-Pohjanmaa 16 Kainuu 17 Pohjois-Pohjanmaa 18 Koillis-Suomi 19 Lappi

(30) Forest management category (default values), see notes 4, 5, 6, 7 and 8

1 forest land, no restrictions for timber production 2 forest land, administrational restrictions for timber production 3 scrub land, no restrictions or administrational restrictions for timber production 6 waste land, no restrictions or administrational restrictions for timber production 7 forest, scrub and waste land, no timber production allowed

(31) Method of the last cutting, see note 9

0 no cutting 1 thinning (basal area instructions) 2 clear cutting 3 (first) thinning (number of stems/ha instructions) 4 over story removal 5 seed-tree cutting (natural regeneration for Scotch pine) 6 shelterwood cutting (natural regeneration for Norway spruce)

(32) Municipality (codes by Statistics Finland)
(33) Reserved for system
(34) Reserved for system

Tree variables of initial data, 1-17 (see note 1)

(1) Number of stems/ha (that the tree represents)
(2) Tree species

1 Scotch pine (Pinus silvestris) 2 Norway spruce (Picea abies) 3 Silver birch (Betula pendula) 4 Downy birch (Betula pubescens) 5 Aspen (Populus tremula) 6 Alder (Alnus incana, Alnus glutinosa) 7 other coniferous species than 1 or 2

	8 other deciduous species than 3 - 6
(3)	Diameter at 1.3 m height, cm
(4)	Height, m
(5)	Age at 1.3 m height, a
(6)	Biological age, a
-(7)	Reduction to model-based saw log volume (relative value 0.0 - 1.0)
-(8)	Year of pruning (0 = no pruning), a
-(9)	Age at 1.3 m height when reached 10 cm diameter at breast height, a
-(10)	Origin
	0 natural 1 seeded 2 planted 3 supplementary planted
-(11)	Identification number of the sample tree (default: number of order on the sample plot)
-(12)	Direction of the tree from the origo of the sample plot, in degrees
-(13)	Distance of the tree from the origo of the sample plot, m
-(14)	Height difference of the tree from the origo of the sample plot, m
-(15)	Height of the lowest living branch, m
-(16)	Management category of the tree
	1 no restrictions in forest management operations 2 preserved (untouched in forest management operations)
-(17)	Reserved for system

Generation

Variables of the initial data record are created by user routines or by MELASIM-program (when **rsu** type files are used in storing forest resource data).

Notes

1. The variables above equipped with the sign '-' may well have value zero, if relevant data is not available.

2. Land-use categories 4-9 are not currently allowed in the simulation.

3. Forest taxation class is a combination of sample plot variables (13) and (14).

4. Forest management categories are used to regulate the simulation of events (each event is feasible in the categories provided by the actual event definition, default: event is always feasible).

5. Forest management categories are used to regulate the collection of decision variable values into the categories defined by the MANAGEMENT_CATEGORY_GROUPS parameter.

6. Forest management categories are used to define the limit between timberland (timber production activities allowed) and other forestry land (timber production

activities not allowed) for collecting decision variables. Most of the decision variables are currently collected for timberland only.

7. Users may define and use their own values for the forest management categories in the limits of the available (10) categories. However, the users are responsible for the validity of initial data, event definitions, and headings and titles of reports. It is recommended to use default values for the MANAGEMENT_CATEGORY_GROUPS parameter allowing a large number of forest management categories for the event definitions in the form of floating-point values without the need to change any other definitions.

8. The forest management category cannot change between sample plots within same management unit. The forest management category of a management unit is defined by the category of the last sample plot in the management unit.

9. The cutting method '0' refers to a sample plot where has never been cuttings. Do not use this code if cuttings have sometimes been executed. Take also care for the compatibility of the sample plot variables (28) and (31).

10. Default coordinate system in MELA2009 is Finnish uniform coordinate system (YKJ). If EUREF-FIN coordinates are used, YKJ_COORDINATES parameter must be declared with value 0. Coordinate values must be inside Finland borders.

See also

Initial data file (**rsd** type file)
Initial data record

FOREST_GATEGORIES item in EVENT –parameter
MANAGEMENT_CATEGORY_GROUPS parameter
TIMBER_PRODUCTION_LAND parameter

MELA variables
Simulation record variables (SMR variables)

Simulation Record variables
(SMR-variables)

Variables

Management unit variables of simulation data

(1..93) See sample plot variables of simulation data and note 1

Sample plot variables of simulation data (see notes 2, 3 and 4)

(1) Identification number of the management unit (unique id in ascending order in each **rsd** type file; length must not override 7 digits)
(2) Year, a (that the sample plot data represents, for example, 1996)
(3) Actual area, ha (or 1000 ha on large areas)
(4) Area weight for growing stock, same value as (3) (except FNFI data)
(5) North, X coordinate, km (Finnish uniform coordinate system) (appropriate values in Finland from 6 600 to 7 800 km)
(6) East, Y coordinate-3000, km (Finnish uniform coordinate system) (appropriate values in Finland from 0 to 800 km after the 3000 km subtraction)
-*(7) Identification number of the stand (see the sample plot variable (7) of the initial data record)
(8) Height of the sample plot above sea level, m
(9) Actual temperature sum, dd (appropriate values in Finland 500 - 1 350 dd)
(10) Owner category (see the sample plot variable (10) of the initial data record)
(11) Land-use category (see the sample plot variable (11) of the initial data record)
(12) Soil and peatland category (see the sample plot variable (12) of the initial data record)
(13) Site type category (see the sample plot variable (13) of the initial data record)
*(14) Reduction of forest taxation class (see the sample plot variable (14) of the initial data record)
(15) Forest taxation class (see the sample plot variable (15) of the initial data record)
*(16) Drainage category (see the sample plot variable (16) of the initial data record)
*(17) Feasibility for drainage (see the sample plot variable (17) of the initial data record)
-(18) '0'
(19) Year of the last drainage, a
(20) Year of the last fertilization, a
(21) Year of the last soil surface preparation, a
(22) Feasibility for natural regeneration (see the sample plot variable (22) of the initial data record)
(23) Year of the last cleaning of regeneration area, a
-*(24) Simulated development class

0 land-use category other than forest land or unknown 1 treeless area 2 small seedling stand with over story 3 small seedling stand 4 advanced seedling stand with over story

5 advanced seedling stand
6 young thinning stand
7 advanced thinning stand
8 mature stand
9 seed tree stand
10 shelterwood stand
11 small seedling stand with protective over story
12 young thinning stand with over story

(25) Year of the last artificial regeneration, a
(26) Year of the last tending of young stand, a
(27) Year of the last pruning, a
(28) Year of the last cutting, a
(29) Forestry Board District (see the sample plot variable (29) of the initial data record)
(30) Forest management category (see the sample plot variable (30) of the initial data record)

DOMINANT STORY (variables (31) - (40))

(31) Number of stems/ha (including small trees)
(32) Dominant tree species (see the tree variable (2) of the initial data record)
(33) Mean age, a
(34) Volume, m^3/ha
(35) Basal area, m^2/ha
(36) Mean diameter, cm
(37) Mean height, m
(38) Saw log volume, m^3/ha
(39) Value, €/ha
(40) Volume of commercial timber, m^3/ha

SECONDARY STORY (variables (41) - (50))

(41) Number of stems/ha (including small trees)
(42) Dominant tree species (see the tree variable (2) of the initial data record)
(43) Mean age, a
(44) Volume, m^3/ha
(45) Basal area, m^2/ha
(46) Mean diameter, cm
(47) Mean height, m
(48) Saw log volume, m^3/ha
(49) Value, €/ha
(50) Volume of commercial timber, m^3/ha

(51) Reserved for system
(52) Reserved for system
(53) Reserved for system
(54) Reserved for system
(55) Reserved for system
(56) Reserved for system
(57) Reserved for system
(58) Reserved for system
(59) Reserved for system

(60) Reserved for system
(61) Reserved for system
(62) Reserved for system
(63) Reserved for system
(64) Reserved for system
(65) Reserved for system
*(66) Method of the last draining
*(67) Method of the last fertilization
*(68) Method of the last soil surface preparation
(69) Method of the last artificial regeneration. The integer part shows the method of the last artificial regeneration (see the tree variable (10) of the initial data record) and the first three decimals represent the actual event identification number (see the event identification line of the EVENT parameter).
(70) Method of the last cutting. The integer part shows the method of the last cutting (see the sample plot variable (31) of the initial data record) and the first three decimals represent the actual event identification number (see the event identification line of the EVENT parameter).
*(71) Reserved for system
(72) Municipality code (see the sample plot variable (32) of the initial data record)
*(73) Reserved for system
*(74) Reserved for system
(75) Reserved for system
(76) Volume of pine, m^3/ha
(77) Volume of spruce, m^3/ha
(78) Volume of birch, m^3/ha
(79) Volume of other deciduous, m^3/ha
(80) Total volume, m^3/ha
(81) Increment of pine, m^3/ha/a
(82) Increment of spruce, m^3/ha/a
(83) Increment of birch, m^3/ha/a
(84) Increment of other deciduous, m^3/ha/a
(85) Total increment, m^3/ha/a
(86) Cutting removal of pine, m^3/ha
(87) Cutting removal of spruce, m^3/ha
(88) Cutting removal of birch, m^3/ha
(89) Cutting removal of other deciduous, m^3/ha
(90) Total cutting removal, m^3/ha
*(91) Reserved for system
*(92) Reserved for system
*(93) Reserved for system

Tree variables of simulation data (see note 5)

(1) Number of stems/ha (that the tree represents)
(2) Tree species (see the tree variable (2) of the initial data record)
(3) Diameter at 1.3 m height, cm
(4) Height, m
(5) Basal area at 1.3 m height, m^2
(6) Age at 1.3 m height, a
(7) Initial volume, m^3
(8) Current volume, m^3

(9) Biological age, a
(10) Volume, saw timber, m^3
(11) Volume, pulpwood, m^3
(12) Value, €
-(13) Reduction to the model-based saw log volume (value from the model, relative value 0.0 - 1.0). If value is greater than 1.0 this variable is reserved for system. See note 6.
(14) Simulated story

1 dominant 2 secondary

-(15) Pruned height (0 = no pruning)
-(16) Age at 1.3 m height when reached 10 cm diameter at breast height, a
-(17) Management category of the tree (see the tree variable (16) of the initial data record)
(18) Origin (see the tree variable (10) of the initial data record)
(19) Volume of commercial timber (saw log and pulpwood), m^3
(20) Reserved for system
(21) Reserved for system
(22) Reserved for system
(23) Identification number of the tree on the sample plot
(default: number of order on the sample plot)
-(24) Direction of the tree from the origo of the sample plot, in degrees
-(25) Distance of the tree from the origo of the sample plot, m
-(26) Height difference of the tree from the origo of the sample plot, m
-(27) Height of the lowest living branch, m
(28) Reserved for system
(29) Reserved for system
(30) Reserved for system

Generation

Simulation records are created by MELA routines.

Notes

1. Simulation data consist of 270 variables in total. Only the variables (1) - (90) are described here. Other variables (91) - (270) are used for system maintenance.

2. The variables above equipped with the sign '*' have currently value zero at the management unit level.

3. The variables above equipped with the sign '-' may well have value zero, if relevant data is not available.

4. The values of sample plot variables (1) - (23), (25) - (30), (70) and (72) come directly from the initial data.

5. The values of the tree variables (2), (17) - (18) and (23) - (27) come directly from the initial data.

6. Value of this variable is greater than 1.0 if log volume reduction or log percentage is given in the data.

See also

Simulation record files (**smr** type files)
Simulation record

Initial data files (**rsd** type files)
Initial data record
Initial data record variables (RSD variables)

EVENT parameter
MELA variables

Updated stratum data variables

(SMT variables)

Variables

(1) Number of stems, stems/ha
(2) Tree species (see note 1), (2)

1 Scotch pine (Pinus silvestris) 2 Norway spruce (Picea abies) 3 Silver birch (Betula pendula) 4 Downy birch (Betula pubescens) 5 Aspen (Populus tremula) 6 Alder (Alnus incana, Alnus glutinosa) 7 other coniferous species than 1 or 2 8 other deciduous species than 3 - 6

(3) Mean diameter, cm (see note 2)
(4) Mean height, m (see note 2)
(5) Basal area, m^2/ha
(6) Age at breast height, a (see note 2)
(7) Initial volume, m^3/ha
(8) Current volume, m^3/ha
(9) Biological age, a (see note 2)
(10) Volume of saw timber, m^3/ha
(11) Volume of pulpwood timber, m^3/ha
(12) Value, €/ha
(13) Reserved for system
(14) Reserved for system
(15) Reserved for system
(16) Age at 1.3 m height when reached 10 cm diameter at breast height, a
(17) Management category of the tree

1 no restrictions in forest management operations 2 preserved (untoutched in forest management opeations)

(18) Origin (see note 1), (18)

0 natural 1 planted 2 seeded 3 supplementary planted

(19) Volume of commercial timber, m^3/ha
(20) Reserved for system
(21) Reserved for system
(22) Reserved for system
(23) Reserved for system
(24) Reserved for system
(25) Reserved for system
(26) Reserved for system
(27) Height of the lowest living branch, m (see note 2)
(28) Reserved for system
(29) Reserved for system

(30) Reserved for system
(101) Log percentage (%,1 > % ≤ 100) (see note 4)
(102) Future net increment, m^3/ha/a (see note 5)
(103) Year of calculation, a
(104) Reserved for system
(105) Total increment during updating, m^3/ha (see note 6)
(106) Future net value increment (see note 5)

Generation

Variables of the updated stratum data text file (**smt** type file) are generated by MELA routines.

Notes

1. Categories are similar to the categories in MELA simulation record. The number in parenthesis refers to the number of the tree variable in MELA simulation record (in **smr**-type files).

2. Mean diameter at the 1.3 m height (3), height (4), age at the 1.3 m height (6), biological age (9), age at 1.3 m height when reached 10 cm diameter at breast height (16) and lower bound for the living crown (27) are weighted during the updating. Weight is set by parameter SMT_WEIGHTS.

3. Calculated from the current volume.

4. Future net increment (102) and future net value increment (106) are calculated by subtraction and are calculated correctly only if the simulation period does not include simulated events. Five years is recommended to be the length of the simulation period because growth models are based on five year growth period.

5. When updating of the stand data, total growth between the year of the inventory and year of calculation is also calculated by subtraction. Treatments (cuttings) made after the year of inventory may cause the estimate of total growth to become negative.

See also

Updated stratum data text files (**smt** type files)
Updated stratum data record

Simulation record files (**smr** type files)
Simulation record variables (SMR variables)

SMT VARIABLES parameter
SMT WEIGHTS parameter

MELA variables

Natural process variables

Age

Generic name in Finnish

Ikä

Variable type

Numerical

Functions

Age of a tree (at breast height) is one of the tree variables required for the models used in the simulation of biological processes (Hynynen et al. 2002).

