Bavarian Scots pine forests rich in lichen species.

Sets of old relevés help to predict future development.

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Outline

Bavarian Scots pine forests rich in lichen species.
Sets of old relevés help to predict future development.

- Background
- Questions
- Methods
- Results
- Consequences

Forests dominated by Scots pine and lichens

In former times wide-spread in certain parts of Bavaria for centuries.

They seem, however, to change both in

- species composition
- and in area.

Habitat conditions

Mighty wind-borne sand deposits

Poor in nutrients,
Podzol soils

Bavarian Scots pine forests rich in lichen species:

1. Did the species composition of this forest type really change during the past decades, and if yes: how?
2. Did the area covered by this pine forest type really decrease in the past two to three decades?
3. What are the reasons for a change and what can be done to protect this forest type in the future?

Bavarian Scots pine forests rich in lichen species, how did they look like in the past?

To evaluate the current floristic quality of this forest type a benchmark is needed:

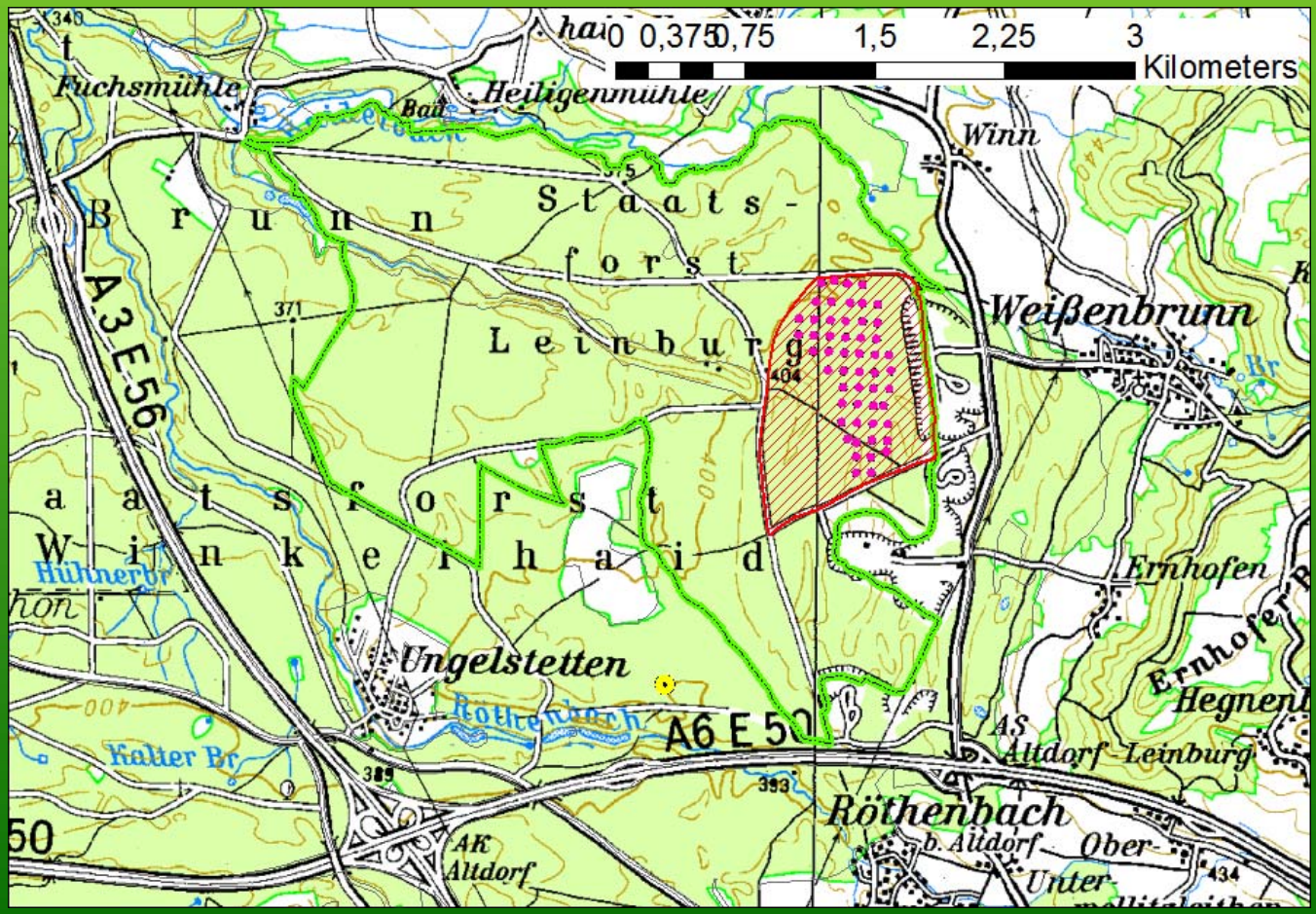
- We collected almost all available phytosociological relevés of this forest type in Bavaria
  - publications
  - diploma theses (usually unpublished)
  - project reports (usually unpublished)
- and found **2363** relevés from Bavaria with dominating Scots pine.
- With the help of
  - Correspondence analysis , cluster analysis, analysis of variance releves
  - R (R development core team 2010) with the libaries vegan (Oksanen et al., 2011), dave (Wildi, 2013), RColorBrewer (Neuwirth, 2014) and gclus (Hurley, 2012)

