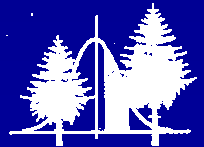# A Retrospective Study of Canopy Gap Dynamics of a European Beech Stand

Robert Nuske

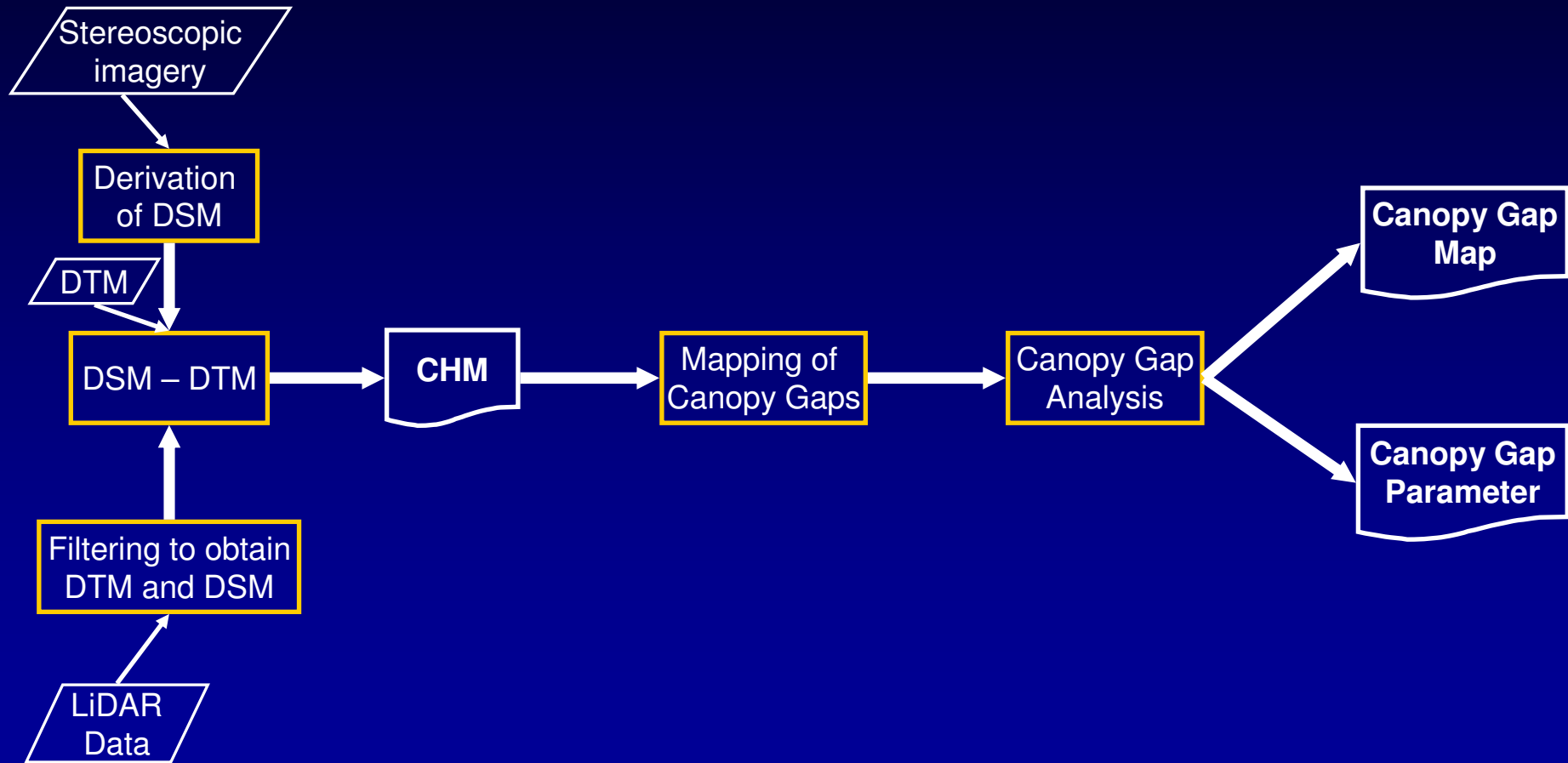Institute for Forest Biometrics
& Applied Computer Science

