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Automatic detection of forest management units as a basis to optimally coordinate planning, forest operations and controlling in forest enterprises

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Research Group Sustainable Forestry

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Existing planning: by means of stand map



- Boundaries of stand maps
- Forest roads

Access of a stand



Planning based on stand maps: Inefficient harvesting layout



 \rightarrow Single, 'not coordinated' cuts and cable roads

Establish Forest Management Units (FMUs)

Aim of FMU: spatially coordinate forest planning, execution and control of forest management activities

Public / government / silvicultural criteria, such as ecosystem services



Operational view: efficient fine access, in particular for cable-based systems (but not solely)

Objectives of a Forest Management Unit





Independent planning areas (operational, provision of ecosystem services, further criteria) Long-term orientation

Plan Do Do Act Check

Suitable for operational controlling

Allocation of FMUs on the basis of fine accessibility



Concept of FMUs Optional set of criteria for the delineation of FMUs







Operational / Harvesting Topics

Roads) Modelling of harvesting Systems (e.g. Cable Roa



Aggregation / Optimisation

Objectives:

- [1] Compact, spatially contiguous FMU
- [2] FMUs as homogeneous as possible (according to defined criteria)
- [3] Operationally / technically coordinated

Constraints:

Number of FMUs or Minimum or Maximum Size of a FMU

Method:

Mixed Integer Linear Programming

Modell Representation



Homogenous according to criteria

- E.g.: each sub-unit ...
- Is in only one fine access unit
- Has only one ES

Representation as network / graph



Aggregation of the sub-units to FMUs

Example of Application



40 FMUs **G** Forest Enterprise FMUs Colours Landeskarte @swisstopo Gletscher Dur Tschimas da l 2 km

Criterias:

Harvesting concept

Transportation boundaries

Number = 40 FMUs

Main findings

- FMUs are a very useful concept to coordinate planning, execution and control of forest management
- Optimization: target oriented planning and fast comparison of variants
- Requires interaction between model and expert: solution should not be applied without reviewing (expert knowing model limitations)
- Modelling of forest operations is an important key for useful FMUs
- «Intermediate products» are quite useful for practical applications
 - Map of potential harvesting systems,
 - Map of sub-units,
 - Map of transportation direction (ground- / cable based).

Thank you

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