The biological age is used, for example, as criteria in the event definition and in the reports.

Age is also used when predicting the saw log volume reduction.

Origins

The MELA initial data can include either individual trees (**rsd** and **rsu** type files) or only plot- or stand-level information with average tree measures by strata (**rsu** type files). In tree input data (in **rsu** type file) either the biological age or age at the breast height has to be given. If only tree stratum data is given in the input data the MELA extension for the initial data conversion can be used to generate trees from theoretical distributions. The stratum data have to include either biological age or age at the breast height. The missing age is derived by the models. Thus, the age of simulation trees created by the extension can be either the mean age of a tree stratum or a computed estimate.

During the simulation the age of the trees is kept up-to-date. The MELA extension for updating of stand data can be used to export biological age or age at the breast height for tree strata.

Mean biological age is updated and stored in the simulation record separately for dominant and secondary story. The mean ages are calculated by weighting with basal area.

Locations

Location	Variables
a) Variables of the stratum data record	- biological age (9)

(RSU variables)	- age at breast height (10)
b) Variables of the tree data record (RSU variables)	- age at breast height (8) - biological age (9) - age at 1.3 m height when reached 10 cm diameter at breast height (12)
c) Tree variables of initial data record (RSD variables)	- age at 1.3 m height (5) - biological age (6) - age at 1.3 m height when reached 10 cm diameter at breast height (9)
d) Sample plot variables of simulation data record (SMR variables)	- mean age, dominant story (33) - mean age, secondary story (43)
e) Tree variables of simulation data record (SMR variables)	- age at 1.3 m height (6) - biological age (9) - age at 1.3 m height when reached 10 cm diameter at breast height (16)
f) Variables of updated stratum data (SMT variables)	- age at breast height (6) - biological age (9) - age at 1.3 m height when reached 10 cm diameter at breast height (16)
g) Collective variables	- **Ap1** (mean age, dominant story), category variable

Valid since

MELA96, changed in MELA2007

See also

Collective variables

Basal area

Generic name in Finnish

Pohjapinta-ala

Variable type

Numerical

Functions

Either basal area or number of stems for each tree stratum has to be given to scale the theoretical distributions used to generate simulation trees from tree stratum information.

The growth of trees over 1.3 m is predicted with distance-independent models for tree basal area growth and height growth (Hynynen et al. 2002).

The basal area is used, for example, as a criteria in the event definition.

Formula

The conversion between basal area and number of stems is based on the relascope theory by Bitterlich (1948).

Origins

If only tree stratum data are given in the input data the MELA extensions for the initial data conversion can be used to generate trees from theoretical distributions. Either basal area or number of stems for each tree stratum has to be given to scale the distribution. The missing variable can be derived from the existing one using a formula and/or a model.

In the simulation the basal area of a tree is calculated from the diameter (at breast height) of trees and the basal area of dominant and secondary story as a sum of trees.

The MELA extensions for updating of stand data can be used to export basal area for tree strata.

Locations

Location	Variables
a) Variables of the stratum data record	- basal area (5)

(RSU variables)	
b) Sample plot variables of simulation data record (SMR variables)	- basal area of dominant story (35) - basal area of secondary story (45)
c) Tree variables of simulation data record (SMR variables)	- basal area (at breast height) (5)
d) Variables of updated stratum data (SMT variables)	- basal area (5)
e) Collective variables	- **G** (basal area), collectible variable

Valid since

MELA96

See also

MELA extensions

Diameter

Generic name in Finnish

Läpimitta

Variable type

Numerical

Functions

Diameter of a tree (at breast height) is one of the tree variables required for the models used in the simulation of biological processes (Hynynen et al. 2002).

Diameter of a tree (at breast height) is used together with the tree height as a key when retrieving the stem volume.

Diameter is also used when predicting the saw log volume reduction.

Origins

The MELA initial data can include either individual trees (**rsd** and **rsu** type files) or only plot- or stand-level information with average tree measures by strata (**rsu** type files). In tree input data diameter at the breast height has to be given.

If only tree stratum data are given in the input data the MELA extensions for the initial data conversion can be used to generate trees from theoretical distributions. For strata where trees are above breast height the diameter of the mean tree of the stratum given as input data is used in the prediction of the distribution. From the distribution the trees are sampled by diameter classes to represent a number of stems per hectare. Thereafter the tree variables include tree species, number of stems/ha (that each tree represents) species and diameter.

During the simulation the diameter of trees is kept up-to-date. The MELA extension for updating of stand data can be used to export diameter for tree strata.

Mean diameter is updated and stored in the simulation record separately for dominant and secondary story.

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- mean diameter (7)
b) Variables of the tree data record (RSU variables)	- diameter at breast height (6)
c) Tree variables of initial data record (RSD variables)	- diameter at 1.3 m height (3)
d) Sample plot variables of simulation data record (SMR variables)	- mean diameter, dominant story (36) - mean diameter, secondary story (46)
e)) Tree variables of simulation data record (SMR variables)	- diameter at 1.3 m height (3)
f) Variables of updated stratum data (SMT variables)	- mean diameter (3)
g) Collective variables	- **d** (diameter at 1.3 m height), category variable - **Dp1** (mean age, dominant story), category variable

Valid since

MELA96, changed in MELA2007

See also

MELA extensions

Height above sea level

Generic name in Finnish

Korkeus meren pinnan yläpuolella

Variable type

Numerical

Functions

Height above sea level is used in the prediction of (height corrected) temperature sum, if temperature sum is not given in the MELA input data.

Origins

The MELA initial data can be either in **rsd** type files or in **rsu** type files.

In **rsd** type files both temperature sum and height above sea level for sample plots have to be given.

In **rsu** files the user can provide height above sea level. When the accurate height above sea level is not known it is better to give value zero (0) to the variable.

If accurate height above sea level is given in a **rsu** type it is used in the prediction of temperature sum. If height above sea level does not exist height above sea level is retrieved from a table as a function of site coordinates. Therefore users must keep attention to the correctness of the coordinates.

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- height above sea level (12)
b) Sample plot variables of initial data record (RSD variables)	- height above sea level plot (8)
c) Sample plot variables of simulation data record (SMR variables)	- height above sea level (8)

Valid since

MELA96, MELA98, changed in MELA2002

Height

Generic name in Finnish

Pituus

Variable type

Numerical

Functions

Height of a tree is one of the tree variables required for the models used in the simulation of biological processes (Hynynen et al. 2002).

Height of a tree is used together with the diameter (at breast height) as a key when retrieving the stem volume.

Origins

The MELA initial data can include either individual trees (**rsd** and **rsu** type files) or only plot- or stand-level information with average tree measures by strata (**rsu** type files). In tree input data height has to be given.

If only tree stratum data are given in the input data the MELA extensions for the initial data conversion can be used to generate trees from theoretical distributions. For tree strata where the diameter of the mean tree is greater or equal than 5 cm the trees are sampled from diameter (basal area) distribution by diameter classes to represent a number of stems per hectare. Thereafter the trees are furnished with height. Height of the mean tree of the stratum given as input data can be used as a correction factor. For tree stratums where the diameter of the mean tree is less than 5 cm the trees are sampled from height distribution and furnished with diameter.

During the simulation the height of trees is kept up-to-date. The MELA extension for updating of stand data can be used to export height for tree strata.

Mean height is updated and stored in the simulation record separately for dominant and secondary story.

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- mean height (8)

b) Variables of the tree data record (RSU variables)	- height (7)
c) Tree variables of initial data record (RSD variables)	- height (4)
d) Sample plot variables of simulation data record (SMR variables)	- mean height, dominant story (37) - mean height, secondary story (47)
e) Tree variables of simulation data record (SMR variables)	- height (4)
f) Variables of updated stratum data (SMT variables)	- mean height (4)

Valid since

MELA96

Increment

Generic name in Finnish

Kasvu

Variable type

Numerical

Functions

The volume increment is a decision and report variable. A volume increment can be either net increment or gross increment. Net increment is gross increment minus mortality.

Origins

In the simulation the growth of the trees is predicted based on individual-tree models. The growth of trees over 1.3 m is predicted with distance-independent models for tree basal-area growth and height growth (Hynynen et al. 2002). Height growth of individual tree on mineral soils is driven by the height development of dominant trees. Regeneration, ingrowth and the juvenile development of trees until they reach the height of 1.3 m is predicted with regeneration models (Hynynen et al. 2002).

During the simulation the diameter and height of sample trees are updated with the growth of diameter and height, respectively, and the new volume of stems is retrieved from a table using the updated diameter and height as a key. Thereafter the volume increment of each tree for the required period is calculated as a difference of volumes in two states. The volume increment of dominant and secondary stories or tree species is calculated as a sum of trees and stored in simulation record. Increment and mortality for different strata is stored for each management schedule as a decision variable.

The MELA extensions for updating forest resource data can be used to export future volume increment for tree strata.

Locations

Location	Variables
a) Sample plot variables of simulation data record (SMR variables)	- increment by tree species (81-84) - total increment (85)
b) Variables of updated stratum data (SMT variables)	- future net increment (102) - total increment during updating (105)
c) Decision data variables (MSD	- increment of the dominant story (39)

variables)	- increment of trees generated during simulation by tree species categories (56-60) - increment by diameter classes and tree species categories (66-90) - increment on forest land by age classes (91-100) - increment of saw log volume (326) - increment of pulpwood volume (327) - increment of logging residue (328) - increment of commercial timber (329) - increment by forest management categories (371-380) - increment by owner categories (381-384) - increment of the secondary story (385) - net increment by tree species categories (386-390) - increment by tree species categories and soil types (391-400) - total increment on forestry land by tree species categories (401-405) - increment by tree species categories and soil fertility categories (406-440) - summarized increment over the calculation period by tree species categories (911-915)
d) Collective variables	- **IV** (inrement), collectible variable

Valid since

MELA96, MELA98

Mortality

Generic name in Finnish

Luonnonpoistuma

Variable type

Numerical

Functions

The number of stems presented by each sample tree is updated based on the estimate of mortality.

Mortality is a decision and report variable.

Origins

In the simulation mortality of trees is predicted with models for the probability of a given tree to die under the next five years, and stand level self-thinning model. The self thinning line controls stand development in situations, where accelerated mortality is expected due to suppression and competition. (Hynynen et al. 2002).

During the simulation mortality is stored for each management schedule as a decision variable.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- mortality by forest management categories (351-360) - mortality by tree species categories (361-365) - mortality of retained trees by tree species categories (589-593)
b) Collective variables	- **MR** (mortality), collective variable

Valid since

MELA96, MELA98

Number of stems

Generic name in Finnish

Runkoluku

Variable type

Numerical

Functions

Either basal area or number of stems for each tree stratum has to be given to scale the theoretical distributions used to generate simulation trees from tree stratum information.

The number of stems is used, for example, as a criteria in the event definition.

Formula

The conversion between basal area and number of stems is based on the relascope theory by Bitterlich (1948).

Origins

If only tree stratum data are given in the input data the MELA extensions for the initial data conversion can be used to generate trees from theoretical distributions. Either basal area or number of stems for each tree stratum has to be given to scale the distribution. The missing variable can be derived from the existing one using a formula and/or a model.

From the distribution the trees are sampled by diameter classes to represent a number of stems per hectare. Thereafter the tree variables include tree species, number of stems sper ha (that each tree represents) species and diameter.

In the simulation the number of stems per ha that each tree represent is kept up-to-date. The MELA extension for updating forest resource data can be used to export the number of trees for tree strata.

The number of trees for dominant and secondary stories is calculated as a sum of trees.

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- number of stems (6)
b) Variables of the tree data record (RSU variables)	- number of stems (4)
c) Tree variables of initial data record (RSD variables)	- number of stems (that the tree represents) (1)
d) Sample plot variables of simulation data record (SMR variables)	- number of stems/ha (including small trees), dominant story (31) - number of stems/ha (including small trees), secondary story (41)
e) Tree variables of simulation data record (SMR variables)	- number of stems/ha (that the tree represents) (1)
f) Variables of updated stratum data (SMT variables)	- number of stems (11)
g) Collective variables	- **N** (number of trees), collectible variables

Valid since

MELA96

See also

Thinning based on number of stems instructions

Temperature sum

Generic name in Finnish

Lämpösumma

Variable type

Numerical

Functions

Height corrected temperature sum is one of the site variables required for the models used in the simulation of biological processes (Hynynen et al. 2002).

Formula

The prediction of temperature sum is based on the models by Ojansuu & Henttonen (1983).

Origins

In **rsd** type files both (height corrected) temperature sum and height above sea level for sample plots have to be given.

In **rsu** files the user can provide height above sea level, **but not temperature sum**. When **rsu** file is used temperature sum is calculated by MELA. Calculation is then based on the coordinates.

Locations

Location	Variables
a) Sample plot variables of initial data record (RSD variables)	- actual temperature (9)
b) Sample plot variables of simulation data record (SMR variables)	- actual temperature sum (9)

Valid since

MELA96,MELA98, changed in MELA2002

See also

- Height above sea level variable

Total yield

Generic name in Finnish

Kokonaistuotos

Variable type

Numerical

Functions

Total yield is a decision variable and it describes the cumulative yield of the commercial timber.

Formula

$$Total\ yield = \sum_{k=1}^{n} CR_{a(k-½)} + cV_{an} - cV_0$$

CR = cutting removal
cV = commercial volume
a = length of calculation period, years
k = calculation period (k = 1...n)

Origins

During the simulation the total yield is calculated as the cumulative sum of cutting removals (decision data variable 195) plus the change of the commercial volume from the beginning of the calculation period until the year in question. Commercial volume is the sum of saw log volume (decision data variable 697) and pulpwood volume (decision data variable 698).

Locations

Location	Variables
a) Decision data variables (MSD variables)	-total yield (816)

Notes

1. In general the yield is defined as the commercial volume of trees felled periodically. In MELA the total yield consists also the change of the commercial volume of the initial inventory and the ending inventory.

2. In the current MELA version the commercial volume consists of saw timer and pulpwood. The bucking instructions for timber assortments are described in the definition of the volume.

See also

Volume variable

Volume

Generic name in Finnish

Tilavuus

Variable type

Numerical

Functions

The stem volume and timber assortment volumes are used in the assessment of forest resources, increment, cutting possibilities and their value. Forest-level information is calculated by summing up the standwise information and stand-level information is calculated by summing up the treewise information. For example, cutting removal is a sum of cut trees meeting the standards for commercial round wood, felling residues excluded.

Formula

The Finnish taper curve models and volume functions (Laasasenaho 1982). The original modelling data for stem curves are collected in years 1968-72 (FNFI6).