Georg-August-University Göttingen

Canopy Gaps

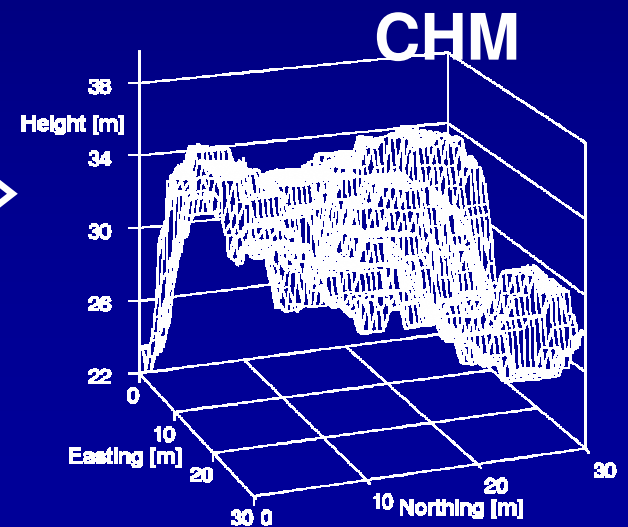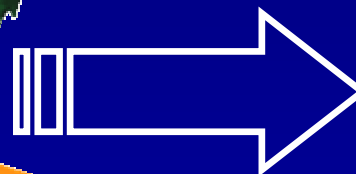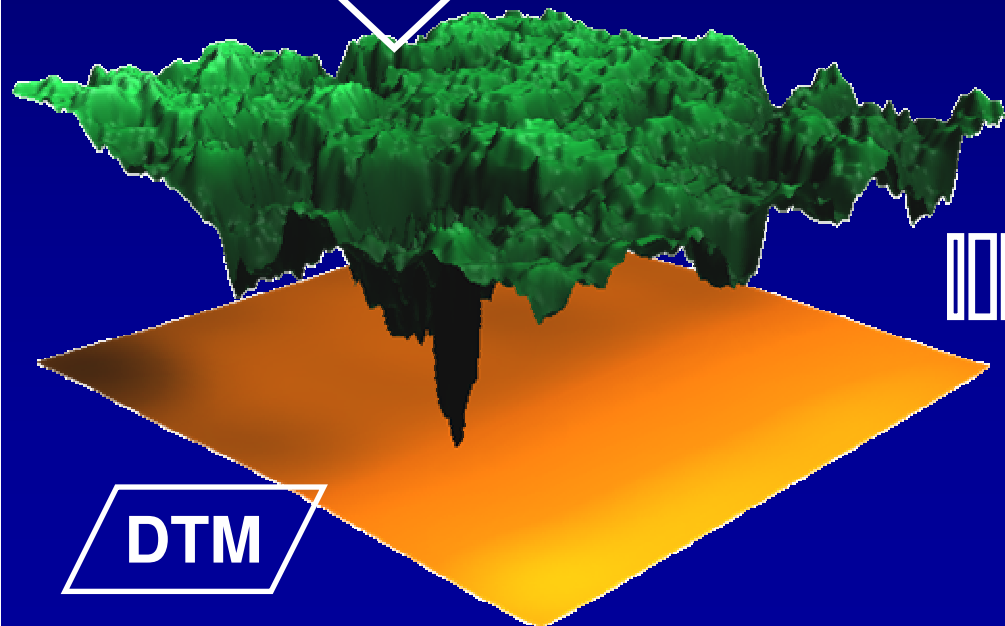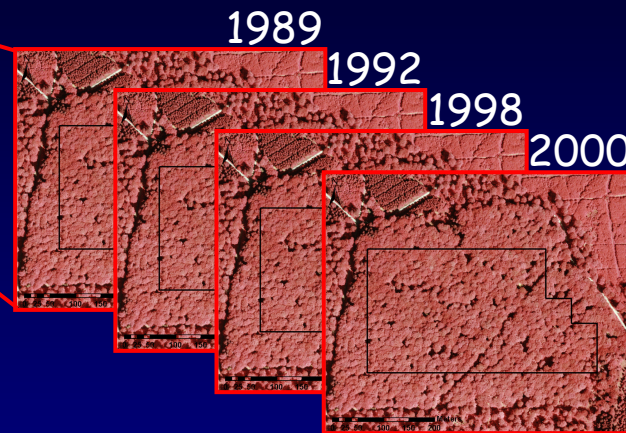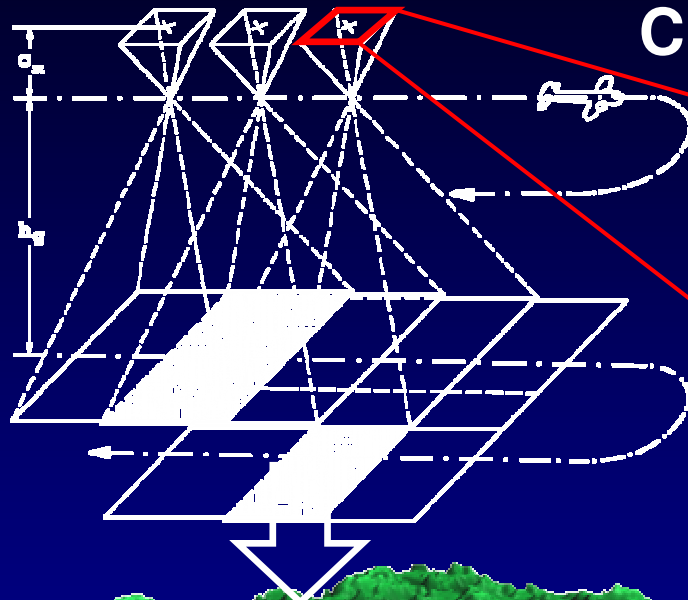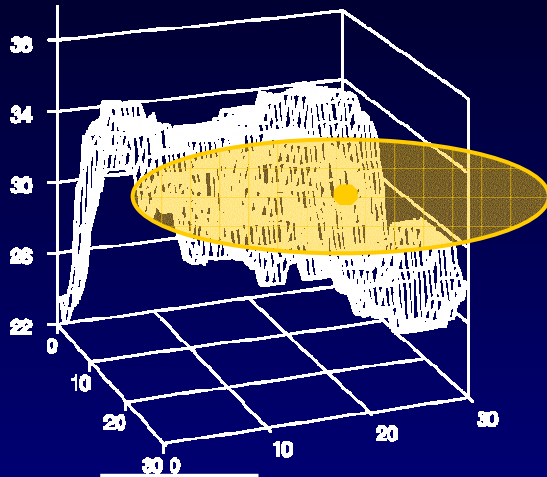Areas of natural regeneration in closed canopy forests

