

# **Impacts of drought and heat on tree and forest growth – A synthesis of studies on short-, medium- and long-term effects observed under temperate climatic conditions –**

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Shortage in water supply is the most widespread limiting factor for tree growth. Trees have developed various strategies to mitigate or avoid drought stress. Stress responses range from short-term physiologic accommodation, to medium-term modificative and long-term genetic adaptation. Depending on strain intensity small effects might be recognized only as weakened vitality being completely reversible. Whereas severe disturbances might lead to plastic shifts associated with irreversible organ and tissue damages and increased mortality.

Based on retrospective observational data on forest growth taken from selected case studies as well as from systematic surveys the role of droughts and heat in the past is analysed. Special emphasis is laid on medium- to long-term effects on growth. Historic drought events are compared with the 2003 drought, and the validity of the historical analogues concept is critically discussed.

Only very few data are available which already cover the growth in the year 2003. High resolution data from dendrometer measurements on spruce and beech sample trees on selected sites in different elevations give insight in the specific magnitude and also intra-annual development of radial growth in 2003 as compared to preceding years.

The presented synthesis focuses on the following questions:

To which extent has forest growth changed in 2003?

What are the most affected forest tree species?

What are the most affected sites?

What are the most affected forest stands?

What conclusions can be drawn for tactic and strategic forest management to decrease risk and increase drought-resilience and -stability of forest ecosystems in the future?