Origins

A separate program CRKVIC (Laasasenaho 1982, Snellman 1984) is used to calculate the estimates of the total volume of stem from stump height to top, volume of saw log section of stem, volume of pulpwood section of stem, and volume of residual section of stem above pulpwood section. In CRKVIC the bucking algorithm is based on the module length together with the minimum and maximum lengths for the saw logs, the minimum length of pulpwood, and the minimum requirements for top diameters of saw log and pulpwood section of stems by tree species. CRKVIC stores the estimates in the binary table (**vol** type file) from which MELASIM can retrieve the estimates for each stem whenever the initial tree data are read or tree lists updated after growth prediction. The retrieval keys are the tree species or species categories defined by the tree variable of the initial data record, tree diameter and height. The total volume of small size trees (maximum height 3-5 m depending on tree species) is calculated in MELASIM using a specific formulae by Kujala.

The volume estimates are given as the cell values of the volume table for trees which are between

- 1-80 cm in diameter
- 3-40 m in height.

The size of diameter cells is 1 cm and the size of height cell 1 m.

In the bucking (CRKVIC) the following assumptions are applied:

- The length of module for saw logs 0.3 m.
- The minimum length of saw logs 4.3 m.
- The maximum length of saw logs 6.1 m.
- The minimum length of pulpwood 2.0 m.

The minimum diameters in CRKVIC are

- 14.5 cm for pine and other coniferous, 17.0 cm for spruce and 16.5 cm for deciduous species saw logs and
- 6.3 cm for pine and other coniferous and 6.5 cm for spruce and deciduous species pulp wood.

The estimate of saw log volume of a stem can be corrected using a built-in saw log volume reduction model or the log volume reduction given in forest resource data. The use of the log reduction can be controlled using LOG_VOLUME_REDUCTION parameter.

In addition, the volume estimates can be corrected using general adjustment coefficients given by forestry board districts, see VOLUME_CALIBRATION parameter.

Saw log volumes can also be corrected using general adjustment coefficients given by forestry board districts, see LOG_VOLUME_CALIBRATION parameter. When saw log volumes are corrected with LOG_VOLUME_CALIBRATION parameter it always affects to the pulp wood volumes. Growth in saw log volume reduces the pulp wood volume, and vice versa. LOG_VOLUME_CALIBRATION doesn't affect to the total volume.

The volume estimates of each stem are stored in the simulation record from which they can be retrieved for additional calculations.

Locations

Location	Variables
a) Sample plot variables of simulation data record (SMR variables)	- volume, dominant story (34) - volume, secondary story (44) - saw log volume, dominant story (38) - saw log volume, secondary story (38) - volume of commercial timber, dominant story (40) - volume of commercial timber, secondary story (50) - volume by tree species (76-79)
b) Tree variables of simulation data record (SMR variables)	- initial volume (7) - current volume (8) - volume, saw timber (10) - volume, pulpwood (11) - volume of commercial timber (19)
c) Decision data variables (MSD	- total volume on forestry land by tree species

variables)	categories (551-555) - total volume of retained trees by tree species categories (566-570) - total volume of retained trees by timber assortments (576-577) - volume of selected retained trees by tree species categories (579-583) - volume by diameter classes, timber assortments and tree species categories (601-700) - volume by tree species categories and owner categories (701-730) - volume by site types and tree species categories (731-765) - volume by soil types and tree species categories (771-785) - volume by forest management categories (786-795) - saw log volume of trees generated during simulation by tree species categories (841-845) - volume on forest land by tree species categories and age classes (851-900) - initial volume of trees existing in initial data by tree species categories (901-905) - actual volume of trees existing in initial data by tree species categories (906-910) - volume of the trees generated during simulation by tree species categories (936-940) - volume of dominant story by tree species categories (971-975) - volume of secondary story by tree species categories (976-980) - saw log volume of dominant story by tree species category (981-985) saw log volume of secondary story by tree species category (986-990)
d) Variables of updated stratum data (SMT variables)	- initial volume (7) - current volume (8) - volume of saw timber (10) - volume of pulpwood timber (11) - volume of commercial timber (19)
e) Collective variables	- **V** (volume of growing stock), collectible variable - **VC** (commercial volume), collectible variable - **VL** (saw log volume), collectible variable - **VP** (pulpwood volume), collectible variable - **VR** (cutting residue volume), collectible variable

Instructions

The taper curve and volume functions are applicable only in Finnish conditions for five tree species (pine, spruce, birch, aspen and alder).

Valid since

MELA96, changed in MELA 2002 (updated version, released February 2004)

Notes

1. The stem volume calculation is based on a volume table because of the speed of the execution. Minor accuracy losses are due to interpolation.

2. The cell values are retrieved as a function of diameter and height. When using the same volume table all over the Finland it is implicitly assumed that the stem form is uniform for all trees of same size in diameter and height.

3. The original modelling data for stem curve and volume functions originates from year 1968-72. Therefore the stem form corresponds to forest management of years preceding the measurement years. The applicability of the functions in different management conditions should be analysed.

4. The bucking algorithm is based on fixed minimum requirements. For changing the parameters and for the generation of user-supplied stem volume tables, the MELA team should be contacted.

See also

LOG_VOLUME_REDUCTION parameter
VOLUME_CALIBRATION parameter
LOG_VOLUME_CALIBRATION parameter

Collective variables
Decision data variables (MSD variables)
Cutting removal variable

Economy and technology variables

Costs

Generic name in Finnish

Kustannukset

Variable type

Numerical

Functions

The costs of logging and silvicultural operations are used together with the cutting revenues in the calculation of net revenues and net present values, consequently determining the preference and the priority of management operations in the economic analysis.

Formula

$$c_i = (E_i p_i + E_{ai} p_{ai}) q_i + M_i$$

c_i = costs of logging or silvicultural operation i
E_i = time consumption of logging or silvicultural operation i (h/m³ or h/ha)
E_{ai} = time consumption of supervision and planning for logging or silvicultural operation i (h/m³ or h/ha)
q_i = output of logging or silvicultural operation i (m³ or ha)
p_i = unit price i.e. hourly cost of logging or silvicultural operation i - wages, machine costs etc. (price/h)
p_{ai} = unit price i.e. hourly cost of supervision and planning for logging or silvicultural operation i - wages, machine costs etc. (price/h)
M_i = material costs of logging or silvicultural operation i

Origins

Since MELA99 the costs are calculated as a product of unit price and the time consumption used for the operation. The determination of time consumption (E) is based mainly on the productivity functions of Kuitto et al. (1994), Rummukainen et al (1995), and Metsäpalkkarakenteen ... (1995) coded into the MELA or the user can utilize own values by applying the parameter TIME_EXPENDITURE_IN_LOGGING. The unit prices can be given with the parameters LOGGING_COSTS and SILVICULTURAL_COSTS. The costs include also the costs of administration (supervision and planning) and the used materials.

During the simulation costs for manual and mechanized felling are calculated simultaneously and the MELA selects automatically the lower costs, unless the user does not control the use of cutting methods with the EVENT_CALL arguments of the EVENT parameter.

The cost calculations of the earlier MELA versions than MELA99 are based on the average hectare costs of silvicultural operations (€/ha) and on the average logging costs (€/m³). Thus the cost calculations with older versions do not base on the actual usage of resources but rather on the statistical usage.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- costs by owner categories and cutting methods (40-47) - silviculture costs (366) - forest improvement costs (367) - costs by owner categories and forest management activities (451-474) - summarized costs over the calculation period (818)
b) Collective variables	- **W** (total costs), collectible variable - **WC** (roundwood logging costs), collectible variable - **WE** (energy wood logging costs), collectible variable - **WRA** (costs of artificial regeneration), collectible variable - **WSR** (costs of soil surface preparation), collectible variable - **WCA** (costs of clearing), collectible variable - **WCY** (costs of tending), collectible variable

Valid since

MELA96, MELA99 changed in MELA2002 and MELA2007

Notes

1. The model for time consumption of supervision and planning was adjusted for the updates of MELA99 and versions since.

See also

EVENT parameter
LOGGING_COSTS parameter
SILVICULTURAL_COSTS parameter
TIME_EXPENDITURE_IN_LOGGING parameter

Collective variables
Decision data variables (MSD variables)

Cutting removal

Generic name in Finnish

Hakkuukertymä

Variable type

Numerical

Functions

Cutting removal and it's sub-items are used as decision variables and in calculation of the revenues. There are several common examples of the usage of cutting removals as decision variables in MELA problem definitions; one of the most common is the non-declining yield definition.

Origins

Cutting removal is defined as the commercial timber harvested in cuttings, and thus far it consists of saw log and pulpwood. During the simulation the cuttings are controlled via EVENT parameter and either with the user given or built-in tree selection instructions. The volume estimates for timber assortments of each tree to be cut are retrieved from a special binary type file VOLUME.VOL. Volume estimates stored in that file are calculated beforehand using a separate program CRKVIC. More detailed information concerning CRKVIC program and bucking algorithm can be find in the definition of volume variable.

Locations

Location	Variables
a) Sample plot variables of simulation data record (SMR variables)	- cutting removal by tree species (86-89) - total cutting removal (90)
b) Decision data variables (MSD variables)	- removal of trees generated during simulation by tree species categories (61-65) - cutting removal by forest management categories (111-285) - cutting removal by tree species categories and soil fertility categories (291-325) - saw log removal of the trees generated during simulation by tree species categories (441-445) - summarized saw log removal over calculation period by tree species categories (836-840) - summarized cutting removal over the

	calculation period by tree species (921-925)
c) Collective variables	- **RC** (commercial cutting removal), collectible variable - **RL** (saw log removals), collectible variable - **RP** (pulp log removals), collectible variable - **RE** (total energy wood removal), collectible variable - **REst** (energy wood removal of stem wood), collectible variable - **REsr** (energy wood removal of stumps and roots removals), collectible variable - **REcr** (energy wood removal of crown), collectible variable

Valid since

MELA96

See also

Volume variable
EVENT parameter
Tree selection instructions
Decision data variables (MSD variables)
Collective variables

Drain (total drain, cutting drain)

Generic name in Finnish

Poistuma (kokonaispoistuma, hakkuupoistuma)

Variable type

Numerical

Functions

Total drain, cutting drain and mortality are decision variables. The drain constitutes the debit side of the forest balance.

Formula

cutting drain =
    cutting removal +
    logging residue
total drain =
    cutting drain +
    mortality

Origins

Total drain is the sum of cutting drain and mortality. Cutting drain constitutes of cutting removal and logging residue. Logging residue is the part of stem wood felled in cuttings or in silvicultural operations (tending of young stands, clearing of regeneration areas) that does not fullfil the standards of commercial timber (saw log or pulpwood). Mortality is defined as the stem volume of dead trees that are left on the ground to decompose. Mortality and logging residue compose the waste wood.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- total drain by forest management categories (101-110) - total drain on forestry land by tree species categories (286-290, 346-350) - cutting drain by tree species categories (336-340) - summarized total drain over the calculation period by tree species categories (916-920)

b) Collective variables	- **DR** (total drain), collective variable
c) Collective variables	- **R** (cutting drain), collective variable

Valid since

MELA96

See also

Mortality variable
Cutting removal variable
Logging residue variable
Decision data variables (MSD variables)
Collective variables

Income/revenue/return

Generic name in Finnish

Tulo, tuotto

Variable type

Numerical

Functions

In principle there are no conceptual differences in MELA terminology between the income, revenue or return and actually they are used more or less as synonyms. Incomes/ revenues/ returns describe monetary benefits resulting from timber sales and they are used as decision variables but also during the calculation of net present values, consequently determining the preference and the priority of management operations in the analysis from the economic point of view.

Formula

net income =
    gross income with roadside prices -
    total costs (including explicit logging costs)
net revenue (net change of capital property) =
    net income +
    the change of cutting value of growing stock

Origins

During the simulation the incomes of timber sales calculated with stumpage prices are stored in decision data variable 500. The variable define the "pure" value of timber. The gross income value at roadside (499) is calculated using roadside prices, not as a sum of stumpage price value and lopping coasts.

Average annual net incomes (370) earned during each sub-period are calculated by subtracting the total costs (costs of logging, costs of silviculture and costs of forest improvement) occurred during the sub-period in question from the gross incomes calculated with roadside prices.

Total net returns per period (819) take into account also the change of capital i.e. the change of the cutting value of growing stock during each preceding sub-period (value of growing stock at time t minus the value at time t-1.

Total return (817) is similarly equal to cumulative net revenues plus the change of the cutting value from the beginning of the calculation period until the year in question. The total figure for the calculation period is found at the end of the last sub-period.

Locations

Location	Variables
a) Decision data variables (MSD variables)	calculated with stumpage prices: - gross income (500) - summarized revenues the calculation period (820) calculated with roadside prices: - gross income (499) - net revenues (370) - total returns (817) - summarized net revenues (819) - returns per sub-period (822) - summarized gross income over calculation period by tree species categories (931-935)
b) Collective variables	- **NU** (net income as roadside/factory gate prices), collectible variable - **NUS** (net income as stumpage prices), collectible variable - **U** (gross income as roadside/factory gate prices), collectible variable - **US** (gross income as stumpage prices), collectible variable - **UC** (roundwood logging income as roadside prices), collectible variable - **UCS** (roundwood logging income as stumpage prices), collectible variable - **UE** (energy wood logging income as factory gate prices) - **UES** (energy wood logging income as stumpage prices)

Valid since

MELA96, changed in MELA2002

Notes

1. Variables 806-810 (discounted net income on each sub-period) are meant only for intermediate variables in calculating the net present values (variables 801-805).

See also

Costs variable
Net present value variable
Collective variables
Decision data variables (MSD variables)
ROADSIDE_PRICES parameter
STUMPAGE_PRICES parameter

Land value

Generic name in Finnish

Maanarvo

Variable type

Numerical

Functions

Land value is defined in MELA according to Faustmann (1849) as the value of bare land. Land value represents thus the expectation value of future tree generation and it is used both to take into account the revenues and costs from the rotation periods after the ongoing simulation period and to form opportunity cost for present timber growing

Formula

$$\max_{T} LV = \frac{\sum_{t=0}^{T} R_t (1+i)^{T-t} - \sum_{t=0}^{T} C_t (1+i)^{T-t}}{(1+i)^T - 1}$$

LV = value of bare land (soil expectation value)
t = time
T = optimum rotation
R_t = incomes at time *t* (roadside prices)
C_t = costs at time *t*
i = interest rate (p%/100)

Origins

Land values for five built-in or user defined interest rates (DISCOUNT_RATES parameter) can be calculated in a special simulation using a special data. In the special land value simulation the item 16 of SIMULATION_CONTROL parameter have to be 1 and the item 17 is -1. The special input data for land value calculations consist only the sample plot variables of the initial data (**rsd** or **rsu** type files) and the tree variables are omitted. The results of land value simulation are reported on screen or log -type file. The use of decision data variables 811-815 is not recommended because there are no meaningful interpretations for them.

