

Stand Dynamics in the Virgin Forest „Neuwald“

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Introduction

- ▶ The virgin forest „Neuwald“, 20 ha, is one of the last remnants of virgin forests left in the Eastern Alps (Zukrigl et al. 1963; Kral & Mayer 1968) (Figure 1).
- ▶ Vegetation: spruce-fir-beech forest, *Adenostylo glabrae*-Fagetum Moor 1970 and *Cardamino trifoliae*-Fagetum Oberdorfer 1987 (Willner & Grabherr 2007).
- ▶ no silvicultural intervention (harvesting ban in the early 19th century)
- ▶ high deer density during the last century
- ▶ this time no considerable ingrowth into the overstorey



Figure 1: The virgin forest „Urwald Neuwald“. © Steiner

The main questions of this study are:

1. How does the lack of natural regeneration and ingrowth, at simultaneous tree mortality, affect the inventory parameters: stem number, basal area, volume, tree species composition and diameter distribution?
2. Is the ecosystem sufficiently resilient and able to compensate the long-lasting lack of ingrowth and dying trees with an increase of increment of the remaining stand?

Method

- ▶ Survey in 1986, 1996 and 2006, 26 sample plots à 1000 m² in a grid of 60 x 60 m
- ▶ at all trees above a dbh (diameter in breast height) of 10 cm polar-coordinates, dbh, height (1986) and survival of individuals were recorded
- ▶ calculation of the merchantable timber volume by dbh, height model (survey 1986) and form factor functions (Pollanschütz 1974)