Work Flow

DTM: Digital Terrain Model
DSM: Digital Surface Model
CHM: Canopy Height Model

Data Acquisition by Photogrammetry

CIR Aerial Photographs

1989
1992
1998
2000

DTM

CHM

Height [m]
38
34
30
26
22
0

Easting [m]
10
20
30 0

10
20
30
Northing [m]

Gap Mapping

Adaptive Median-Filter

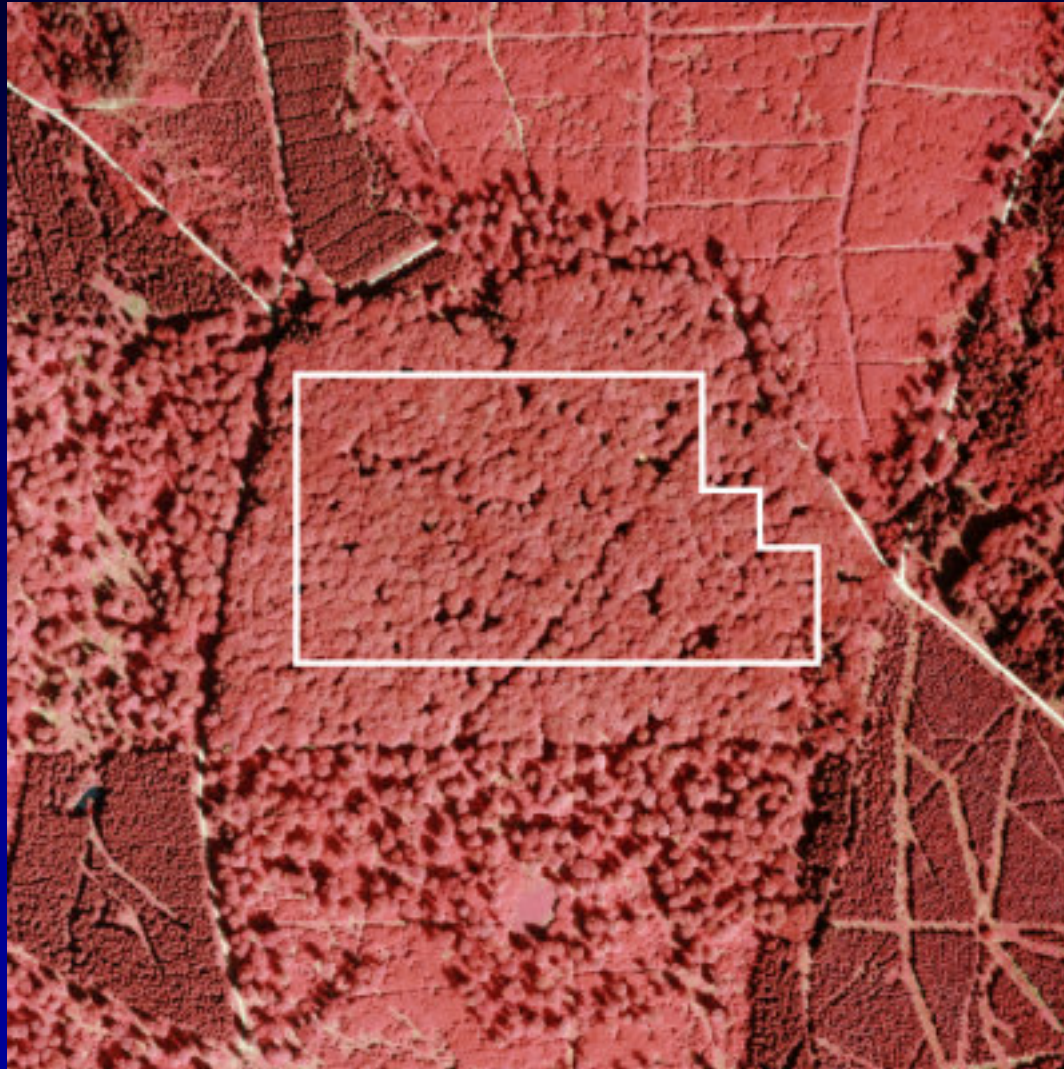$$h_i < \tilde{x}_i - (Q_{3_i} - Q_{1_i})$$
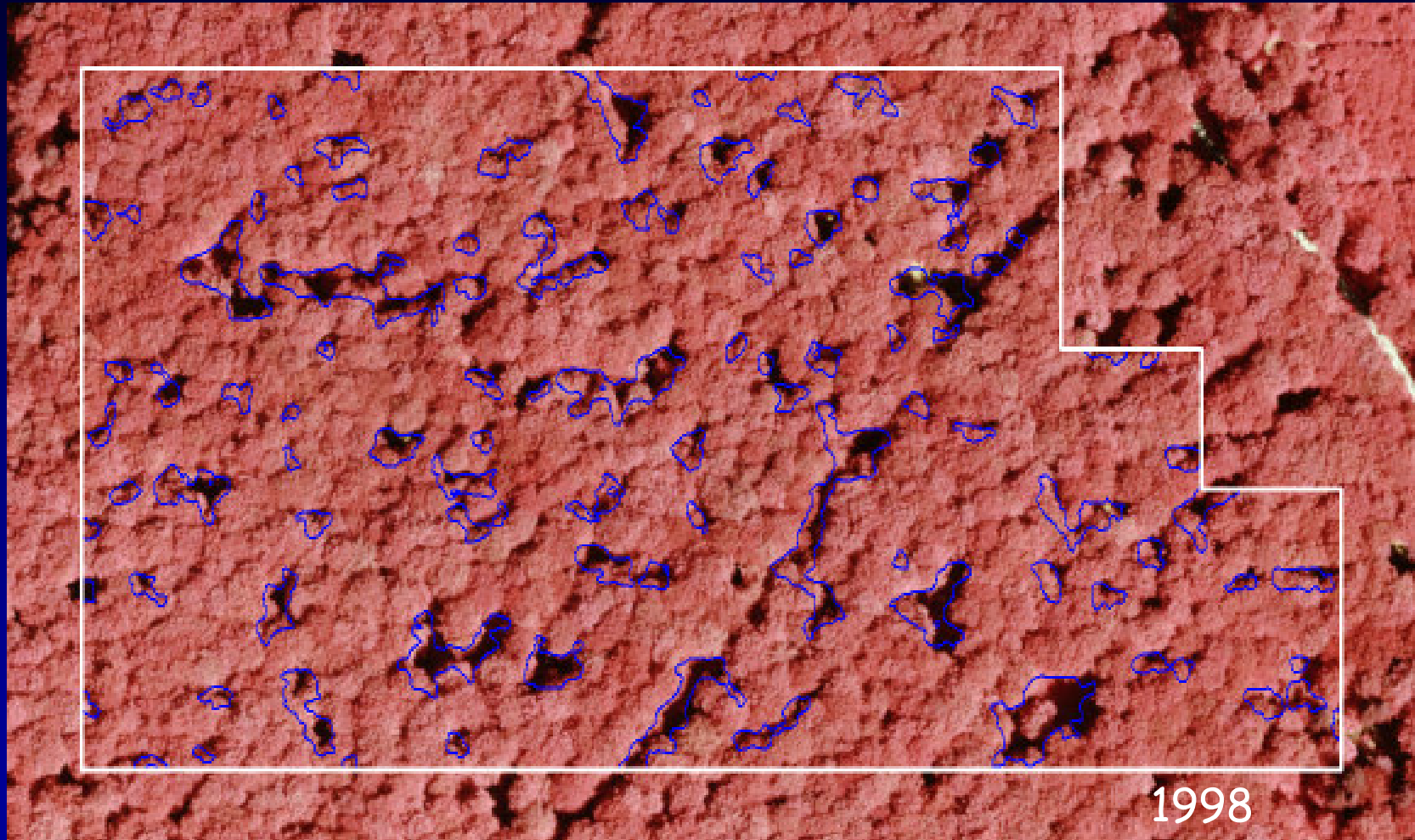
Study Area - Solling