we selected those relevés/stands which were rich in lichens and represent lichen rich Scots pine forest (*Cladonio-Pinetum* resp. *Leucobryo-Pinetum cladonietosum*).

Comparison of past and present situation

1. South of Nürnberg a sub-set of 33 relevés from the 1980s could be localized exactley and were repeated in 2014.
2. In the same region mapping from 1982 was compared with mapping from 2012.
3. A lichen rich forest stand was designated as a strict forest reserve in 1993. In 1994 permanent plots were established in this reserve. We resampled these plots in 2014. The sampling design is based on a regular grid (100m).

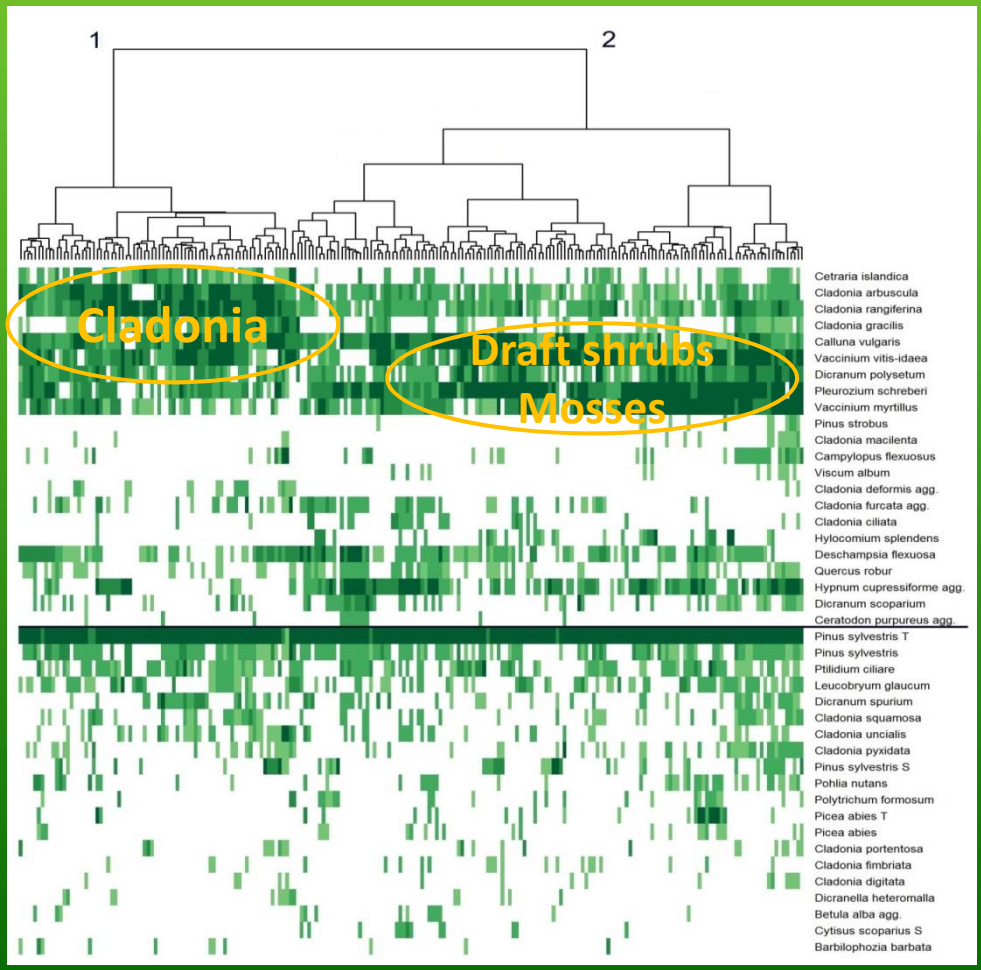
Resurvey BM1 study area



Bavarian Scots pine forests rich in lichen species, in the past: species composition

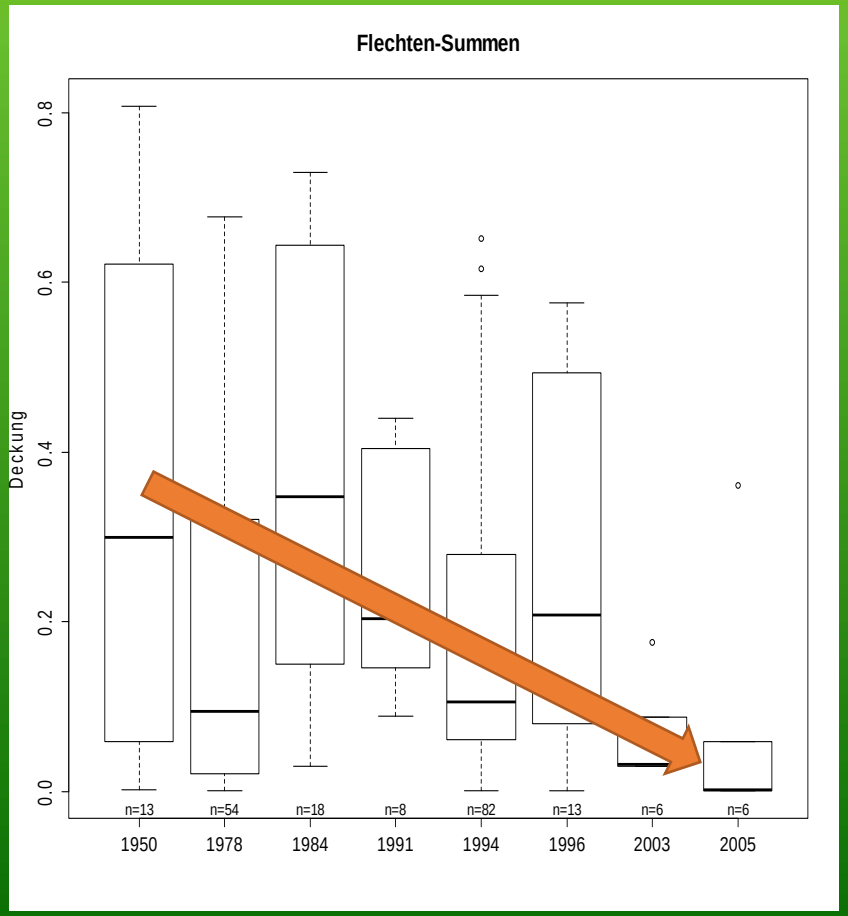
- 216 relevés BM2
- 2 main groups can be separated from each other:
- 1 = Pine forest very rich in lichen species
- 2 = Pine forest rich in dwarf shrubs

  (*Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Calluna vulgaris*).