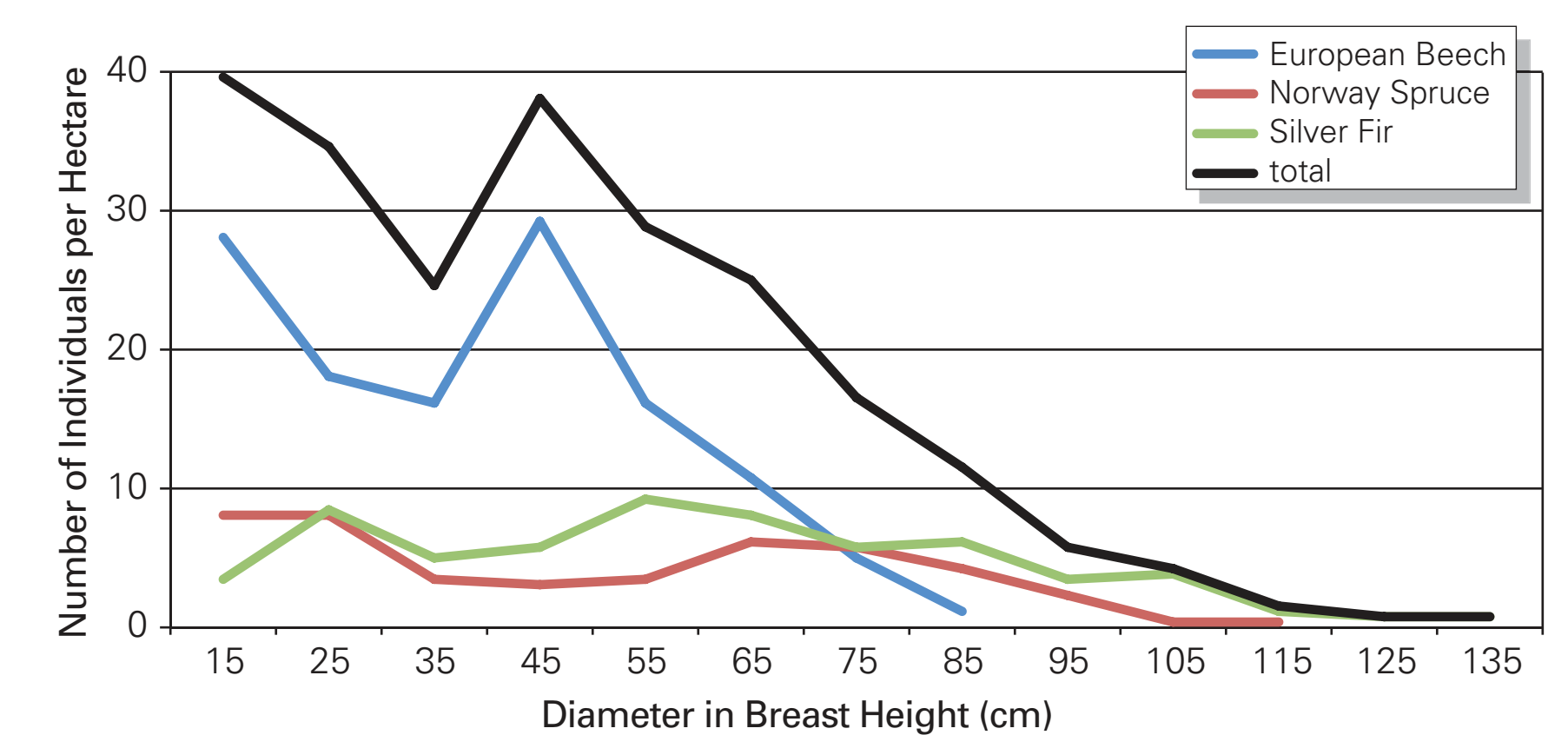


Figure 2: Diameter distribution of main tree species in the virgin forest „Urwald Neuwald“.

Results

Overstorey is composed exclusively by European beech, silver fir and Norway spruce.

The dbh-distribution shows large differences among the tree species (Figure 2)

- ▶ fir and spruce between 20 and 90 cm dbh have relatively constant stem numbers. In the diameter classes above this size spruce decreases rapidly. Fir, however, is found regularly in higher diameter classes reaching a dbh of up to 138 cm.
- ▶ totally different is the dbh range of beech; in the range up to 60 cm dbh stem numbers twice to 3 times as high as conifer species were found. Above this size, it decreases rapidly reaching comparatively modest maxima of just over 80 cm. In the range below 50 cm dbh an unbalanced individuals density becomes evident.

Number of individuals > 10 cm dbh (Figure 3)

- ▶ a decrease of 250 n/ha to 227 n/ha can be noticed for a period of 20 years. While in beech mortality and ingrowth were balanced at 12 n/ha, there is no ingrowth for 7 dead spruce trees/ha and 1 ingrowth for 17 fir/ha.

Volume of the stand (Figure 4)

- ▶ a slight increase in volume (merchantable timber) over the course of 20 years of 715 m³/ha to 741 m³/ha beech and fir show the best growth performance. The excellent growth performance observed especially in older fir trees results in considerable increment of the whole stand – despite the lack of ingrowth.