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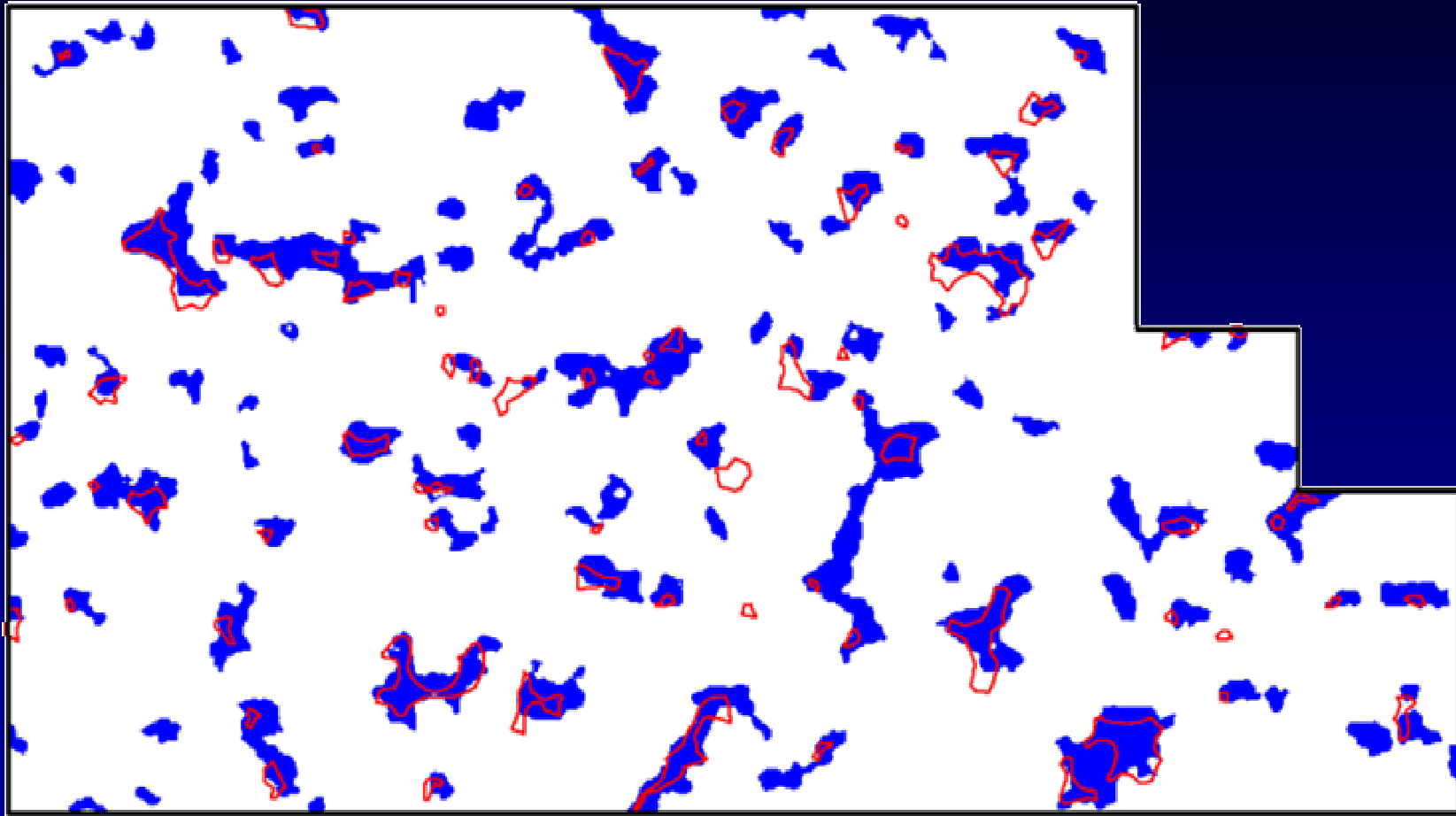- DTM (12.5 m *res.*)
  from the cadastre service