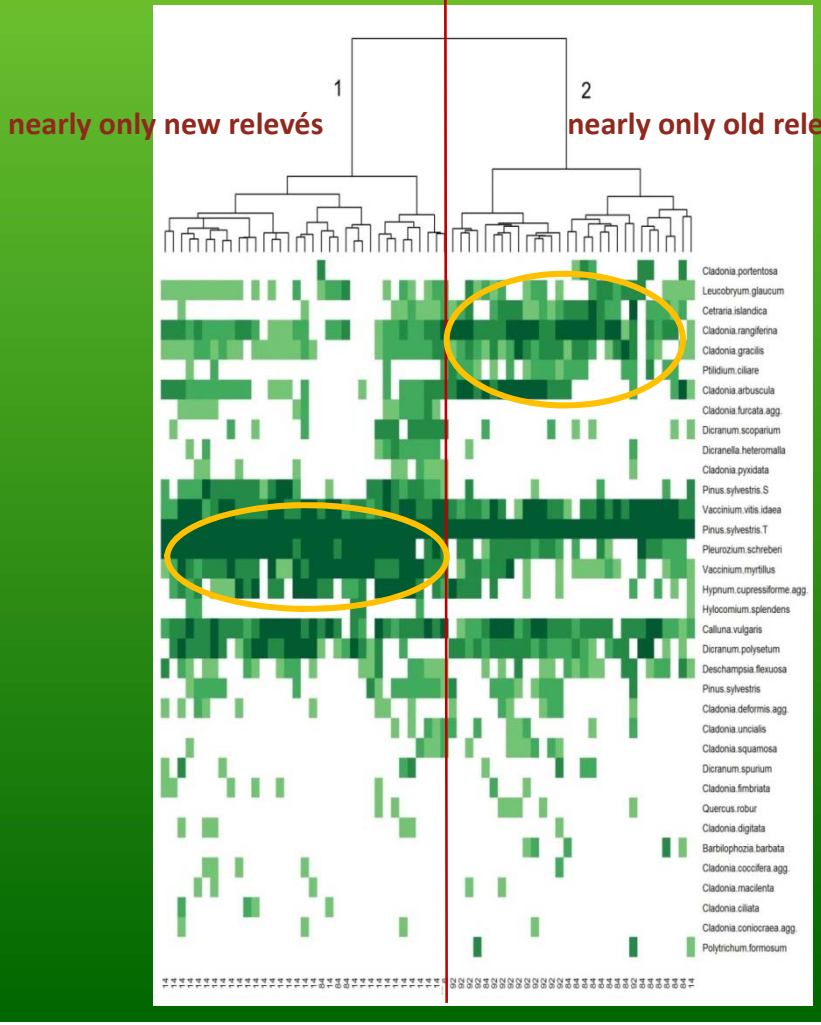
Bavarian Scots pine forests rich in lichen species, in the past: coverage of Lichens

- In the course of time (1950 – 2005) within the set of **historic relevés** the coverage of lichens decreased significantly.
- Reference set:
  - 30 lichen species (mostly *Cladonia*, also *Cetraria*)
  - 50% of relevés: cover degree > 18 %
  - 25% of relevés: cover degree > 38 %
  - maximum: 80 %



Bavarian Scots pine forests rich in lichen species, past 1980-82 /1989-92 and present (2014) : species composition

Comparison of historical and present relevés on nearly identical plots shows clear separation of historical and present species composition.



Bavarian Scots pine forests rich in lichen species, past (A) and present (B): lichens decrease ⇩, mosses increase ⇧

Lichens:

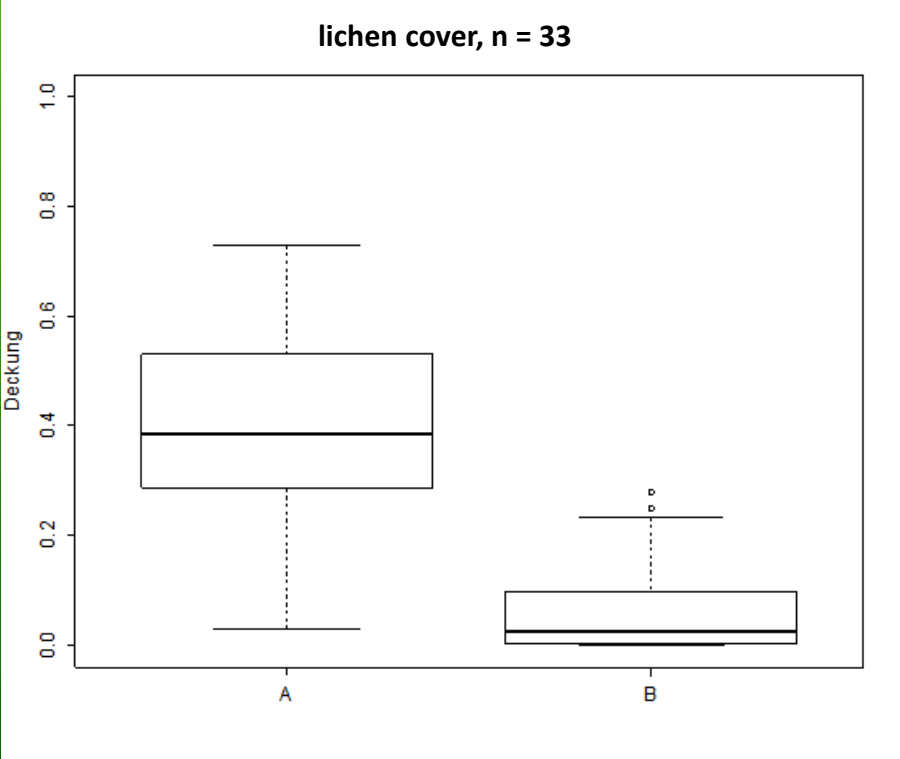
first record (A): min.: 3%; Q25: 29%; median: 39%; mean: 41%; Q75: 53%; max.: 73%;

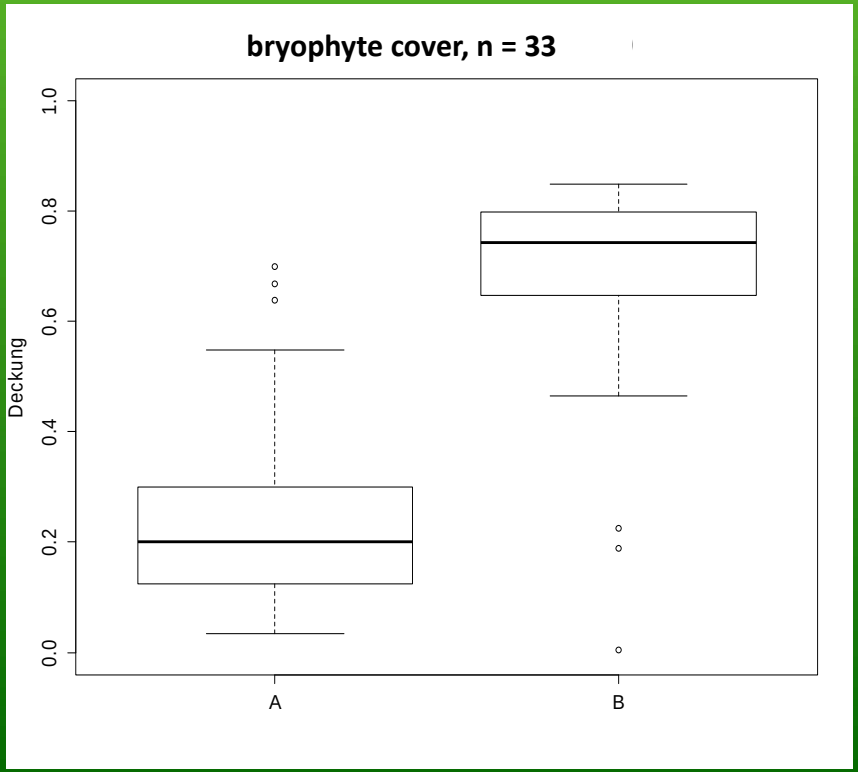
second record (B): min.: 0%; Q25: 0%; median: 0%; mean: 6%; Q75: 10%; max. 28%.