Locations

Location	Variables
a) log-type file or screen	- land values for used interest rates and site types
b) Decision data variables (MSD variables)	- land value (811-815) (these variables have no meaningful interpretation so far)
c) Collective variables	- **LDV1-LDV5** (land values by discount rates at the management unit level)

Valid since

MELA96, changed MELA2002

See also

Net present value variable
Costs variable
Revenues variable
LAND_VALUES parameter
SIMULATION_CONTROL parameter
DISCOUNT_RATES parameter
MPS_VARIABLES parameter

Logging residue

Generic name in Finnish

Hakkuutähde

Variable type

Numerical

Functions

Logging residue is part of cutting drain and it is defined as non-commercial fraction of felled stems. Logging residue and mortality compose the waste wood. However, concerning standing timber waste wood is the non-commercial fraction of a stem.

Formula

$VOL_T = VOL_S + VOL_P + VOL_R$

VOL_T = total volume of a stem
VOL_S = saw log volume
VOL_P = pulpwood
VOL_R = residue

Origins

In the simulation the estimates of logging residue are retrieved for trees from the special binary file VOLUME.VOL. The estimates of residue and waste wood are stored in decision variables.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- logging residue by tree species categories (331-335) - waste wood by tree species categories (341-345) - volume by diameter classes , timber assortments and tree species categories (waste wood, pine: 603,623,643,663,683), (waste wood, spruce: 607,627,647,667,687), (waste wood, birch: 611,631,651,671,691), (waste wood, other deciduous: 615,635,655,675,695), (waste wood: 619,639,659,679,699)
b) Collective variables	- **RR** (cutting residue), collectible variable

Valid since

MELA96, changed in MELA2007

See also

Drain variable
Volume variable
Collective variables
Volume type files (**vol** type files)

Manpower (time consumption)

Generic name in Finnish

Työmenekki

Variable type

Numerical

Functions

Manpower means the time consumption of silvicultural or logging operation. Manpower is decision variable. Since MELA99 it has been also the main component of cost calculations.

Formula

E_i = f (diameter, height, tree species, the size of activity, working method, terrain, season, distance, etc.)

E_i = time consumption of silvicultural or logging operation i

Origins

Since MELA99 the calculation of time consumption is based on Finnish productivity functions of Kuitto et al (1994), Rummukainen et al. and Metsäpalkkarakenteen ... (1995). The productivity functions are for tending, clearing of regeneration areas, scarification, planting and seeding, manual and mechanized logging, forest haulage, supervision and planning The time consumption include the effective work time and the delay times shorter than 15 minutes.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- manpower by owner categories and cutting methods (48-55) - manpower by owner categories and forest management activities (475-498)
b) Collective variables	- **L** (total working time), collectible variable - **LC** (working time of roundwood logging), collectible variable - **LE** (working time of energy wood logging),

	collectible variable - **LRA** (working time of artificial regeneration), collectible variable - **LSR** (working time of soil surface preparation), collectible variable - **LCA** (working time of clearing), collectible variable - **LCY** (working time of tending), collectible variable

Valid since

MELA96, MELA99, changed in MELA2007

Notes

1. The earlier versions of MELA used tabulated averages.

2. The model for time consumption of supervision and planning was adjusted for the updates of MELA99 and visions since.

See also

Costs variable
Collective variables
LOGGING COSTS parameter
SILVICULTURAL COSTS parameter
TIME EXPENDITURE IN LOGGING parameter

Net Present Value (NPV)

Generic name in Finnish

Nettotuottojen nykyarvo

Variable type

Numerical

Functions

Timber production process comprises a set of sequential actions, though the time interval between these actions can be long. A generally accepted way to manage time in forestry is to apply the net present value (NPV) method. In the calculation of the net present value, all predicted future incomes and costs are discounted to the present, compressing the whole future of the management schedule into one figure temporally weighted by the discount rate.

Formula

$$NPV = \sum_{t=1}^{T} \sum_{i=1}^{n} \sum_{j=1}^{mi} w_{ijt} x_{ijt} / (1+r)^{t} \quad (I)$$

$$+ \sum_{t'=T}^{T'} \sum_{i=1}^{n} \sum_{j'=1}^{mi} w_{ij't'} x_{ij't'} / (1+r)^{t'} \quad (II)$$

$$+ LV_i / (1+r)^{T'} \quad (III)$$

s.t

$$\sum_{j=1}^{mi} x_{ij} = a_{ij}, \quad \forall i = 1,...,n$$

$$\sum_{i=1}^{n} a_i = A$$

$$w_{ijt} = p_s V_{ijt}^{s} + p_p V_{ijt}^{p} - c_k E_{ijt}^{k}$$

NPV	=	net present value
t	=	simulation time in which treatment branching is enabled
i	=	number calculation units
j	=	number of alternative treatments in i
w_{ijt}	=	net revenue for i managed according to j (j') at time t (t')
x_{ijt}	=	the proportion of i managed according to j (j') at time t (t')
r	=	interest rate/100
t'	=	simulation time after T to T' in which branching is disabled. Simulation of every j is continued according to j' up to time T* (regeneration) or 151 years whichever is shorter, T' = min(T*, 151)
j'	=	first feasible treatment for j in i after T
LV_i	=	value of bare land (soil exoectation value) for calculation unit i
a_i	=	area of calculation unit i
A	=	total area
p_s, p_p	=	stumpage/roadside price, s= saw log, p= pulpwood
V^s, V^p	=	cutting removal, s= saw log, p= pulpwood
c_k	=	unit price of work k
E^k_{ijt}	=	time consumption of work k needed for i managed according to j (j') at time t (t')

Origins

Discounted future net revenues from the beginning of each sub-period are calculated using five optional interest rates. In the MELA system, the NPV is calculated for each management schedule applying the principles of the formula. The NPV of the whole forestry unit is the sum of the management units. The net present value is sensitive to interest rate.

The NPV in MELA consists of the following three components in order to take into account the infinite time horizon presumed by the NPV method:

I) The revenues from cuttings (gross income with roadside or stumpage prices) and costs due to silviculture, forest improvement and harvesting (if the calculations are made with roadside prices) during the simulation period

II) The revenues and costs from the end of the calculation period until the end of the on-going rotation period or 151 (default value) years whichever is shorter. The simulation of each management schedule is continued by automatically selecting the first feasible event for each new state without alternatives until the regeneration criterion (either minimum rotation period or minimum mean diameter before regeneration dedined e.g. with the MIN_REGENERATION_AGE and MIN_REGENERATION_DIAMETER parameters) or the unconditional finish of the simulation period is met, item (15) of the SIMULATION_CONTROL parameter. In the latter case, the cutting value of the stand (decision variable 823) is calculated instead of the regeneration of the forest.

III) The value of bare land represents the revenues and the costs from the rotation periods after the simulation period. Land values are calculated beforehand and in MELA there is built-in values but the user can give them either with the LAND_VALUES parameter.

In MELASIM, the NPV's or the decision variables 801 - 805 (roadside prices) and 951 - 955 (stumpage prices) are calculated for the beginning of each sub-period on the basis of the decision variables 806 - 810 and 956 - 960. The variables can be transferred to MELAOPT in **msc** and **msd** type files.

The NPV figures for the sub-periods refer to the future from the beginning of each sub-period on; the total NPV figure for the entire future is found at the beginning of the first sub-period.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- net present value from actual sub-period by discount factors (801-805) and (951-955)

Valid since

MELA96

Notes

1. Due to the simulation practice explained above, the NPV at the end of the calculation period is conceptually not fully compatible with the NPV in the beginning of the calculation period. This limits the validity of direct NPV comparisons over the calculation period.

See also

Costs variable
Revenues variable
Cutting value variable
MIN REGENERATION AGE parameter
MIN REGENERATION DIAMETER parmeter
SIMULATION CONTROL parameter
LAND VALUES parameter

Reduction of saw log volume

Generic name in Finnish

Tukkivähennys

Variable type

Numerical

Formula

Formula is described in details with the parameter LOG_VOLUME_REDUCTION.

Functions

The saw log volume estimate can be adjusted with user supplied log volume information in the forest resource data.

Origins

In the forest resource data user supplied log volume information can appear in two different forms:
1) log volume reduction coefficient for the log volume model, valid values 0-1.0
2) saw log percentage of the tree or stratum, valid values >1.0 -100.0. The percentage is in simulation transformed into log volume reduction

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- log volume reduction or log percentage (11)
b) Variables of the tree data record (RSU variables)	- log volume reduction or log percentage (10)
c) Tree variables of initial data record (RSD variables)	- reduction to model-based saw log volume (7)

Valid values

1) 0 - 1.0 (log volume reduction coefficient for the log volume model)
2) 1.0 – 100.0 (saw log percentage of the tree or stratum)

Valid since

MELA2000

See also

LOG_VOLUME_REDUCTION parameter
LOG_VOLUME_REDUCTION_MODEL parameter

Value

Generic name in Finnish

Arvo

Variable type

Numerical

Functions

Aggregated value variables, like the value of growing stock and the cutting value of growing stock, are used as decision variables in order to describe the timber production value of an asset and the effect of different measures on it. The value of an individual tree can be seen as an intermediate product in calculating the aggregate variables.

Origins

During the simulation the value of trees are calculated after each event. The value of an individual tree is a product of timber assortments (saw log and pulpwood) and the prices. Pricing is made either with roadside prices or with stumpage prices. The user can apply built-in prices or give the prices with the parameters ROADSIDE_PRICES, ROADSIDE_LOG_PRICE_ADJUSTMENT and STUMPAGE_PRICES, STUMPAGE_ LOG_PRICE_ADJUSTMENT.

The value of the growing stock by tree species in the beginning of each sub-period is evaluated by summing up the value of trees of the simulation record. The stumpage price value of growing stock expresses the value of standing timber and the roadside price value the "gross" value of felled timber at landing without logging costs.

The cutting value of the growing stock is calculated by subtracting the cost of clear cutting and the cost of clearing from the value of growing stock with roadside prices. The cutting value of the growing stock describes the current "net value" of forest excluding both land and future potentials.

Locations

Location	Variables
a) Variables of updated stratum data (SMT variables)	- value (12)
b) Sample plot variables of simulation data record (SMR variables)	- value, dominant story (39) - value , secondary story (49)

c) Tree variables of simulation data record (SMR variables)	- value (12)
d) Decision data variables (MSD variables)	- value of the growing stock (roadside prices) by tree species categories (796-800) - cutting value of the growing stock (823) - stumpage price value of the growing stock by tree species categories (846-850)
e) Collective variables	- **P** (roadside price value), collectible variable - **PS** (stumpage price value), collectible variable

Valid since

MELA96, changed MELA2002

Notes

1. So far the value variables in MELA consist only the monetary values originating from the value of timber to the end-users. Non-timber or non-monetary values are not included.

See also

ROADSIDE_PRICES parameter
ROADSIDE_LOG_PRICE_ADJUSTMENT parameter
STUMPAGE_PRICES parameter
STUMPAGE_LOG_PRICE_ADJUSTMENT parameter

Net present value variable
Value increment variable
Collective variables
Decision data variables (MSD variables)

Value increment

Generic name in Finnish

Arvokasvu

Variable type

Numerical

Functions

Value increment is due to the volume growth (including the ingrowth) of commercial timber. Value increment is used often to define the cutting maturity of stands, e.g. in NPV-calculations a stand may be harvested when the relative value increment is below the calculation rate of interest. Since MELA2009 2011-edition there has also been possiblity to print out at the management level so called indicating percent (WP) At the forest level the aggregate value increment addresses the chance of the value of forest property.

Origins

The value increment is calculated by trees as the difference of the value at time t minus the value at time t-1 using roadside prices. The simulation record transfers the value information between time intervals.

The net value increment is calculated as the value growth of trees minus the value of the trees died during the sub-period.

$$\text{The indicating percent of a managment unit WP} = \frac{net\ value\ increment_{t+5}}{value\ of\ \ growing\ stock_t + land\ value}$$

Locations

Location	Variables
a) Sample plot variables of simulation data record (SMR variables)	- net value increment (62)
b) Decision data variables (MSD variables)	- net value increment by tree species categories (446-450) - summarized value increment over the calculation period by tree species categories (926-930)

c) Collective variables	- **IP** (roadside price value increment), collectible variable - **IPS** (stumpage price value increment), collectible variable - **PMR** (roadside price value of mortality), collectible variable - **PMSR** (stumpage price value of mortality), collectible variable
d) Collective variables	- **WP1-WP5** (indicating percent by discount rates)

Valid since

MELA96, changed MELA2002

See also

Increment variable
Value variable
Net Present Value variable
Collective variables
Decision data variables (MSD variables)

Enumerated variables

Drainage category

Generic name in Finnish

Ojitustilanne

Variable type

Numerical

Functions

Drainage category is used in MELA simulation to indicate the state of productivity in mires (related to ditching) and to indicate the need and possibility to simulate ditching or re-ditching in order to improve and maintain wood production condition of the site.

Origins

The variable is read from stand data and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- drainage category (18)
b) Sample plot variables of initial data record (RSD variables)	- drainage category (16)
c) Sample plot variables of simulation data record (SMR variables)	- drainage category (16)

Valid values

Categories:
(0) undrained mineral soils
(1) ditched mineral soils
(2) undrained mires
(3) ditched mires (unchanged pruductivity), (ojikko in Finnish)
(4) transforming mire (improved productivity), (muuttuma in Finnish)
(5) transformed mire (productivity comparable to mineral soils), (turvekangas in Finnish)

Valid since

MELA96

Notes

1. The simulation of drainage events depends on variables “Feasibility of drainage” and “Drainage category” and the parameter values for respective events in EVENT parameter.

See also

Feasibility of drainage variable
EVENT parameter definitions for drainage

Finnish forest taxation class

Generic name in Finnish

Veroluokka

Variable type

Numerical

Functions

Finnish forest taxation class indicates wood production capacity of a site. The taxation class is a combination of variables "Site type category", "Reduction of forest taxation class" and "Drainage category". Taxation class is determined at the field inventory and read in as an input variable. It is used as a category variable for decision variables.

Taxation class is not used as an input variable for growth models.

Origins

a) The variable is read from initial data files (**rsd** type files).
b) The variable is determined as a function of variables "Site type category", "Reduction of forest taxation class" and "Drainage category" read from stand data text files (**rsu** type files).