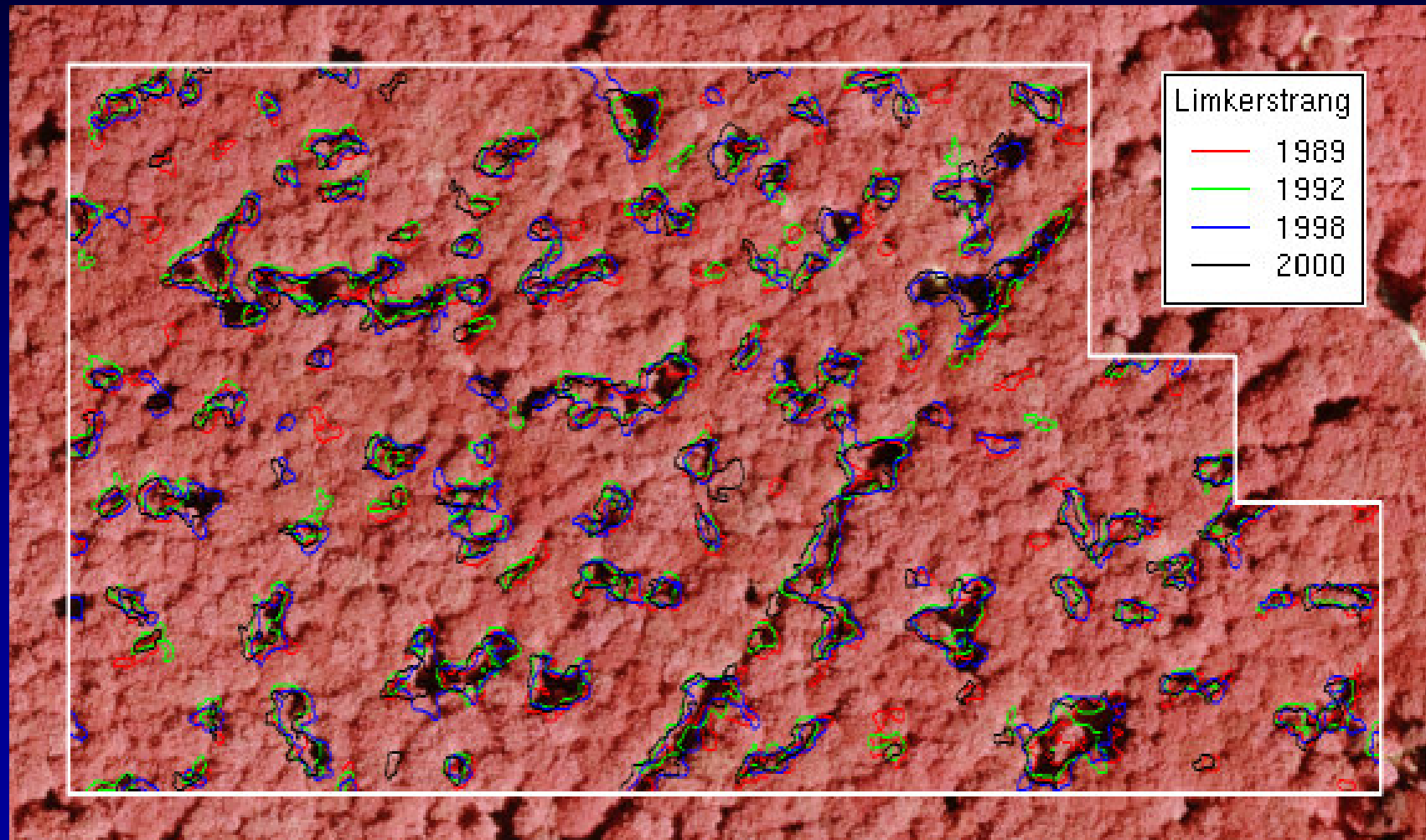Limkerstrang part of the woodland Solling

