A Retrospective Study of Canopy Gap Dynamics of a European Beech Stand

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Canopy Gaps

Areas of natural regeneration in closed canopy forests
Work Flow

Stereoscopic imagery

Derivation of DSM

DTM

DSM – DTM

Filtering to obtain DTM and DSM

LiDAR Data

CHM

Mapping of Canopy Gaps

Canopy Gap Analysis

Canopy Gap Map

Canopy Gap Parameter

DTM: Digital Terrain Model
DSM: Digital Surface Model
CHM: Canopy Height Model
Data Acquisition by Photogrammetry
Gap Mapping

Adaptive Median-Filter

\[ h_i < \tilde{x}_i - (Q_{3_i} - Q_{1_i}) \]
Study Area - Solling

Data
- CIR aerial Imagery
- DTM (12.5 m res.)
  from the cadastre service

Limkerstrang part of the woodland Solling
Results - Gap Map

1998
Comparison with manual Gap Delineation

- Blue areas: automatically detected gaps
- Red polygons: reference delineation
Results - Solling
Study Area - Eifel

Data
- CIR aerial Imagery
- DTM (1 m res) from LiDAR data

NWZ3 part of the National Park Eifel
Results - Eifel
Results - Eifel

NWZ3 core
- 1989
- 1995
- 2001
Comparison of Gap Size Distributions
Summary

- Aerial photographs are well suited to study gap dynamics, since long time series of aerial imagery exist for many forests.

- Digital image processing methods can be used to delineate canopy gaps automatically.

- Automatic gap delineation ensures objective processing and reproducible results.

- Automatically delineated gap areas are within the range of the reference delineation, but they tend to slightly overestimate the gap size.
Outlook

Methodology

- Further development of methods for gap mapping for large areas and mixed stands

Applications

- Characterisation of typical gap patterns & dynamics
- Comparison of managed stands and forest reserves
- Development of recommendations for close to nature forestry
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