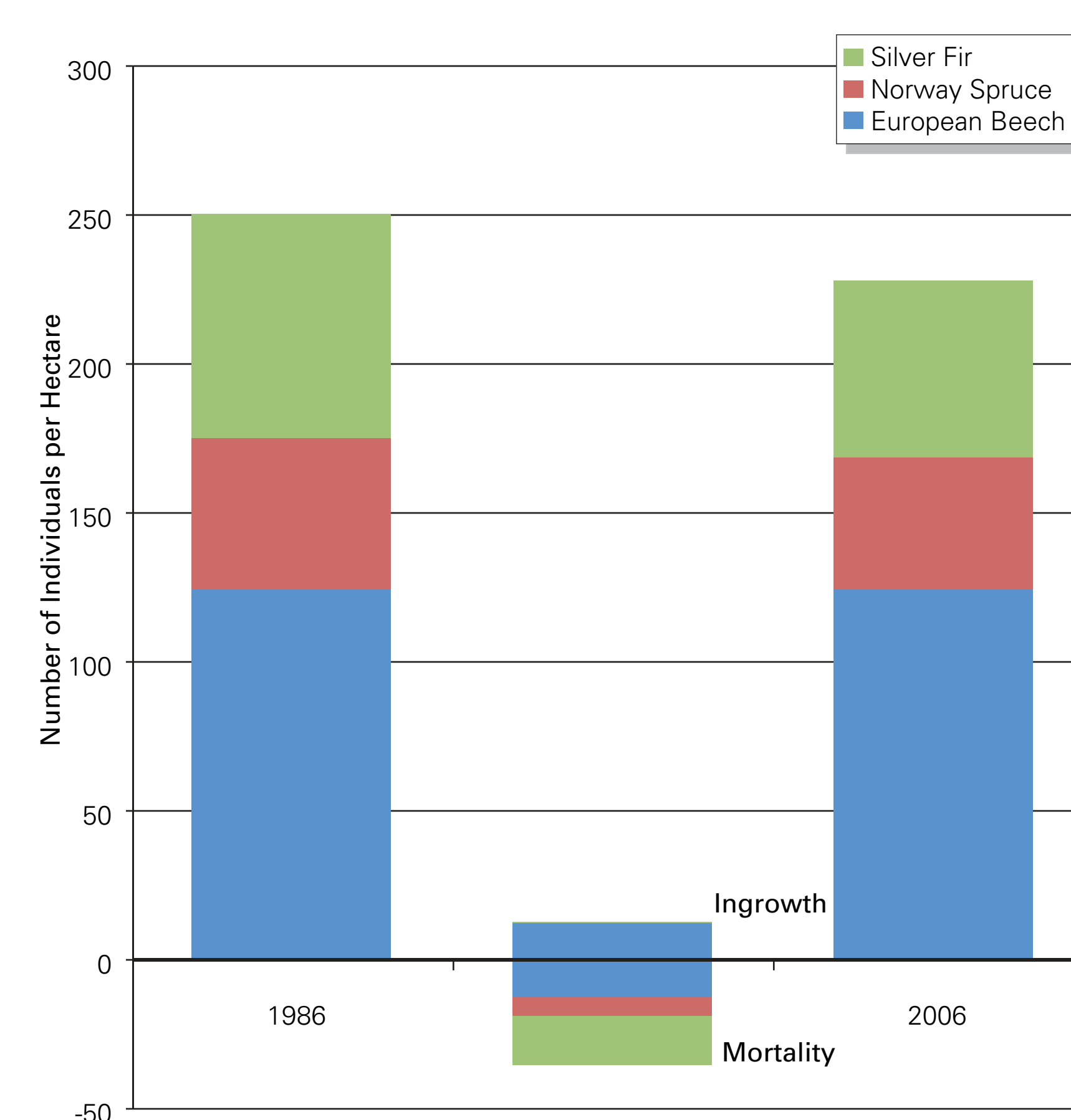


Figure 3: Comparison of 1986 survey with 2006; number of stems of main tree species per ha, ingrowth and mortality.