Mosses:

first record (A): min.: 3%; Q25: 12%; median: 20%; mean: 23%; Q75: 30%; max.: 70%;

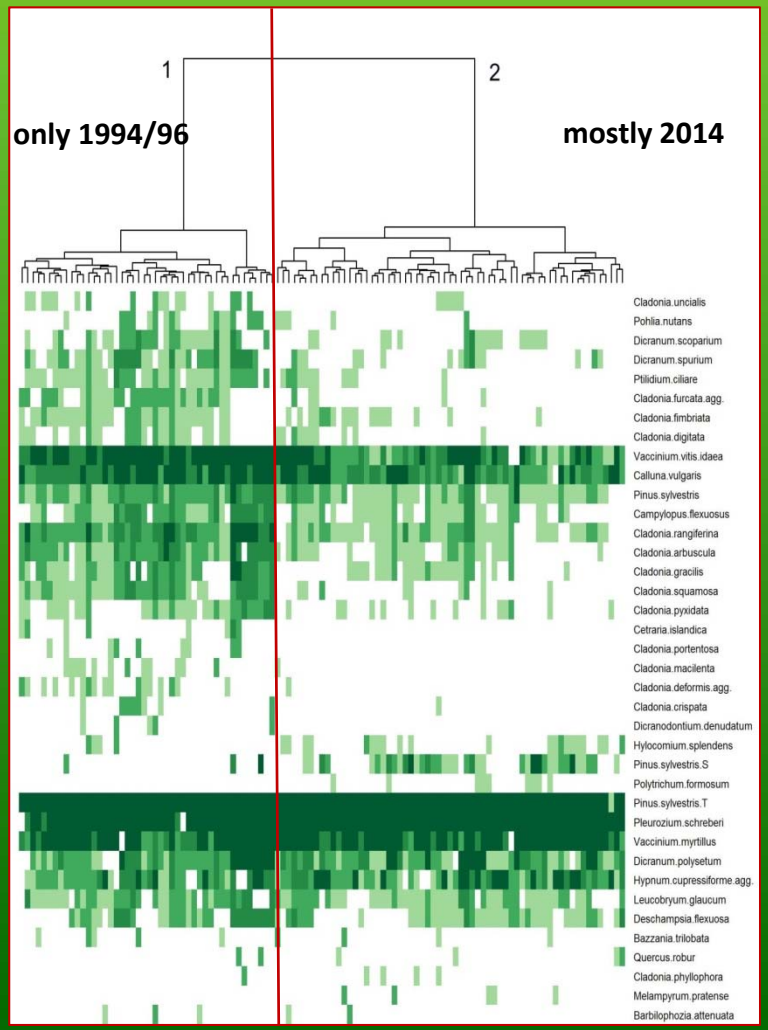
second record (B): min.: 0.5%; Q25: 65%; median: 74%; mean: 68%; Q75: 80%; max.: 85%.





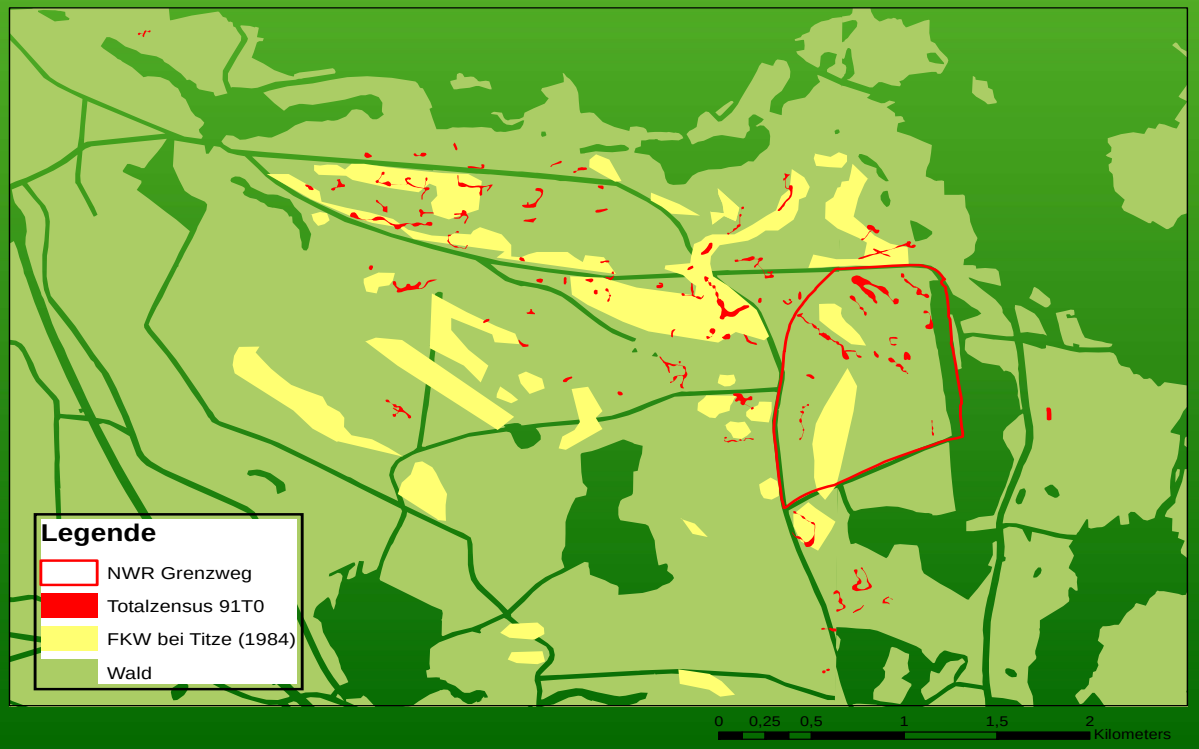
Bavarian Scots pine forests rich in lichen species, past (1994-1996) and present (2014), resurvey in a strict forest reserve

