Variability of tree ring properties along an altitudinal gradient

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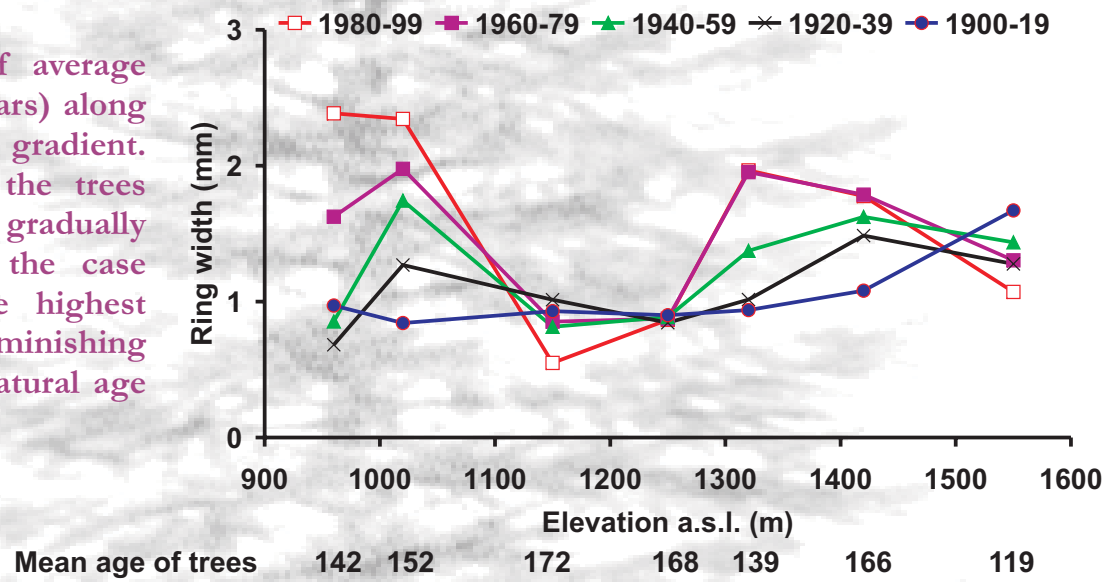
Increment cores were taken from Norway spruce trees (Picea abies) along an altitudinal gradient of 600 m in the Achental valley, Tyrol, Austria. Three representative trees were cored at each of seven intervals (approx. 100m). Ring width, latewood proportion, x-ray densitometric density and lignin content were determined.

Observing the temporal dynamics during the past 100 years it was found that the expected natural gradient of the investigated tree ring characteristics was heavily disturbed by human activity. Cattle grazing in the forest strongly diminished tree growth at low elevations during the first part of the investigated period, resulting in less growth at lower elevation than at tree line. The reduction of grazing in the past decades lead to a recovery of growth at most of the sampled low- and mid-elevation sites,and the natural gradient, with lowest growth at highest altitudes was restored.

Figure 1 - Time course of average ring width (blocks of 20 years) along the Achenkirch elevational gradient. During the 20th century, the trees at the two lowest stands are gradually recovering, which is not the case at mid elevations. At the highest elevation, growth is slowly diminishing over the years due to the natural age trend.



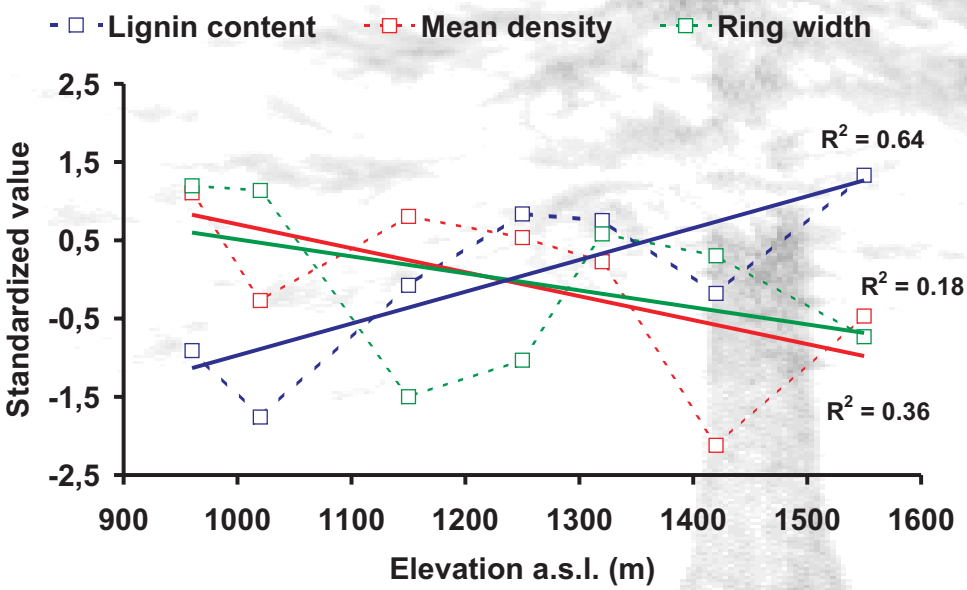


Figure 2 - Distribution of ring width, mean annual density and lignin content (1980-1999) across the Achenkich gradient. Mean annual density and ring width are gradually decreasing with increasing elevation, although highly scattering. Lignin content shows a clear, highly significant increase with elevation.

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between species. Some species however prove to be very well suitable for growth ring analysis.

Tree Ring Analysis of Spruce in the Ore Mts., Region Heavily Loaded by Air Pollution

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In 1999 total of 400 cores were taken in the spruce stands within the Ore Mts. The study was aimed to investigate the relationship among climate, air pollution load, and the tree growth, and to define extreme factors, crucial for the increment decrease, which can also be connected with forest damage. Analysis of the monthly climate and air pollution data has shown that the increment is affected mainly by the temperature course in the year when the tree-ring was formed. Significant positive correlation was surprisingly found for the temperature during the winter months which can indicate lower frost hardiness of spruce under the SO2 impact. Among the air pollution factors high average SO2 concentrations in autumn and winter months are unambiguously of negative impact. Analysis of daily climate data has confirmed that mainly temperature breaks during spring are an important factor affecting tree growth. Analysis of the frequency of negative pointer years, when the increment was strongly reduced, and also decline of the stands has been observed, it has been shown that mainly extreme climatic conditions, intensified by high SO2 concentrations, were the cause of such development.

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