Results - Gap Map

1998

Comparison with manual Gap Delineation

blue areas: automatically detected gaps
red polygons: reference delineation

Results - Solling

Limkerstrang
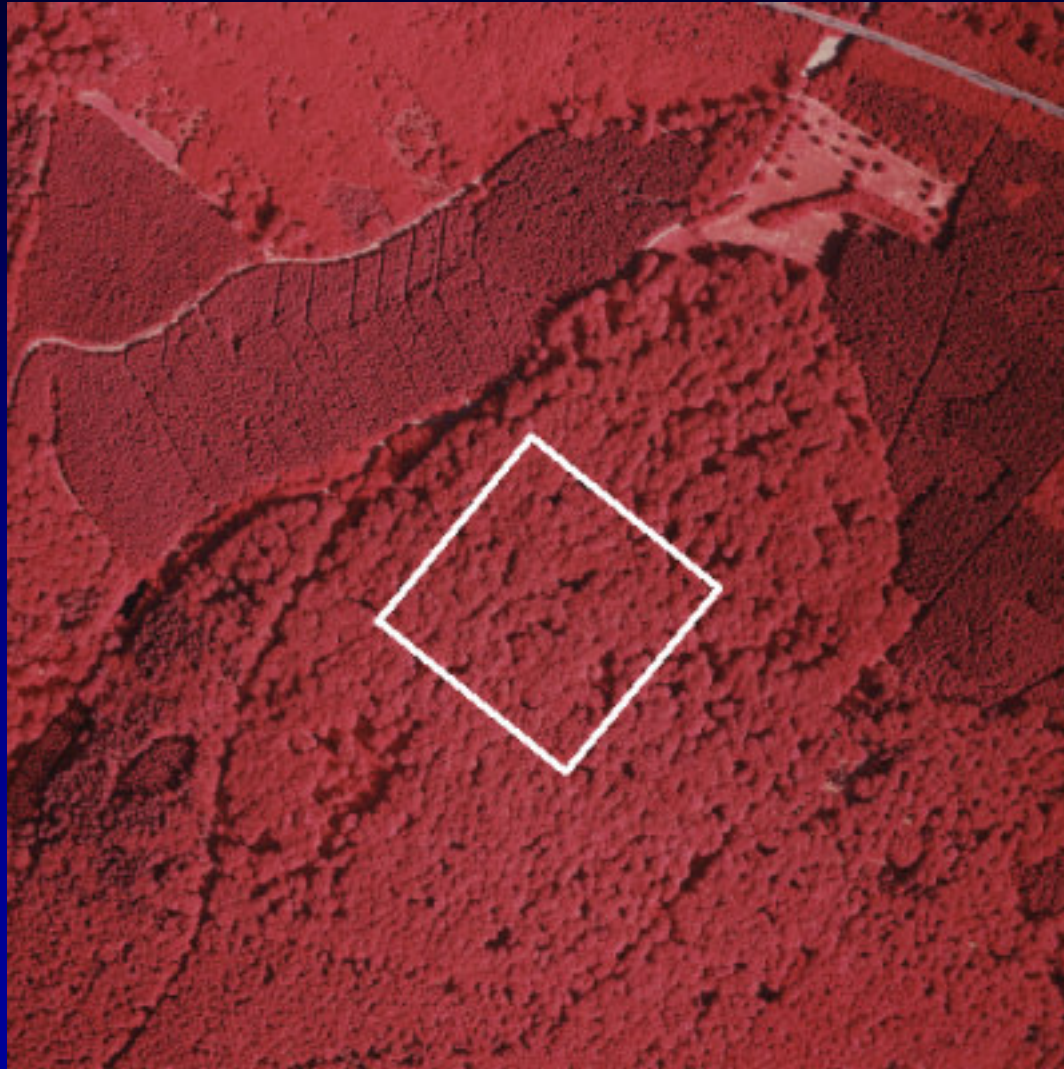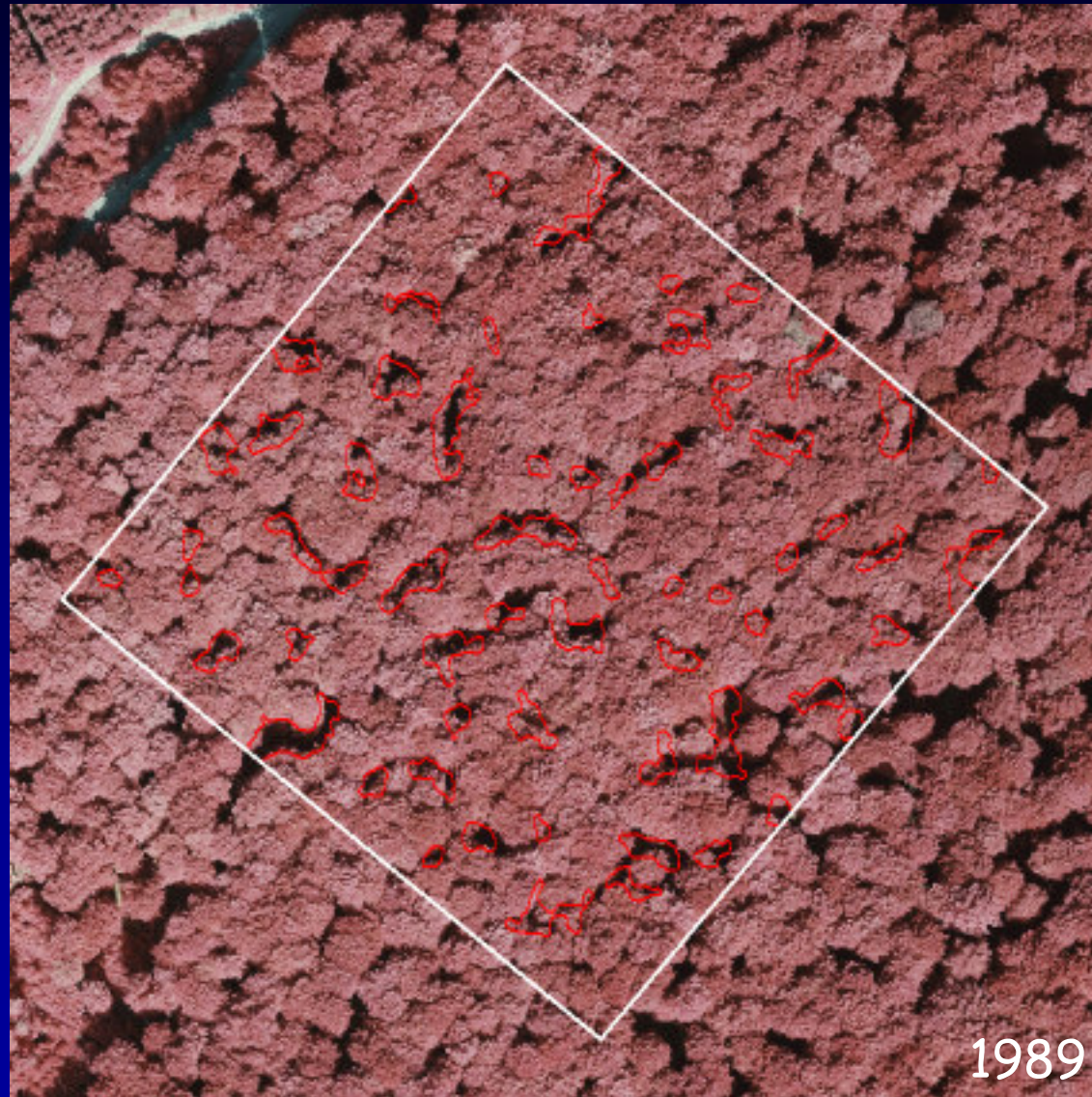— 1989
— 1992
— 1998
— 2000

