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Forest operations / treatments in SIMO simulator

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Simulating future scenarios

- Simulator module computes probabilistic future development of a given computational unit (ie. stand, forest area etc.)
- Forest management operations (treatments) are used to create a group of possible **alternative scenarios** for the given forest unit
- 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)

- **Feasibility**
  - Simulated scenarios must be ”reasonable”
- **Controllability**
  - Enabled control of operation parameters, eg. thinning restraints and limits, thinning power, local calibration of the parameters, number of alternative scenarios etc...
- **Transparency**
  - Operations and treatments implementation must be transparent to the user (not a ”black-box”)

Operation implementation in SIMO

- 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

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

<operation> (treatment) XML definition

- 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

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

User-control of operations, avoiding infeasible scenarios

- 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

- With the use of conditions, infeasible or undesirable operations can be ruled out

- User can define the conditions for their applications, local adjustments of the conditions also possible

- ”Forced” operations also possible

Forest operations in SIMO

- Forest site and soil preparation?
- Planting, tending
- Harvesting:
  - Thinnings (different kinds, by species or site-class)
  - Shelterwood harvests
  - Seedwood harvests
  - Clear-cuttings
- What else?