



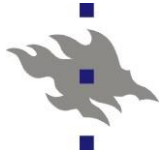
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Forest operations / treatments in SIMO simulator

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Simulating future scenarios

- n Simulator module computes probabilistic future development of a given computational unit (ie. stand, forest area etc.)
- n Forest management operations (treatments) are used to create a group of possible **alternative scenarios** for the given forest unit
- n From the alternative scenarios, the **best** (different criteria) alternative can be chosen by optimization



Forest treatment requirements in SIMO (from the user point-of-view)

n Feasibility

- Simulated scenarios must be "reasonable"

n Controllability

- Enabled control of operation parameters, eg. thinning restraints and limits, thinning power, local calibration of the parameters, number of alternative scenarios etc...

n Transparency

- Operations and treatments implementation must be transparent to the user (not a "black-box")



Operation implementation in SIMO

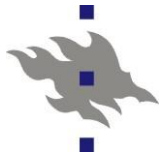
n Operations implemented as models (similar to the SIMO model implementation)

- Operation functions in C language DLL libraries
- Operation definitions, description, metadata etc. in XML documents
- Good documentation of the functions and the XML definitions contribute to the transparency of the operation implementation



Operation implementation in SIMO

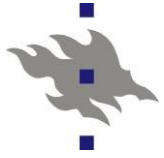
- n Simulator processes the set of XML files, that define the current simulator
- n Model chains include the information on how to eg. grow single trees and update stand attributes
- n Also, model chains include the **operations**, that are evaluated in similar way to "normal" models
- n Evaluating an operation model, creates a **branch** (a copy of the current data unit) to the data



<operation> (treatment) XML definition

n Operation model definition (pre-defined):

- <name> (eg. "low_thinning")
- <definition> (the metadata)
- <data> (the input data, eg. a set of trees, diameter distribution, stand variables etc., extracted from the simulation data)
- <variables> (variables for the operation model, extracted from the simulation data)
- <parameters> (operation control parameters, extracted from the model chain, user-controllable)
- <results> (the result variables of the operation)



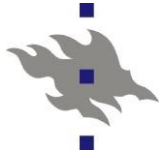
User-control of operations

- n The user can control the operation execution with modifying certain parameters in the model chains
- n <parameters> (eg. thinning strength, maximum removals etc.)
- n <long_term> (the time-span of the effect of given operation)
- n <cost_table>/<cost_model> (the costs of the operation)



User-control of operations, avoiding infeasible scenarios

- n The conditions for the operations can be modified, eg.
 - if time from last thinning > 10 years: evaluate operation
 - if BA > thinning limit: evaluate operation
 - if SP > spruce **and** Age > 70: No thinning
- n With the use of conditions, infeasible or undesirable operations can be ruled out
- n User can define the conditions for their applications, local adjustments of the conditions also possible
- n "Forced" operations also possible



Forest operations in SIMO

n Forest site and soil preparation?

n Planting, tending

n Harvesting:

- Thinnings (different kinds, by species or site-class)
- Shelterwood harvests
- Seedwood harvests
- Clear-cuttings

n What else?