Study Area - Eifel
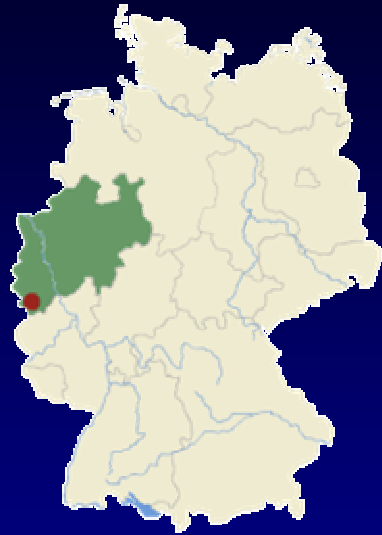
Data
- CIR aerial Imagery
- DTM (1 m *res*)
  from LiDAR data

NWZ3 part of the National Park Eifel

Results - Eifel
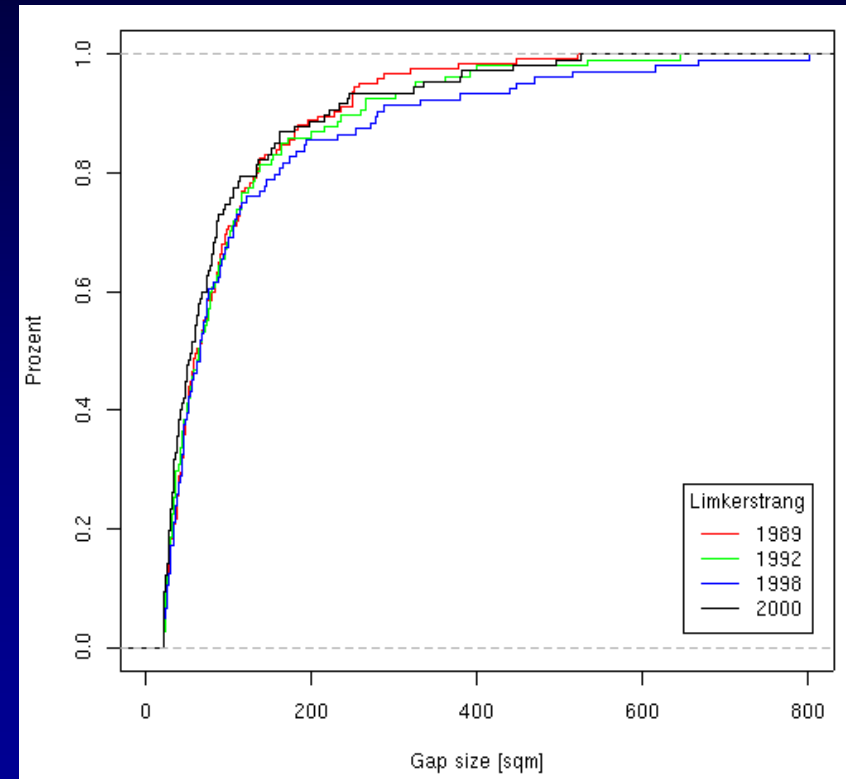

1989

Results - Eifel

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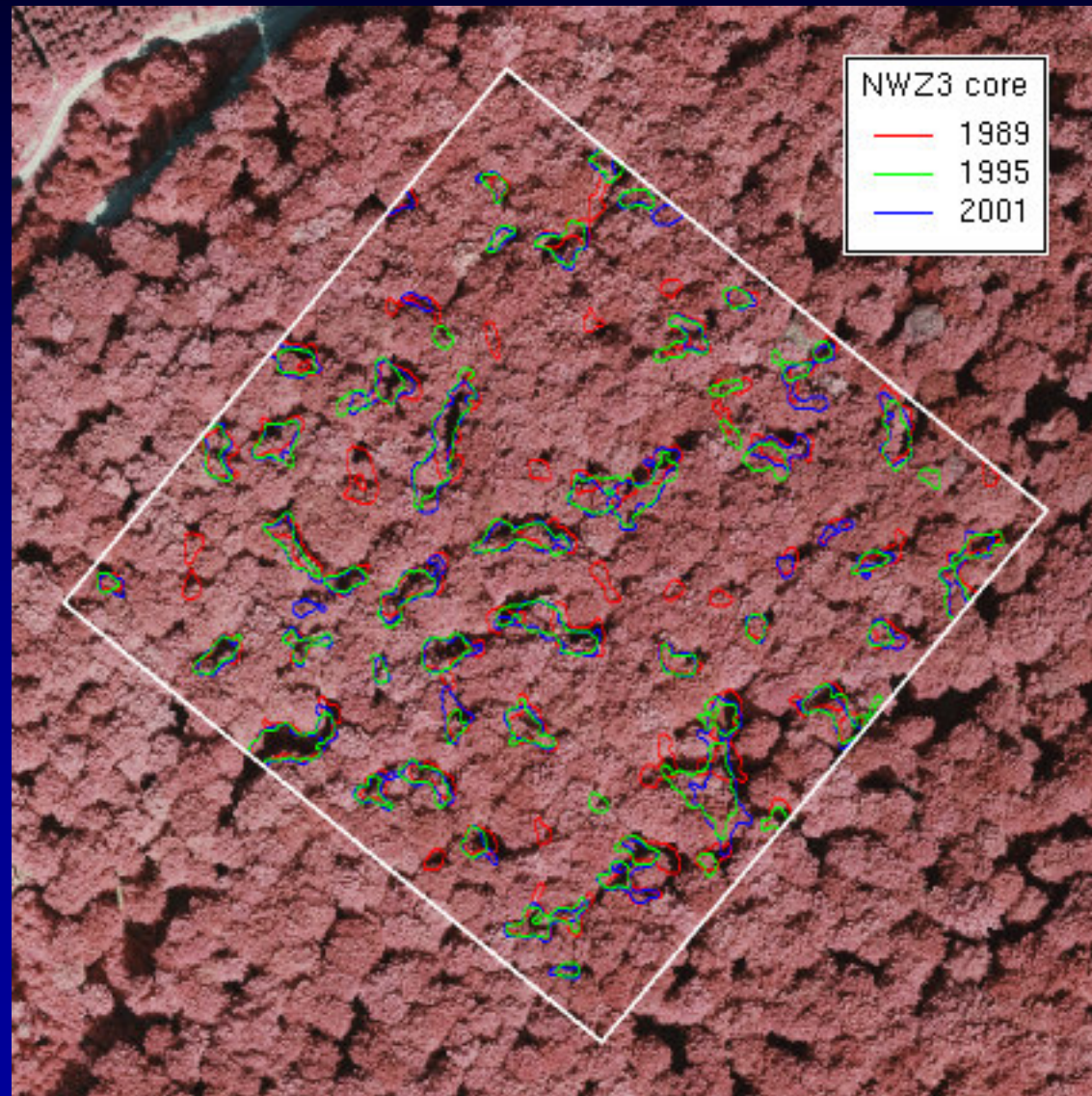
