Long-term study reveals accelerated tree growth in Central Europe

Data from experimental forest plots that were monitored continuously since 1870 has revealed an accelerated growth of trees in the last five decades. Three decades ago, "forest dieback" was a hot topic, which questioned the survival of large forest ecosystems. But instead of a collapse, recent studies indicate that forests have actually been growing at a faster rate. Whether, how and why forest stands have changed their growth patterns over the last century are still unclear. Some insights were gained as the plots have been observed systematically since 1870. The experimental forests, representing the typical climate and environmental conditions of Central Europe, are among the oldest forest study sites in the world. This finding, published recently in Nature Communications *is the outcome of a study carried out by scientists from Technische Universität München (TUM).*

Faster growth

Head of the research team Prof. Hans Pretzsch from TUM briefed that spruce and beech, the dominant species of coniferous and deciduous trees respectively in Central Europe showed significant accelerated tree growth. Beech trees exhibited a growth rate that was 77 percent faster than in 1960, while the figure for spruce was 32 percent faster. Likewise, the stand volume growth for beech was 30 percent, and 10 percent for spruce. "The stands as a whole had a lower growth rate than the individual trees essentially because larger trees require more space, hence each stand will have fewer trees," explained Pretzsch.

Growth ring sampling from an experimental tree plot

As forest stands develop faster, tree numbers are currently 17-20% lower than in past same-aged stands. Carbon dioxide (CO_2) and nitrogen are other factors contributing to the faster growth. The concentrations of these gases in the atmosphere have been rising steadily over the last century. "Interestingly, we observed that acid rain only had a temporary slowing effect on the growth of our experimental plots. Indeed, the input of pollutants started to fall off significantly from the 1970s," said Pretzsch.

Change requires adaptation

While both the trees grow and age faster, the appearance of the forest does not change as a result. But the same tree and stand sizes are achieved significantly earlier than in the past. This could benefit the forestry industry in that target diameters and the optimal harvest rotation age will be reached sooner. At the same time, the altered timescale has not yet been incorporated into traditional forestry yield models, which monitor growth merely as a function of age. The risk here is that the newly discovered benefits will not be exploited. Meanwhile, the accelerated growth and aging of trees is also significant for the forest ecosystem as a whole, as Pretzsch explained: "The plant and animal species that will be most affected are those living in habitats which depend on special phases and structures of forest development. These species may have to become more mobile to survive."

Long-term observation with unique data set

The study was based on 6,00,000 individual tree surveys conducted since 1870. Over such a long timescale, it was possible to determine from the growth of the trees how they responded to changing environmental conditions. Pretzsch added that even though the experimental areas varied in terms of climate and soil conditions, still it was possible to recognize an overall trend of faster growth. Further, it was not just the experimental plots and the long observation period that make the data so interesting. "Focus was not only paid to observe the trees in isolation, but rather always in interaction with their neighbours. This helped us understand how the dynamics of individual trees influence the stand as a whole. Because growth trends at stand level are relevant for the forestry industry in terms of productivity, carbon sequestration and climate risks," concluded Pretzsch.

Source:
sciencedaily.com

Pretzsch, H., Biber, P., Schütze, G., Uhl, E. and Rötzer, T. 2014. **Forest stand growth dynamics in Central Europe have accelerated since 1870**. *Nature Communications* 5: 4967 DOI: 10.1038/ncomms5967