Locations

Location	Variables
a) Sample plot variables of initial data record (RSD variables)	-finnish forest taxation class (15)
b) Sample plot variables of simulation data record (SMR variables)	- finnish forest taxation class (15)

Valid values

Categories:
(1) IA respective to very rich or rich sites
(2) IB respective to damp sites
(3) II respective to sub-dry sites
(4) III respective to dry sites
(5) IV respective to barren sites or lower, if forest land
(6) scrub land
(7) waste land

Valid since

MELA96

See also

Decision data variables (MSD variables)

Forest management category

Generic name in Finnish

Maankäyttöluokka

Variable type

Numerical

Functions

There are two separate purposes of the variable. First, forest management categories are used to regulate the simulation of events. Each event is feasible in the categories provided by the actual event definition. As a default event is always feasible.

Second, forest management categories are used to regulate the collection of decision variable values into the categories defined by the MANAGMENT_CATEGORY_GROUPS parameter.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- forest management category (19)
b) Sample plot variables of initial data record (RSD variables)	- forest management category (30)
c) Sample plot variables of simulation data record (SMR variables)	- forest management category (30)
d) Collective variables	- **FM** (forest management gategory), category variable

Valid values

Floating point values. Variable values are not limited, but they should be in the limits of the MANAGEMENT_CATEGORY_GROUPS parameter definition.

Categories:
(1) forest land, no restrictions for timber production
(2) forest land, administrational restrictions for timber production
(3) scrub land, no restrictions or administrational restrictions for timber production
(6) waste land, no restrictions or administrational restrictions for timber production
(7) forest, scrub and waste land, no timber production allowed

Instructions

Users may define and use their own values for the forest management categories in the limits of the available (10) categories.

It is recommended to use default values for the MANAGEMENT_CATEGORY parameter allowing a large number of forest management categories for the event definitions in the form of floating-point values without the need to change any other definitions

Valid since

MELA96, changed in MELA2002

Notes

1. The forest management category cannot change between sample plots within same management unit. The forest management category of a management unit is defined by the category of the last sample plot in the management unit.

2. It is recommended to use default values for the MANAGEMENT_CATEGORY_GROUPS parameter allowing a large number of forest management categories for the event definitions in the form of floating-point values without the need to change any other definitions.

3. Most of the decision variables are currently collected for timberland only. Upper bound value of categories belonging to the timberland can be changed with the TIMBER_PRODUCTION_LAND parameter.

See also

Collective variables
MANAGEMENT_CATEGORY_GROUPS parameter
TIMBER_PRODUCTION_LAND parameter

Land use category

Generic name in Finnish

Maaluokka

Variable type

Numerical

Functions

Land use category is used as an input variable in growth models and as a category variable for decision variables.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- land use category (14)
b) Sample plot variables of initial data record (RSD variables)	- land use category (11)
c) Sample plot variables of simulation data record (SMR variables)	- land use category (11)
d) Collective variables	- **LU** (land-use gategory), category variable

Valid values

Categories:
(1) forest land has the potential stemwood production capacity at least 1 m^3/ha/a on the average during the recommended rotation period
(2) scrub land has the potential stemwood production capacity from 0.1 to 1.0 m^3/ha/a
(3) waste land, if not naturally treeless, has lower potential stemwood production capacity than 0.1 m^3/ha/a
(4) other forestry land than 1-3, cannot be used for timber growing for permanent or temporary reasons (for example forest roads and timber depots)
(5) agricultural land consists of arable and pasture land as well as associated waste land and farm tracks

(6) built-up land consist of urban, semi-urban and other settlement areas as well as industrial areas
(7) roads, electric lines, etc. are roads, railways, airfields, power lines and similar areas outside urban and semi-urban areas
(8) lakes and rivers
(9) sea

Valid since

MELA96, changed in MELA2007

Notes

1. Category values 4-9 must not appear in the initial data (**rsu** and **rsd** type files).

See also

Collective variables
Decision data variables (MSD variables)

Management category of a tree

Generic name in Finnish

Puun käsittelyluokka

Variable type

Numerical

Functions

Management category of a tree controls the treatment of simulation trees in forest management operations. Trees with no restrictions can be touched in the simulated forest management operations. Trees with value "preserved tree" are left untouched. The event "selecting of retained trees" is used to change the category of selected trees in order to make them untouchable in forest management operations.

Origins

a) The variable is read from initial data files (**rsu** and **rsd** type files).
b) The value can be changed in the event "selecting of retained trees" in simulation.

Locations

Location	Variables
a) Tree variables of initial data record (RSD variables)	Tree variable: management category of a tree (16)
b) Tree variables of simulation data record (SMR variables)	Tree variable: management category of a tree (17)
c) Variables of the stratum data record (RSU variables)	Stratum data variable: management category of a tree (13)
d) Variables of the tree data record (RSU variables)	Tree data variable: management category of a tree (19)

Valid values

Categories:
(1) no restrictions in forest management operations
(2) preserved (untouched in forest management operations)

Valid since

MELA2000

See also

Selecting of retained trees in EVENT parameter

Method of the last cutting

Generic name in Finnish

Hakkuutapa

Variable type

Numerical

Functions

Method of the last cutting is used together with the year of the last cutting to control the occurrence and time intervals between simulated cuttings and other possible treatments. Time intervals between comparable events are regulated with EVENT_INTERVALS parameter item of the EVENT parameter. Method of the cutting is used as a category variable for decision variables.

Origins

a) The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).
b) The value of the variable is changed with simulation of cuttings.

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- method of the last cutting (28)
b) Sample plot variables of initial data record (RSD variables)	- method of the last cutting (31)
c) Sample plot variables of simulation data record (SMR variables)	- method of the last cutting (70) , see note 1

Valid values

Categories:
(0) no cutting
(1) thinning (basal area instructions)
(2) clear cutting
(3) (first) thinning (number of stems/ha instructions)
(4) over story removal
(5) seed-tree cutting (natural regeneration for Scotch pine)
(6) shelterwood cutting (natural regeneration for Norway spruce)

Valid since

MELA96

Notes

1. In the simulation record variable has real value, which integer part shows the method of the last cutting (values as shown above) and the first three decimals represent the actual event identification number (see the event identification line of the EVENT parameter).

Municipality code

Generic name in Finnish

Kunta

Variable type

Numerical

Functions

Municipality code is used to determine the Forestry board district in MELA extensions for the initial data conversion

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- municipality code (7)
b) Sample plot variables of initial data record (RSD variables)	- municipality code (32)
c) Sample plot variables of simulation data record (SMR variables)	- municipality code (72)

Valid values

Categories based on Statistics Finland

Valid since

MELA96

Notes

1. Both the municipality code and forestry board district are obligatory variables in **rsd** type files.

Origin

Generic name in Finnish

Syntytapa

Variable type

Numerical

Functions

Origin of the tree is used as an input variable for growth models for birch.

Origins

a) The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).
b) The variable is generated by MELASIM for new trees born in the simulation.

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- origin (12)
b) Variables of the tree data record (RSU variables)	- origin (13)
c) Tree variables of initial data record (RSD variables)	- origin (10)
d) Tree variables of simulation data record (SMR variables)	- origin (18)

Valid values

Categories (in initial data record and in simulation record):
(0) natural
(1) seeded
(2) planted
(3) supplementary planted

Categories (in stratum data record and in tree data record) :
(1) natural
(2) planted

(3) seeded
(4) supplementary planted

Valid since

MELA96

Owner category

Generic name in Finnish

Omistajaryhmä

Variable type

Numerical

Functions

Owner category of a calculation unit is used as category variable for decision variables.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- owner category (5)
b) Sample plot variables of initial data record (RSD variables)	- owner category (10)
c) Sample plot variables of simulation data record (SMR variables)	- owner category (10)

Valid values

Categories:
(0) private persons
(1) enterprises (forest industries, etc.)
(2) state (Forest and Park Service, etc.)
(3) municipalities etc.
(4) communities

Valid since

MELA96

Reduction of forest taxation class

Generic name in Finnish

Veroluokan alennus

Variable type

Numerical

Functions

Reduction of forest taxation class indicates an unfavourable factor in growth conditions. the forest taxation class is a combination of variables “Site type category”, “Reduction of forest taxation class” and “Drainage category”. Taxation class is used as a category variable for decision variables.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- reduction of forest taxation class (17)
b) Sample plot variables of initial data record (RSD variables)	- reduction of forest taxation class (14)
c) Sample plot variables of simulation data record (SMR variables)	- reduction of forest taxation class (14)

Valid values

Categories:
(0) no reduction
(1) stony soils
(2) wet soils
(3) thick moss layer expressing low soil productivity (kunttaisuus in Finnish)
(4) unfavourable location (coastal areas, mountains)

Valid since

MELA96

Simulated development class

Generic name in Finnish

Simuloitu käsittelyluokka

Variable type

Numerical

Functions

Simulated development class is calculated by MELASIM. Development class indicates the state of the rotation of a stand. The variable is not used during the simulation.

Origins

The variable is calculated in the simulation.

Locations

Location	Variables
a) Sample plot variables of simulation data record (SMR variables)	- simulated development class (24)

Valid values

Categories:
(0) land-use category other than forest land or unknown
(1) treeless area
(2) small seedling stand with over story
(3) small seedling stand
(4) advanced seedling stand with over story
(5) advanced seedling stand
(6) young thinning stand
(7) advanced thinning stand
(8) mature stand
(9) seed tree stand
(10) shelterwood stand
(11) small seedling stand with protective over story
(12) young thinning stand with over story

Valid since

MELA96

Notes

1. This variable is used neither as input data nor during the simulation.

Simulated story

Generic name in Finnish

Jakso

Variable type

Numerical

Functions

The simulation of treatments is based on the dominant story. The tree story is calculated by MELASIM. It is not an input variable.

Origins

Simulated story is calculated by MELASIM.

Locations

Location	Variables
a) Tree variables of simulation data record (SMR variables)	- simulated story (14)

Valid values

Categories:
(1) dominant
(2) secondary

Valid since

MELA96

Site type category

Generic name in Finnish

Kasvupaikkatyyppi

Variable type

Numerical

Functions

Site type category indicates the wood production potential of the site. It is used as input variable for growth models. It is also used to control the simulation of forest management operations.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- site type (16)
b) Sample plot variables of initial data record (RSD variables)	- site type (13)
c) Sample plot variables of simulation data record (SMR variables)	- site type (13)
d) Collective variables	- **ST** (site type category), category variable

Valid values

Categories:
(1) very rich sites (OMaT in South Finland)
(2) rich sites (OMT in South Finland)
(3) damp sites (MT in South Finland)
(4) sub-dry sites (VT in South Finland)
(5) dry sites (CT in South Finland)
(6) barren sites (ClT in South Finland)
(7) rocky or sandy areas
(8) open mountains

Valid since

MELA96, changed in MELA2005

See also

Collective variables

Soil and peatland category

Generic name in Finnish

Alaryhmä

Variable type

Numerical

Functions

Soil and peatland category is used in controlling the simulation of the natural processes for mineral soils and peatlands.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- soil and peatland category (15)
b) Sample plot variables of initial data record (RSD variables)	- soil and peatland category (12)
c) Sample plot variables of simulation data record (SMR variables)	- soil and peatland category (12)
d) Collective variables	- **SO** (soil and peatland category), category variable

Valid values

Categories:
(1) mineral soils
(2) peatland, spruce mires (korpi in Finnish)
(3) peatland, pine mires (räme in Finnish)
(4) peatland, barren treeless mires (neva in Finnish)
(5) peatland, rich treeless mires (letto in Finnish)

Valid since

MELA96, changed in MELA2005

See also

Collective variables

Tree species

Generic name in Finnish

Puulaji

Variable type

Numerical

Functions

Tree species calls for the use of the respective growth model. Tree species is also used in control of the simulation of forest management operations and as a category variable for decision variables.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stratum data record (RSU variables)	- tree species (4)
b) Variables of the tree data record (RSU variables)	- tree species (5)
c) Tree variables of initial data record (RSD variables)	- tree species (2)
d) Tree variables of simulation data record (SMR variables)	- tree species (2)
e) Collective variables	- **s** (tree species code), category variable

Valid values

Categories:
(1) Scotch pine (Pinus silvestris)
(2) Norway spruce (Picea abies)
(3) Silver birch (Betula pendula)
(4) Downy birch (Betula pubescens)
(5) Aspen (Populus tremula)
(6) Alder (Alnus incana, Alnus glutinosa)

(7) other coniferous species than 1 or 2
(8) other deciduous species than 3 - 6

Valid since

MELA96, changed in MELA2002

See also

Collective variables

Miscellaneous variables

Area

Generic name in Finnish

Pinta-ala

Variable type

Numerical

Functions

The variable is used to define the area the management unit or sample plot in question represents.

Origins

The variable is read from **rsu** or **rsd** type file. As a default, the forest resource data consists of actual stands and the area is expressed in hectares. When applying large forest areas or sample plot data as forest resource data, the management units can be aggregates of stands and the area can be transformed to larger units, for example to 1000 hectares. However, the values of decision data record variables depend on the scaling of the area. Furthermore, the scaling of the area have to be taken in account in the calculation of appropriate logging and silvicultural costs (MANAGEMENT_UNIT_TYPE parameter).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- area (9)
b) Sample plot variables of initial data record (RSD variables)	- actual area (3) - area weight for growing stock (4)
c) Management unit variables of simulation data record (SMR variables)	- actual area (3) - area weight for growing stock (4)
d) Sample plot variables of simulation data record (SMR variables)	- actual area (3) - area weight for growing stock (4)
e) Decision data variables (MSD variables)	- cutting area (1-7) - area of tending of young stands (8) - area of clearing of regeneration areas (9) - area of soil surface preparation (10)

	- artificial regeneration area (11-15) - seeding area (16-20) - planting area (21-25) - supplementary planting area (26) - pruning area (27) - fertilization area (29) - natural regeneration area (30) - regeneration area (31-35) - drainage area (36-38) - forest land area (501-510) - area (511-537, 594-600) - forestry land area (541-550)
f) Collective variables	- O (land area), collectible variable - OC (area of rounwood logging), collectible variable - **OE** (area of energy wood logging), collectible variable - **ORA** (area of artificial regeneration), collectible variable - **ORA** (area of natural regeneration), collectible variable - **OSR** (area of soil surface preparation), collectible variable - **OCA** (area of clearing), collectible variable - **OCY** (area of tending), collectible variable

Valid values

The values of the variable area have to be greater than zero

Instructions

Usually the area weight for growing stock (variable (4)) is the same as the actual area (variable (3)) in the initial data and the simulation record.

The decision data record variables concerning areas, for example the cutting areas (variables (1-7)), are calculated using the actual area (variable (3)) in the simulation record. Decision data record variables concerning growing stock are calculated by using area weight for growing stock as area.