Comparison of Gap Size Distributions
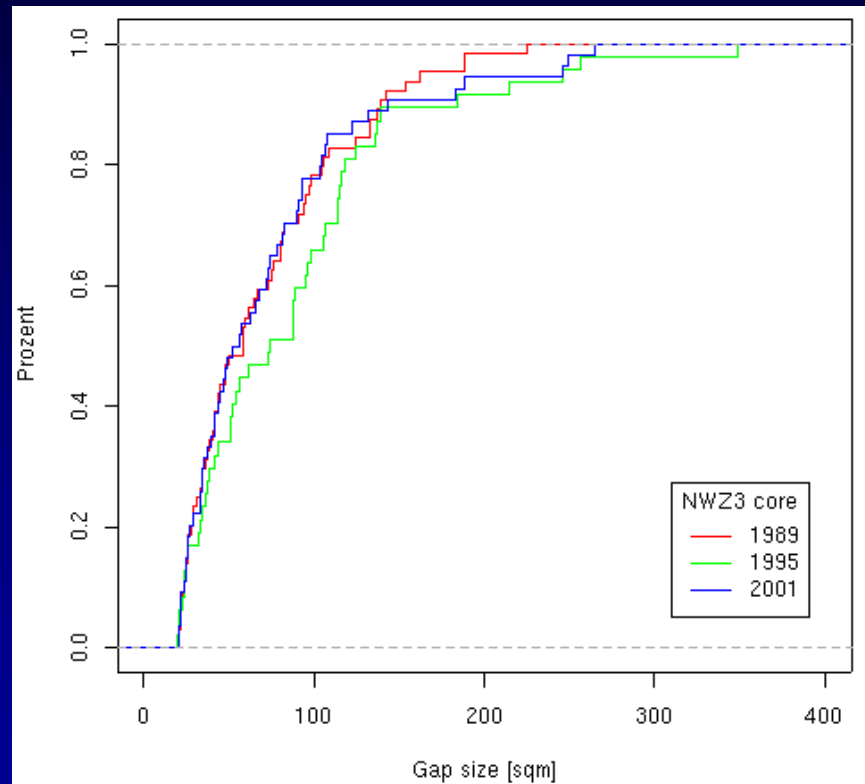
Summary

- 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

Acknowledgment

- **This study was funded by the German Federal environmental Foundation**

- **Data were generously provided by the**

  - **LÖBF North Rhine - Westphalia and the**
  - **Forest research agency Lower Saxony**