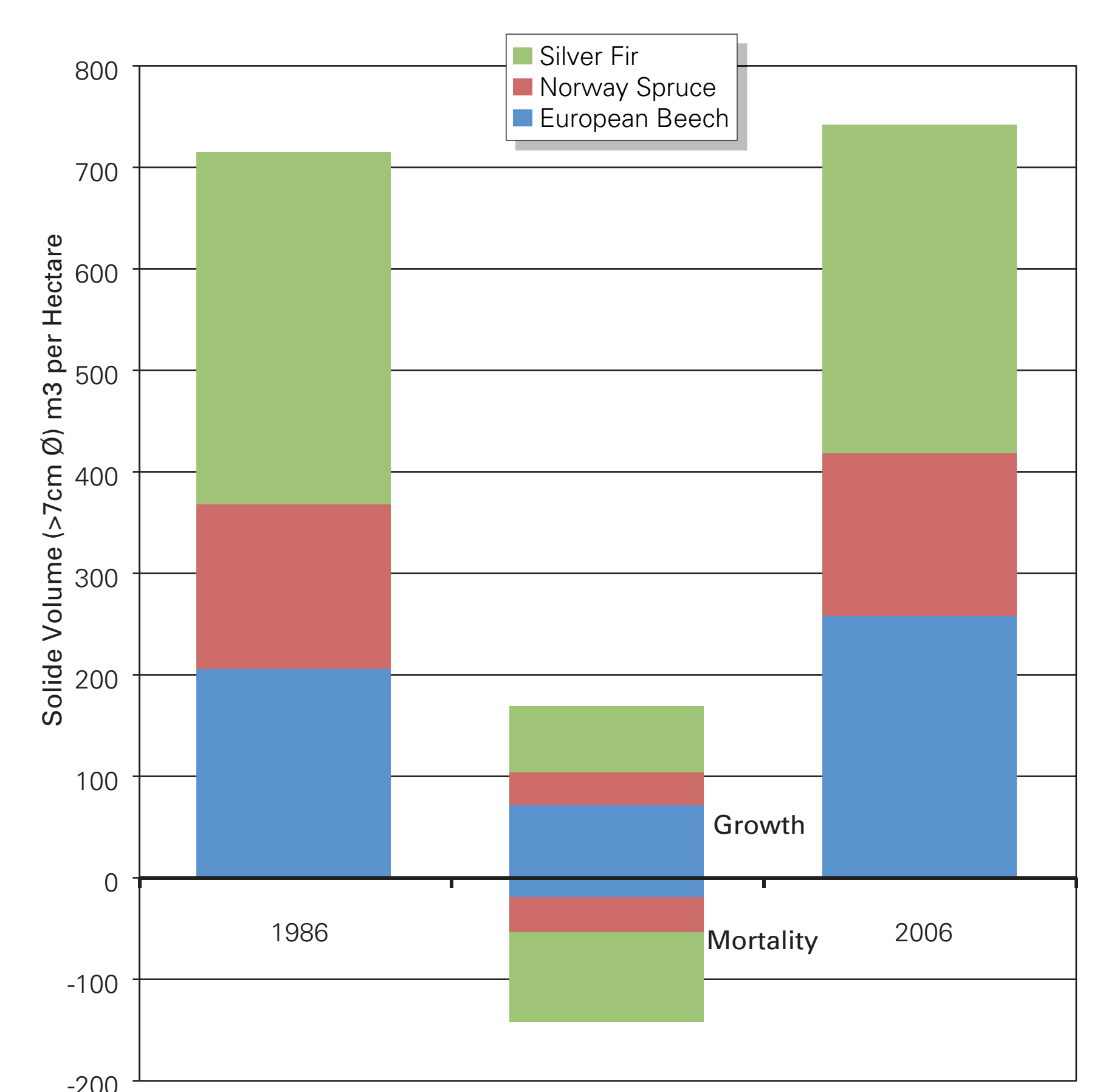


Figure 4: Comparison of solid volume of 1986 survey with 2006; total solid volume (>7cm Ø) m³ per ha, growth and mortality.

Discussion

Massive browsing on regeneration by red deer for decades has led to a permanent disturbance of the natural stand development. Studies in spruce-fir-beech forests in south-eastern Europe suggest a similar trend to increasing beech dominance at the expense of fir in comparable forest types (Vrška et al. 2009; Diaci et al. 2011). However, in the virgin forest „Neuwald“ not only a change of tree species can be observed, but a decrease of all three main tree species spruce, fir and beech. A total dieback of fir projected in 1988 (Frank & Mayer 1988) from the perspective of air pollution induced „Waldsterben“ (forest dieback) cannot be confirmed from today's point of view. All the more surprising is the long lasting capacity of the forest ecosystem to compensate the age-related mortality and the lack of regeneration by overstorey growth. Under the current view of climate change and the discussion concerning the status of unmanaged forests as carbon sinks these findings could be important because they demonstrate the ability of these forests for carbon storage over many decades.

References

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