Valid since

MELA96

See also

MANAGEMENT_UNIT_TYPE parameter
Collective variables
Decision data variables (MSD variables)

Branching instructions for a event

Generic name in Finnish

Haarautuminen

Variable type

Numerical

Functions

In the simulation of the management schedules, there may be several feasible alternative events in the same state. If branching is allowed, alternative events ("branches") are simulated (if they are feasible). If branching is not allowed, the event cannot have alternative events in the same state; the event is obligatory (supposing that it is feasible).

The branching is controlled by EVENT_BRANCHING item of the EVENT parameter. Common branching instructions for all events can be set with EVENT_DEFAULTS parameter.

Origins

The variable is read from user defined EVENT definitions.

Locations

Location	Variables
a) EVENT_BRANCHING parameter item	- argument nr 1

Valid values

Categories:
(0) branching not allowed
(1) branching allowed

Instructions

Common branching instructions for all events can be set with EVENT_DEFAULTS parameter. Event - specific branching instructions are set with EVENT_BRANCHING parameter item of the EVENT parameter.

Valid since

MELA96

See also

EVENT parameter
EVENT_DEFAULTS parameter

Date

Generic name in Finnish

Päiväys

Variable type

Character

Functions

Variable date is used to define the inventory date of the sample plot data.

Formula

The syntax of the variable date is "dd.mm.yyyy" where

dd	= date
mm	= month
yyyy	= year

Origins

Variable date is read from stand data text file (**rsu** type file). The inventory data is user-supplied variables in the stand data record.

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- date of inventory (8)

Valid values

dd:	1<= x <= 31
mm:	1<= x <= 12
yyyy:	1900 <= x <= 2100

Valid since

MELA96

Notes

1. The inventory date is converted to year (sample plot variable (2) in the initial data record) in MELA simulation.

See also

YEARS parameter
Stand data text files **(rsu** type files)
YEAR variable

Event identification code

Generic name in Finnish

Tapahtuman tyyppi

Variable type

Numerical

Functions

Event identification code determines the basic event routine which is called when simulating events in MELASIM. Specific instructions for the simulation of the event are defined in respective EVENT parameter arguments and they are passed to the basic event routine.

Origins

The variable is read from user defined EVENT definitions.

Locations

Location	Variables
a) EVENT_CALL parameter item	- argument nr 1

Valid values

Categories:
(1) natural processes
(2) cuttings
(3) tending of young stands
(4) artificial regeneration
(5) clearing of regeneration area
(6) soil preparation
(7) drainage of peatlands
(8) fertilization
(9) pruning of pine
(11) run-time change in the value of a management unit level variable in the simulation record, for example, the change of the forest management category
(12) selecting of ‘retained trees’ to be left standing on the cutting areas.

Valid since

MELA96

See also

EVENT parameter

Event identification number

Generic name in Finnish

Tapahtumanumero

Variable type

Numerical

Functions

Event identification number is used to define a unique number for each event in a MELA-application.

Origins

Event identification number is defined by EVENT parameter. The variables in stand simulation instruction record, initial data record and simulation record have to be compatible with the EVENT parameter.

Locations

Location	Variables
a) EVENT parameter	- event identification number in Event identification line of the EVENT parameter
b) Variables of stand simulation instruction record (SMU variables)	- event identification number (3)
c) Sample plot variables of initial data record (RSD variables)	- method of the last cutting (31): decimal part of the number
d) Management unit variables of simulation data record (SMR variables)	- method of the last artificial regeneration (69) - method of the last cutting (70): decimal part of the number
e) Sample plot variables of simulation data record (SMR variables)	- method of the last artificial regeneration (69) - method of the last cutting (70): decimal part of the number

Valid values

The values of the event identification number have to be greater then 1. The greatest event identification number is reserved to the natural processes. Definition of the natural processes must always be the last of the definitions.

Valid since

MELA96, changed MELA2002

Notes

1. The event identification number defines also the order of the events to be simulated.

See also

Event identification line in EVENT parameter

Feasibility of drainage

Generic name in Finnish

Ojituskelpoisuus

Variable type

Numerical

Functions

Feasibility of drainage variable controls the possibility to simulate drainage in MELASIM. The factors affecting the feasibility can be ecological or administrational.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	Stand data variable: feasibility of drainage (29)
b) Sample plot variables of initial data record (RSD variables)	Sample plot variable: feasibility of drainage (17)
c) Sample plot variables of simulation data record (SMR variables)	Sample plot variable: feasibility of drainage (17)

Valid values

Categories:
(0) drainage feasible or allowed
(1) drainage not feasible or not allowed

Valid since

MELA96

Notes

1. The simulation of drainage events depends on variables “Feasibility of drainage” and “Drainage category” and the parameter values for respective events in EVENT parameter.

See also

Drainage category variable
EVENT parameter definitions for drainage

Feasibility for natural regeneration

Generic name in Finnish

Luontaisen uudistamisen mahdollisuus

Variable type

Numerical

Functions

This variable indicates the feasibility of natural regeneration of the stand. It is used to determine if respective cuttings for natural regeneration can be simulated.

Origins

The variable is read from stand data text and initial data files (**rsu** and **rsd** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	Stand data variable: feasibility for natural regeneration (30)
b) Sample plot variables of initial data record (RSD variables)	Sample plot variable: feasibility for natural regeneration (22)
c) Sample plot variables of simulation data record (SMR variables)	Sample plot variable: feasibility for natural regeneration (22)

Valid values

Categories:
(0) natural regeneration feasible
(1) natural regeneration not feasible.

Valid since

MELA96

Identification number

Generic name in Finnish

Tunnistenumero

Variable type

Numerical

Functions

Identification number is used to identify

a) management unit,
b) sample plot and
c) sample tree.

Origins

Identification numbers are read from **rsu**, **smu**, **rsd**, **smr**, **smt**, **mpu** or **mps** type files.

There are 5 types of identification numbers in MELA application related to forest resource data:

1) unique management unit identifier (UID) (see note 1)
2) identification number of management unit (see note 1)
3) identification number of stand
4) identification number of stratum data
5) identification number of sample tree

The unique management unit identifier (UID) in the stand data record (variable (1)) in **rsu** type file is converted to double precision format to be used as UID in the MELA standard binary (MSB) records and in **mpu** type files. The identification number of the management number (variable (3)) in the stand data record is transferred to the identification number of the management unit (variable (1)) in the initial data record and simulation record. The identification number of stand (variable (4)) in the stand data record is transferred to the identification number of stand (variable (7)) in the initial data record and simulation record.

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- UID (1) - identification number of management unit (3) - identification number of stand (4)

b) Variables of the stratum data record (RSU variables)	- UID (1) - identification number of stratum data (3)
c) Variables of the tree data record (RSU variables)	- identification number of stratum data (3) - identification number of sample tree (14)
d) Variables of stand simulation instruction record (SMU variables)	- UID (1) - identification number of management unit (2)
e) Sample plot variables of initial data record (RSD variables)	- identification number of management unit (1) - identification number of stand (7)
f) Tree variables of initial data record (RSD variables)	- identification number of sample tree (11)
g) Management unit variables of simulation data record (SMR variables)	- identification number of management unit (1) - identification number of stand (7, see note 2)
h) Sample plot variables of simulation data record (SMR variables)	- identification number of management unit (1) - identification number of stand (7)
i) Tree variables of simulation data record (SMR variables)	- identification number of sample tree (23)
j) Management report record	- UID (1)
k) Variables of updated stratum data (SMT variables)	- identification number of stratum data (2)
l) MELA standard binary (MSB) record	- UID (the first variable of MSB record)

Valid values

The values of the variable have to be greater than zero.

Valid since

MELA96

Notes

1. Management unit numbers must always be in ascending order in the data.

2. The management unit variables in simulation record are aggregate ones calculated from the sample plots. Therefore management unit variables cannot be identified to any specific sample plot and the identification number of stand (management unit variable 7) is zero.

Need for the restoration drainage

Generic name in Finnish

Kunnostusojitustarve

Variable type

Numerical

Functions

The need for the restoration drainage indicates unfavourable factor in growth conditions of the site. There is a dummy variable in growth models for peatlands which takes this factor into account. The variable in the stand data text files (**rsu** type files) is not used in MELASIM but the probability model to estimate the need for restoration drainage is used.

Formula

The need for the restoration drainage is estimated with a probability model. Probability is estimated as a function of north coordinate and years from ditching. If the estimated probability is greater than 0.5 the respective dummy variable is set on. Cleaning of ditches and supplementary ditching set the dummy variable off.

Origins

The variable is read from stand data text files (**rsu** type files).

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- need for restoration drainage (31)

Valid values

Categories:
-1. value not known
0. restoration drainage not needed
1. restoration drainage is recommended

Default values

None

Valid since

MELA96

Notes

1. This variable is not used by the growth models in the current MELA-version.

Proportion

Generic name in Finnish

Osuus

Variable type

Numerical

Functions

The variable is used to define the proportions of the selected management schedules of management unit. The selection of the management schedules is made in optimisation.

Origins

The proportions of the selected management schedules are determined in the optimisation. In optimisation one or more management schedules are selected to a management unit to fulfill the goal and the restrictions of optimisation application. The sum of the proportions within one management unit is 1.

Locations

Location	Variables
a) Management report record	- last variable of the record
c) Management schedule report file (**sch** type file)	- last variable of the record

Valid values

0 < x <=1

Valid since

MELA96

Random number

Generic name in Finnish

Satunnaisluku

Variable type

Numerical

Functions

Variable random number is generated to be used in the optimisation problem formulating by user, if necessary.

Origins

Random number is generated during simulation by random function from even distribution.

Locations

Location	Variables
a) Decision data variables (MSD variables)	- random numbers from even distribution (991-1000)

Valid values

$0.0 < x < 1.0$

Valid since

MELA96

Type of instruction

Generic name in Finnish

Toimenpidetyyppi

Variable type

Numerical

Functions

Type of instruction is used in stand simulation instruction record (in **smu** type files) to indicate if the event in question is an implemented operation or a field prescription. Implemented operations can be simulated in updating of the forest resource data. Field prescriptions can be simulated as a part of alternative management schedules.

Origins

The variable is read from stand simulation instruction text files (**smu** type files).

Locations

Location	Variables
a) Variables of stand simulation instruction record (SMU variables)	Variables in the record are defined with SMU_VARIABLES parameter.

Valid values

Categories:
(0) Implemented operation
(1) Prescription

Valid since

MELA96

See also

SMU_VARIABLES parameter

Urgency category of management proposal

Generic name in Finnish

Kiireellisyysluokka

Variable type

Numerical

Functions

Urgency category of management proposal is used to control the time to simulate the treatment prescription. Categories are related to the year of the beginning of the simulation.

Formula

Each urgency category refers to the number of years from the beginning of simulation when the prescribed event is to be simulated. For definition of the urgency categories, see example 1.

Origins

The variable is read from stand simulation instruction text files (**smu** type files)

Locations

Location	Variables
a) Variables of stand simulation instruction record (SMU variables)	Variables in the record are defined with SMU_VARIABLES parameter.

Valid values

User defined categories

Instructions

Urgency categories are defined with SMU_YEAR_CODES parameter.

Valid since

MELA96

Notes

1. This variable can be used in stand simulation instruction record only if the categories are defined with SMU_YEAR_CODES parameter.

2. Either urgency category or the year of the treatment must be included in the stand simulation instruction record. If both are included, the year of the treatment is used.

3. Urgency categories can only be used for simulation of prescripted treatments.

See also

SMU_VARIABLES parameter
SMU_YEAR_CODES parameter

Examples

Example 1: A definition if four urgency categories with SMU_YEAR_CODES parameter.

```
SMU_YEAR_CODES
 1 6
 2 12
 3 26
 4 36
```

Validity of the instructions record

Generic name in Finnish

Simulointiohjeen soveltaminen

Variable type

Numerical

Functions

Standwise simulation instructions can be provided using simulation instruction records in standwise simulation instruction files (**sms** type files). If standwise simulation instructions are given, they are obeyed instead or before general event definitions. The user can control how standwise simulation instructions and general event definitions are combined.

It is possible to provide one or several simulation instruction records for each management unit. Simulation starts with the standwise simulation instructions and can continue with the automated simulation of management schedules.

Simulation instructions for individual management units are needed, for example

- to simulate the management proposals provided in the field inventory, and
- to control the re-simulation of the selected management schedules after a MELAOPT solution.

Origins

The variable is read from the simulation instructions record in standwise simulation instruction files (**sms** type files)

Locations

Location	Variables
a) Simulation instruction record	- variable nr 1

Valid values

Categories:
(0) Temporary, instructions are valid for the actual management unit only

(1) Continuous, instructions are valid for all the following management units until a new simulation instruction record is found

Valid since

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Year

Generic name in Finnish

Vuosi

Variable type

Numerical

Functions

Variable year is used to define

a) the year of the sample plot data,
b) the year of the last treatment,
c) the year of the treatment proposal in question represents or
d) the year of the calculation.

Origins

The variables are read from **rsu**, **rsd, smu, smr** or **smt** type files. During simulation, the year that the sample plot data represents will be updated depending of the phase of the simulation. Also the years of the last treatment will be updated to the simulation record when the treatment in question is simulated.

In case of **rsu** type file, the year that the sample plot data represents (sample plot variable (2) in the simulation record) is generated from the inventory date (stand variable (8) in stand data record). If inventory date is earlier than the first of August, the inventory year will be used as the sample plot variable (2). Otherwise, the value of the sample plot variable (2) in the simulation record is the inventory year increased by one.

Locations

Location	Variables
a) Variables of the stand data record (RSU variables)	- year of the last drainage (20) - year of the last fertilization (21) - year of the last soil surface preparation (22) - year of the last cleaning of regeneration (23) - year of the last artificial regeneration (24) - year of the last tending of young stand (25) - year of the last pruning (26) - year of the last cutting (27)
b) Sample plot variables of initial data	- year (2)

record (RSD variables)	- year of the last drainage (19) - year of the last fertilization (20) - year of the last soil surface preparation (21) - year of the last cleaning of regeneration (23) - year of the last artificial regeneration (25) - year of the last tending of young stand (26) - year of the last pruning (27) - year of the last cutting (28)
c) Variables of stand simulation instruction record (SMU variables)	- year of the management prescrition (6)
e) Sample plot variables of simulation data record (SMR variables)	- year (2) - year of the last drainage (19) - year of the last fertilization (20) - year of the last soil surface preparation (21) - year of the last cleaning of regeneration (23) - year of the last artificial regeneration (25) - year of the last tending of young stand (26) - year of the last pruning (27) - year of the last cutting (28)

Valid values

1900 <= x <= 2100

Valid since

MELA96

Notes

1. The year variable represent the state of the beginning of the year in question, so before the treatments and natural processes of that year.