- Massive change in species composition, also true without any direct impact (management)
- Past: rich in lichen species
- Present: rich in bryophytes and regenerating spruce



Mapping Bavarian Scots pine forests rich in lichen species, past (1982) and present (2011)

- in 1982 (yellow) and 2011 (red), respectively.
- Decrease by 90 % within three decades.



Present situation of former Bavarian Scots pine forests rich in lichen species,

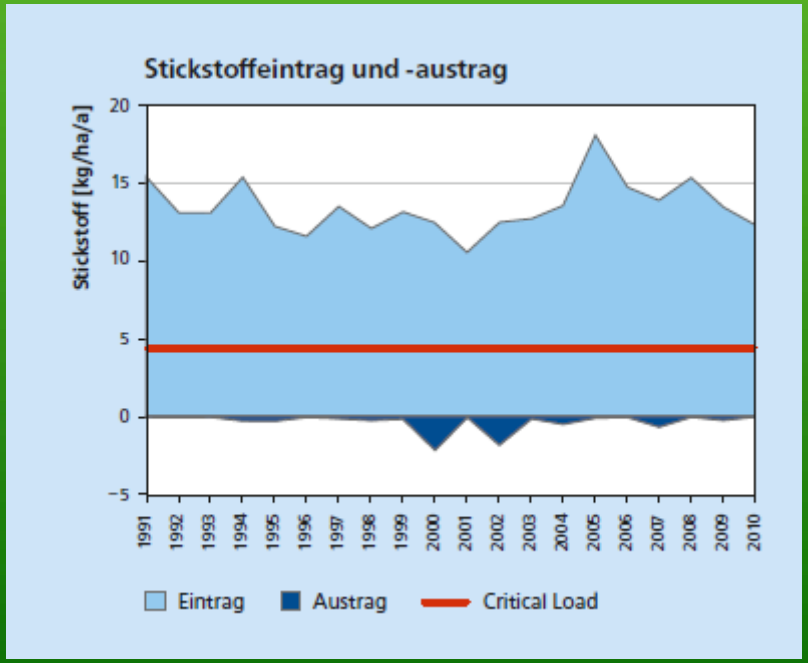
1. The relevé reference set allows to valuate the current state of lichen rich pine forests:
   - → extrem loss of lichens (species numbers and cover degrees),
   - → while few common bryophytes and dwarf shrubs dominate
   - → only very few stands left which correspond to the charcteristics of „Caldonio-Pinetum“
2. The area covered with this forest type decreased by around 90% within the last three decades.

causes

Causes

loss of the formerly practised litter raking

N immissions via atmosphere



Future of Bavarian Scots pine forests rich in lichen species

Future

Without management also the last remains of this forest type will disappear soon (within the next decade?) more or less totally.

Nature conservation options:

- Litter raking, (using modern machinery?)
- „seeding“ of thallus-parts (because a source of lichens is no longer be present in the surroundings)

This nature conservation perspective of this forest type could only become obvious by using huge sets of (historic) relevés representing this forest type.

Thank you for your attention

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