See also

Stand data text files (**rsu** type files)
Initial data files (**rsd** type files)
Summary report files (**sum** type files)
Simulation record files (**smr** type files)

SESSION MONITORING AND TROUBLESHOOTING

Session monitoring and troubleshooting

MELA session monitoring

MELA provides three types of material for monitoring a session and its termination status.

- Session log consists of informative notes and error messages generated during the session, besides the results presented in the log.
- Session report attached to the end of session log summarises session, if termination is controlled.
- Session monitoring file (named as MELA.PCF) informs of the last phases of all sessions, including uncontrolled terminations. Session monitoring file contains a selection of session report materials.

Session termination status

MELA sessions terminates usually controlled, without or with errors detected. Uncontrolled terminations are rare and occasional. Table 1 explains the combinations of termination status and error recovery categories with respective session monitoring materials.

Table 1: MELA session termination types, error categories and monitoring materials.

Session termination status		Error category	Session log	Session report	Monitoring file MELA.PCF
Controlled	Normal	No errors detected	yes	yes	yes
	Normal with errors	Recoverable error(s) detected	yes	yes	yes
	Abnormal	Irrecoverable error detected	yes	yes	yes
Uncontrolled		Irrecoverable, often unidentified error appeared	partly	no	yes

Termination status comes usually out from the session report attached to session log. In case of uncontrolled terminations, however, only compiler or operating system level error messages and incomplete results manifest the exceptional status of termination. Still, the monitoring file reveals session phase reached preceding occasional interrupt.

In normally completed sessions without errors, intended results, reports and output files are obtained. Otherwise, in the presence of errors, results are usually incomplete, inconsistent or completely absent in an unpredictable way. When unexpected or missing

results appear, session log should contain warning messages indicating to possible origins of discrepancy.

In the absence of errors, MELA session report consists of actual list of files opened during session (FILE CHECK- lines), user identification and session termination status. Each FILE CHECK line contain following information:

- File name (with file extension)
- IO- channel (not useful information for normal users)
- File type (T = text file, B = binary file / I = input file, O = output file)
- Opening times of the file
- Closing times of the file

Example 1 shows a typical session report of controlled termination. Respective session monitoring file contains a list of the last passes of software checkpoints during the session, besides file list, see example 3.

Error conditions and recovery

MELA errors are recoverable or irrecoverable at run-time, depending on each specific condition.

In case of recoverable errors, MELA software generates an error message into session log, abandons current task and prompts new input lines to be processed. User decides further steps in interactive mode while next input lines, if any, are processed in batch mode; otherwise session terminates normally. Irrecoverable errors generate abnormal or uncontrolled termination immediately.

The identification of errors and their causes is supported by MELA error messages. MELA error messages are short and self-explanatory. In case of abnormal termination, MELA error message contains also short recovery suggestions. In addition to error messages, informative notes in session log may as well serve as material for detection of cause of exceptional conditions.

See also MELA FAQ at http://www.metla.fi/metinfo/mela/index.htm (“TUOTTEET JA PALVELUT” ⇒ “MELA-kysymyksiä”) for explanations of some common error conditions as well as recent notes.

Most of error conditions are recognisable and correctable by immediate user actions, for example, by changing respective parameter definitions or optimisation problem and by starting a new session thereafter. Some of irrecoverable errors and uncontrolled failures may require efforts from MELA support side.

Error detection and recovery actions depend much on each specific condition in questions. The importance of user experience and consideration cannot be overemphasised in managing error conditions. One should also be aware of the

possibility of errors beyond the limits of actual detection potential and uncontrolled terminations respectively.

The immediate sources of MELA error conditions fall into one or more of following type of categories:

- user-provided commands, parameter definitions and input data, including unintended directory confusions
- missing input files and inconsistent input information,
- limits of MELA software capacity,
- limits of the actual MELA licence,
- limits of actual computer capacity, and
- unexpected software failures.

Many of the actual errors finally originate from the large number of various selectable options under user control and responsibility, thus limiting selection freedom of MELA users.

General troubleshooting scheme

Common MELA error messages are self-explaining.

The cause and respective corrective action of run-time errors should be self-evident on the basis of error message and preceding session log. Most controlled terminations fall to self-evident category with the support of error message and proposed causes and actions in session report. Also many uncontrolled terminations are solved simply by the reconsideration and respective reformulation of the specific MELA task in question, for example, by checking parameter values and resulting task size.

MELA application developers follow trial and error scheme in analysing and managing less self-evident error conditions encountered:

1. Identify problem or error condition type
and in case of

- run-time error message in session log – go to 2
- controlled abnormal termination in session report – go to 2 or 5.2
- uncontrolled termination – go to 2, 5.2 or 5.3

2. Find out potential causes of problem or error

- read error message and related notes in session log
- consider proposed causes as potential ones, besides your own expertise

3. Select and perform the most promising corrective action

- consider the applicability of proposed actions as a corrective means

4. Rerun MELA task

- check and interpret results

5. If problem is still unsolved

5.1 Retry problem identification – go to 2

5.2 Contact local MELA administrator for help

5.3 Contact MELA support for help (mela@metla.fi), always attaching such documentation as session log, session report and monitoring file with your personal error declaration.

Run-time error messages in session log

MELA session log contains messages of detected errors recoverable by user actions at run-time.

Double minus sign '--' in the beginning of a session log row indicates to a recoverable error.

```
-- No forest report definition found
```

Additionally, the total number of error messages in the preceding session log is shown in session report.

```
.. -- NOTICE 1 SEVERE WARNING(S) IN PRECEDING SESSION LOG
```

Notice also that JLP run-time error messages embedded in MELAOPT session log are of the type

```
error opening file:S3.MDL
*fE* pending commands ignored
```

JLP error messages don't always count to the number of MELA error messages in session report.

Controlled abnormal terminations in session report

Irrecoverable error condition detected by MELA software generates abnormal termination with an error message as a part of MELA session report. Such an error message consists of three rows naming problem, possible causes and recommended actions, in addition to standard session report.

Example 3 shows a typical session report of an controlled abnormal termination with error message. For the contents of respective MELA.PCF job monitoring file, see Example 4.

Uncontrolled terminations

Uncontrolled interrupts originate from software or hardware failures not detected by MELA software.

In the case of an uncontrolled termination, MELA session log usually contains MELA messages until the failure, even though some of the last rows may occasionally be lost. The MELA.PCF job monitoring file in turn shows the phase of the session by indicating the last check points passed before any interrupt.

Notice, that session report cannot be generated in case of uncontrolled interrupt. Instead, there usually is a short compiler or operating system message (in English) at the end of session log. These messages vary by compilers and operating systems and may or may not be user-interpretable.

Compiler error messages may refer to memory overflows (indicating to MELA software capacity), failures of mathematical functions and pure programming errors, for example. Operating system error messages indicate to such problems as hardware (e.g. disk, memory) capacity limits or to capacity settings of operating system itself (e.g. virtual memory available).

Some rare errors

Infinite loops

The possibility of infinite loops is not absolutely out of question with certain occasional parameter and/or data combinations. Infinite loops appear as unexpected long sessions, often without results or with very long results. If in doubt, kill session by the operating system dependent means and then check the monitoring materials, session log first of all. - Check data and parameters.

Accidental disk cram

Some parameter values for detailed monitoring generate huge lots of result material, if applied to any larger materials possibly cramming computer disk. - Check first the OUTPUT and FOREST_REPORT parameters in such a case.

Problems in result substance

Besides technical error conditions touched here, the contents of results themselves may prove unintended, susceptible or clearly erroneous. Unintended contents of results are often due to user-defined parameters. Parameters values might be wrong or

incomprehensible, or parameters name might be wrongly written. If the parameters name is wrong MELA doesn't give any error message.

The origin of susceptible results is more manifold, from defective user data to accumulation of small model biases in long model chains and in optimisation, for example, besides unintended or omitted (i.e. incompatible default) parameter definitions or "extrapolated analyses" simply beyond the applicability limits of individual models or MELA as a whole.

Substance problems in results are just mentioned in this technical reference manual, by no means neglecting their practical importance.

Examples

Example 1: Example of MELA session report, normal termination.

```
.. MELA SESSION REPORT
.. ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
.. LICENCE RELEASE
.. - hasp licence released
.. FILE CHECK
    .. MELA_SET.PAR           - 27 -T/I-        2       2 ..
    .. PDC_DEFS.PAR           - 28 -T/I-        2       2 ..
    .. PDC_EXAMPLE.PAR        - 29 -T/I-        2       2 ..
    .. SUMMARY.PAR            - 29 -T/I-        2       2 ..
    .. MS.PAR                 - 27 -T/I-        1       1 ..
    .. MSD_VARIABLES.PAR      - 28 -T/I-        1       1 ..
    .. MS_EVENT2000.PAR       - 28 -T/I-        1       1 ..
    .. F1C.RSD                -  9 -B/I-        1       1 ..
    .. F1C.MSC                - 10 -B/O-        1       1 ..
    .. F1C.MSD                - 11 -B/O-        1       1 ..
    .. VOLUME.VOL             - 71 -B/I-        1       1 ..
.. USER & LICENCE
    - 1 MELA-Team Helsinki/Joensuu
    - 2 Pajamela2000 Watcom-fortran
    - 3 testi/kehitys
    - 5 */*
    - 7 10000 10 50 3 2
    - 8 31.12.2002
    - 9 MELA2000-23112000-V1
    -10 69552-19584-51848-21784
.. PASS CHECK
    >> 130202 144614 - 130202 144906 << - cc =       39 -
    <> MELASIM <>                      - cc =        3 -
.. ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
.. ++ normally completed session ++
.. no severe warnings in preceding session log
.. ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
.. END OF <>MELA<> SESSION
```

Example 2: Example of MELA session monitoring file, normal termination.

```
<>MELA<> MELA.PCF
-----------------------------------------------------
    >> 130202 144614 - 130202 144906 << - cc =       39 -   1 s_ppc/datetime
    >  EXIT                            - cc =       38 -   2 s_ppc/f_get/f_com
    <> MELASIM <>                      - cc =        3 -   3 s_ppc/f_get/f_xqt
    UID>>      16 =         16         - cc =       36 -   4 s_ppc/ves>>
    <UID>      16 =         16         - cc =       35 -   5 s_ppc/<ves>
    <<UID      16 =         16         - cc =       37 -   6 s_ppc/<<ves
```

```
-----------------------------------------------------
    .. MELA_SET.PAR           - 27 -T/I-        2       2 ..
    .. PDC_DEFS.PAR           - 28 -T/I-        2       2 ..
    .. PDC_EXAMPLE.PAR        - 29 -T/I-        2       2 ..
    .. SUMMARY.PAR            - 29 -T/I-        2       2 ..
    .. MS.PAR                 - 27 -T/I-        1       1 ..
    .. MSD_VARIABLES.PAR      - 28 -T/I-        1       1 ..
    .. MS_EVENT2000.PAR       - 28 -T/I-        1       1 ..
    .. F1C.RSD                -  9 -B/I-        1       1 ..
    .. F1C.MSC                - 10 -B/O-        1       1 ..
    .. F1C.MSD                - 11 -B/O-        1       1 ..
    .. VOLUME.VOL             - 71 -B/I-        1       1 ..
-----------------------------------------------------
<< 130202 144906
```

Example 3: Example of MELA session report, abnormal termination.

```
.
. MELA SESSION REPORT
.. ------------------------------------------------------------
.. -- ABNORMALLY TERMINATED SESSION --
.. -- ERROR INTERRUPT - id = luotp_d --
.. ------------------------------------------------------------
.. LICENCE RELEASE
.. - hasp licence released
.. FILE CHECK
    .. MELA_SET.PAR           - 27 -T/I-        2       2 ..
    .. PDC_DEFS.PAR           - 28 -T/I-        2       2 ..
    .. PDC_EXAMPLE.PAR        - 29 -T/I-        2       2 ..
    .. SUMMARY.PAR            - 29 -T/I-        2       2 ..
    .. MS.PAR                 - 27 -T/I-        1       1 ..
    .. MSD_VARIABLES.PAR      - 28 -T/I-        1       1 ..
    >> F1C.RSD                -  9 -B/I-        1       0 >>
    >> F1C.MSC                - 10 -B/O-        1       0 >>
    >> F1C.MSD                - 11 -B/O-        1       0 >>
    .. VOLUME.VOL             - 71 -B/I-        1       1 ..
.. USER & LICENCE
    - 1 MELA-Team Helsinki/Joensuu
    - 2 Pajamela2000 Watcom-fortran
    - 3 testi/kehitys
    - 5 */*
    - 7 10000 10 50 3 2
    - 8 31.12.2002
    - 9 MELA2000-23112000-V1
    -10 69552-19584-51848-21784
.. PASS CHECK
    >> 130202 145948 - 130202 145952 << - cc =        6 -   1 s_ppc/datetime
    >  SIMULATE MS F1C                 - cc =        2 -   2 s_ppc/f_get/f_com
    <> MELASIM <>                       - cc =        3 -   3 s_ppc/f_get/f_xqt
    UID>>       0 =          0          - cc =        4 -   4 s_ppc/ves>>
    <UID>       1 =          1          - cc =        5 -   5 s_ppc/<ves>
.. no severe warnings in preceding session log
.. ------------------------------------------------------------
.. -- ERROR INTERRUPT - id = luotp_d --
.. problem - internal simulation instructions not generable
.. possible cause - EVENT definitions erroneous or missing
.. recommended action - check and correct EVENT definitions being provided
.. ------------------------------------------------------------
.. END OF <>MELA<> SESSION
```

Example 4: Example of MELA session monitoring file, abnormal termination.

```
<>MELA<> MELA.PCF
-----------------------------------------------------
    >> 130202 144614 - 130202 144906 << - cc =       39 -   1 s_ppc/datetime
    >  EXIT                           - cc =       38 -   2 s_ppc/f_get/f_com
    <> MELASIM <>                     - cc =        3 -   3 s_ppc/f_get/f_xqt
```

```
    UID>>      16 =         16          - cc =       36 -   4 s_ppc/ves>>
    <UID>      16 =         16          - cc =       35 -   5 s_ppc/<ves>
    <<UID      16 =         16          - cc =       37 -   6 s_ppc/<<ves
-----------------------------------------------------
    .. MELA_SET.PAR           - 27 -T/I-        2       2 ..
    .. PDC_DEFS.PAR           - 28 -T/I-        2       2 ..
    .. PDC_EXAMPLE.PAR        - 29 -T/I-        2       2 ..
    .. SUMMARY.PAR            - 29 -T/I-        2       2 ..
    .. MS.PAR                 - 27 -T/I-        1       1 ..
    .. MSD_VARIABLES.PAR      - 28 -T/I-        1       1 ..
    .. MS_EVENT2000.PAR       - 28 -T/I-        1       1 ..
    .. F1C.RSD                -  9 -B/I-        1       1 ..
    .. F1C.MSC                - 10 -B/O-        1       1 ..
    .. F1C.MSD                - 11 -B/O-        1       1 ..
    .. VOLUME.VOL             - 71 -B/I-        1       1 ..
-----------------------------------------------------
<< 130202 144906
```

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Glossary

In the glossary, some concepts and terms are explained such as they are used in the MELA context and in the MELA Reference Manual.

absolute year	A year expressed in absolute terms, for example 1996. See also relative year.
application	In the MELA context, application refers to the set of parameter values defined for a specific purpose or task.
calculation period	The time interval being studied in the analysis. For example, management schedules, optimisation problems and analysis results are generated for the calculation period. (However, decisions are usually made for the first years of the calculation period even if more far-reaching studies are carried out to ascertain the sustainability of forestry.) The calculation period is divided into sub-periods. See also presimulation, simulation period and sub-period.
calculation unit	In MELA, calculation units correspond management units.
category variable	Category variables are used in the relational category expressions of the data collection requests.
collectible variable	Collectible variables are the variables whose aggregated values are requested using data collection requests.
collective variable	Collective variables are results from the user-defined data collection requests.
command file	A text file consisting of operation system commands and/or MELA input lines. Command files are, for example, submitted for execution as batch jobs or included in interactive MELA sessions. See the INCLUDE command.
commercial timber	Sum of saw log and pulpwood.
computed tree	Tree generated using MELA extension for initial data conversion.
cost of decrease	A marginal change in the objective function value if a JLP x variable should get a slightly smaller value than in the current solution while all original constraints stay unchanged.

cost of increase	A marginal change in the objective function value if a JLP x variable should get a slightly higher value than in the current solution while all original constraints stay unchanged.
ctran	A JLP command for the transformations of c variables. See c variable and transformation.
cutting	Harvest of commercial timber from forest.
cutting drain	Sum of cutting removal and logging residue.
cutting potential	The estimate of the commercial timber that could be harvested at a moment or during a period according to the given forest management regimes.
cutting removal	Commercial timber harvested in cuttings.
c variable	A variable describing management units in JLP. See also d variable, x variable and z variable.
data collection request	Data collection request is an expression to define aggregated values of collectible variables resulting in a set of collective variables. See also category variable.
decision hierarchy	The hierarchical structure of a forestry unit consisting of one or more sub-units on several hierarchical levels.
decision variable	The variables of the MELA decision data records. Decision variables are used, for example, for the constraints and the objective function of JLP problems and for summary reports. See also x variable and z variable.
delivery price	See roadside price.
discounting	Assessing the present value of future revenues and costs according to the selected discount rate. See also interest rate.
discount rate	A rate used to calculate the present value of future revenues and costs and expressed in MELA in terms of the real annual rate of compound interest. See also interest rate.
domain	Any set of management units.
drain	See cutting drain and total drain.
dtran	A JLP command for the transformations of d variables. See d variable and transformation.

dual problem	The symmetrical formulation of the original linear programming problem. For further information, see Lappi (1992). See also linear programming, primal problem and shadow price.
d variable	A variable describing data sets (data files) in JLP. See also c variable, x variable and z variable.
event	The basic step of the MELA simulation. Events are natural processes and human activities.
Finnish National Forest Inventory (FNFI)	The continuously repeated statistical survey of the forests of Finland since 1921 based on systematic field sampling. The ninth inventory began in 1996. The new multi-source inventory method combines field measurements with satellite imagery and other digital data. The purpose of the FNFI is to provide information and monitor the changes in the forests, timber resources and forest environment.
FNFI	See Finnish National Forest Inventory.
forest land	See land-use category.
forest level	Regarding a forest area or several stands.
forest management	The act (and the art) of practising forestry for the specified objectives, for example, by the practical application of scientific, economic and social principles to the administration, use, handling and care of forests.
forest management category	A class of land units where the same principles of forest management are followed for the specified use (e.g. timber production, protection or recreation). In MELA, users can define their own forest management categories.
forest operation category	A user-defined category for grouping management prescriptions.
forestry analysis	The analysis of the production, management and decision potentials in forestry, for example, for decision making.
forestry board district	A district level administration unit for private forestry in Finland (recently forestry centre).
forestry land	See land-use category.
forestry unit	The uppermost level of the decision hierarchy in a MELA optimisation problem or the body of one or several hierarchically organized sub-units (and further management units) treated independently from other forestry units in the analysis. Depending on the decision or the question under study,

	the forestry unit can be, for example, a forest holding, enterprise forests or the forests of a country or a region.
forestry unit level	Regarding a forestry unit.
forest value	The monetary value of the forest peculiar to each decision maker in each decision situation. From the viewpoint of pure economic efficiency, the present value of forest when maximizing future net revenues without any constraints.
FORTRAN	A high-level, computer programming language especially used for scientific computation.
genuine stand	See stand. See also management unit.
gross income	The value of cutting removal applying roadside prices. See also net income.
hierarchy level	(1) One level in the MELA decision hierarchy. (2) One of the three hierarchy levels used for the description of management units, i.e. management unit, sample plot or sample tree level.
hierarchy member	A member of any decision hierarchy level.
human activity	A forest management operation or an administrational decision in the simulation of management schedules, for example a cutting. See also event.
implemented operation	A type of management prescription.
income	The earnings from timber sales. See gross income and net income.
indicating percent	The net value increment (t+5) divided by the value of the growing stock (at time t) and the value of land
interest rate	A percentage that indicates a charge paid for the use of money. In investment calculations, money at different points of time is weighed by interest rates.
JLP	A general linear programming software package for solving Model I type forest management planning and conventional LP problems. JLP is characterized by its easy problem definition and outstanding capacity and speed in solving large dynamic multilevel LP problems (or in selecting optimal combinations from optional management schedules for hierarchically organized management units) on the basis of forest level objectives. JLP is the current LP solver of MELA. See also

ctran, dtran, printlevel, solve, xtran, xvar, c variable, domain, d variable, transformation, x variable and z variable.

land-use category

The land area is divided into forestry and non-forestry land in the FNFI (see Salminen 1993). Definitions of the forestry land categories are as follows:

- Forest land has the potential stemwood production capacity at least 1 m^3/ha/a on the average during the recommended rotation period.
- Scrub land has the potential stemwood production capacity from 0.1 to 1.0 m^3/ha/a.
- Waste land, if not naturally treeless, has lower potential stemwood production capacity than 0.1 m^3/ha/a.
- Other forestry land cannot be used for timber growing for permanent or temporary reasons (for example forest roads and timber depots).

Non-forestry land is divided into the following categories:

- Agricultural land consists of arable and pasture land as well as associated waste land and farm tracks.
- Built-up areas consist of urban, semi-urban and other settlement areas as well as industrial areas.
- Roads, power lines, etc. are roads, railways, airfields, powerlines and similar areas outside urban and semi-urban areas.
- Lakes and rivers.
- Sea.

land value

The net present value for bare land from the perpetually repeated optimal rotations with the same optimal management schedules. The value of the future tree generations.

linear programming

A mathematical programming technique to search for the optimum (maximum or minimum) of a linear function subject to linear constraints.

logging

Felling and forest haulage of timber from the forest to roadside.

logging residue	Parts of stems suitable in size or quality neither for pulpwood nor for sawlog.
LP	See linear programming.
management category	See forest management category.
management option	See management schedule.
management prescription	User-defined instructions for simulation. Prescriptions can be either related to management proposals or implemented operations.
management schedule	The (predicted or simulated) development of the growing stock for a management unit under given management operations over the given calculation period.
management unit	The basic data unit and the smallest unit for individual management decisions in simulation and optimisation. A management unit is a genuine stand, a sample stand, or a set of homogeneous stands (or sample plots in homogeneous stands respectively) with regard to the present stand characteristics and the expected future management and development. In MELA, management units (and stands respectively) are described by sample plots and sample trees.
maximum sustained yield	The estimate of the maximum amount of timber that can be harvested from a forestry unit on a sustainable basis according to the given forest management regimes and the conditions for sustainability. Maximum sustained yield can be expressed in terms of commercial timber or cutting drain, for example. See also sustainability and sustained yield.
MELA	MELA is a Finnish forestry model and an operational decision support tool for integrated forest production and management planning. MELA is used for solving problems related to the production potentials of forests and how to manage forest stands in order to achieve the overall (usually forest level) goals for forestry in each particular decision situation.
mortality	The stem volume of the dead trees (that are not used as commercial timber).
National Forest Inventory	See Finnish National Forest Inventory.
natural process	A natural event in the development of management units (without or as a consequence of human activities) in the simulation of management schedules, for example, the growth and the mortality of trees. See also event.

net income	Gross income minus costs. See also gross income.
net present value	All predicted future net incomes discounted to the present, compressing the future (of the management schedule, for example) into one figure temporally weighed by the discount rate. See also discounting, discount rate, interest rate and net incomes.
net revenue	See net income.
non-forestry land	See land-use category.
NPV	See net present value.
objective function	The function to be maximized or minimized in optimisation. See also linear programming and optimisation
operating system	The software managing and maintaining the operation of a computer system, for example, by controlling the execution of other programs, by sharing system resources and by providing common services.
operational planning	Short-term planning focusing on the activities and operations in the near future (for the implementation of the strategic plan).
optimisation	Search for the best solution subject to given conditions, for example goals and constraints. Mathematically, either maximization or minimization of the objective function. In the MELA context also, solving of the given optimisation problem using linear programming and the JLP software.
other forestry land	See land-use category.
planning horizon	The time period being considered in the planning process.
present value	The discounted value of future revenues and costs. See also discounting and net present value.
prescription	See management prescription.
presimulation	The automatic updating (of the growth of the trees) for the management unit data up to the beginning of the calculation period (i.e. the year when the simulation of the management schedules begins).
primal problem	The original formulation of the linear programming problem with the linear objective function and constraints. See also dual problem and linear programming.

printlevel	A JLP command for the selection of the extent of the JLP terminal report.
prob	A JLP command for the definition of a optimisation problem in the JLP problem paragraph (or in the respective 'prob' section of a MELA **mdl** type file).
production program	An optimal solution (of an optimization problem) from the production point of view. In MELA, the management schedules for the management units selected in the optimal solution.
pulpwood	The part of stems not saw log but suitable for size and quality for the manufacture of pulp, paper, fiberboard, or other wood fiber products. See also saw log.
reduced cost	A marginal cost (change of the objective function) of including a new activity (management schedule) into the optimal solution. It equals to zero for all optimal management schedules.
relative year	A year expressed in relative terms in relation to the beginning of the calculation period, like 1 or 11. See also absolute year.
remaining tree	A standing tree with no restrictions for management operations after tree selection. (eg. thinning).
re-simulation	The repeated simulation of the management schedules selected for the management units in the optimal solution. For example, re-simulation is used for the calculation and reporting of the information not stored in the previous calculation steps.
retained tree	A standing tree with management restrictions.
revenue	See income.
roadside	A terminal for timber before the long-distance transportation to the mill.
roadside price	The price of the timber at the roadside, i.e. the price including implicitly or explicitly the costs of logging and hauling.
sample plot	The sub-unit (representing a part) of a management unit, for example, a part of a stand or a genuine field sample plot. Sample plots describe the management unit and the different types of variation in a management unit. See also management unit and sample tree.
sample tree	See simulation tree.

saw log	The part of a stem suitable in size and quality for the production of lumber (or saw log timber).
saw timber	See saw log.
schedule	See management schedule.
scrub land	See land-use category.
shadow price	A marginal change of the objective function caused by the slight modifications of the original LP problem. In JLP, shadow prices are calculated for constraints, x variables, management units and management schedules. For further details, see Lappi (1992).
simulation	An (computational) imitation of (real) objects, phenomena and processes.
simulation period	The time period from the beginning of the calculation period to the actual end of the simulation (after the calculation period). For the calculation of some decision variables, the simulation of each management schedule can be continued after the calculation period until the end of the on-going rotation period at the end of the calculation period. See also calculation period.
simulation tree	A genuine measured tree or its simulated (computed) equivalent on a sample plot (of a management unit). Measured trees represent the growing stock (or the tree distribution) on a sample plot.
site type	A soil fertility class according to the FNFI classification system (see Salminen 1993). The classification is based on forest site types (mineral soils) and peatland types and their ground vegetation.
solution	The result of the optimisation.
solve	A JLP command for solving a JLP problem.
stand	A sufficiently homogeneous and large piece of forest with regard to soil and growing stock to constitute an individual management (and management planning) entity.
stand level	Regarding one stand (at a time).
state	The internal status of a management unit between events in the simulation of management schedules.

strategic planning	Long-term planning focusing on long range objectives and aspects, for example, for obtaining specific goals or results (in the future).
stumpage price	The price of standing timber excluding the costs of logging and hauling.
sub-period	An intermediate step of the calculation period. A calculation period consists of the sub-periods constituting the time framework for simulation, optimisation and reporting in MELA. Typically, the length of one sub-period is from two to ten years. See also calculation period and simulation period.
sustainability	The management policy of taking the satisfaction of the (expected) future needs into account in the (current) human activities, for example, in the form of non-declining objectives for production and/or development in the future (and forever). See also sustained yield and maximum sustained yield.
sustained yield	The periodical balance of the harvests and the net increment in timber production. See also maximum sustained yield and sustainability.
timberland	A land wholly or partly used for timber production.
total drain	Sum of cutting removal, waste wood and mortality.
transformation	The creation of new c, d and x variables in JLP. See also ctran, dtran and xtran.
treatment	See human activity.
utility function	A function expressing the satisfaction that the (forest) production process yields (to the decision maker).
value growth	See value increment.
value increment	The increase in the monetary value of a tree or of the growing stock as a consequence of the growth of the tree(s) during the given period.
volume table	A table showing the estimated (average) stem volume of the trees based on given tree characteristics, for example, tree species, diameter and height.
waste land	See land-use category.

waste wood	Sum of logging residue and the stem volume of felled trees from the clearing of regeneration areas and the tending of young stands.
xdat file	A JLP file containing x variables or management schedule (**msc** and **msd** type) files respectively in MELA.
xtran	A JLP command for transformations of x variables. See transformation and x variable.
xvar	A JLP command for the definition of x variables (or decision variables) to be read in (from the management schedule (**msc** and **msd** type) files) for the subsequent JLP problem definitions (in the respective 'prob' section of a MELA **mdl** type file). See also prob.
x variable	A variable describing management schedules in JLP. See also decision variable, c variable, d variable and z variable.
year	See absolute year and relative year.
z variable	A variable used to formulate conventional LP problems in JLP. See also c variable, d variable and x variable.