Abstract

Terrestrial ecosystems, mainly forests are important sinks of atmospheric carbon with high year-to-year variability driven by moisture availability. Trees store carbon in various compartments of the biomass, namely in stems, roots, and leaves. In this doctoral thesis, I investigated climate-growth responses of stem biomass (represented by tree rings) and leaf biomass (represented by normalized difference vegetation index; NDVI) of *Pinus sylvestris* and *Picea abies* in temperate forests of Czechia. I was interested in (i) general climate-growth responses and specifically, in reactions to drought and (ii) topographical factors influencing these responses at various spatial scales.

We demonstrated that climate-growth responses of both species' tree rings in the lowlands revealed a significant positive and negative influence of moisture and temperature, respectively, while in higher elevations the responses were opposite. At a landscape level, the topography of relief modulated responses of *Pinus sylvestris* tree rings, while at the large-scale level, the geographical position and elevation (temperature gradients) were the main factors for both species. Responses of NDVI were slightly weaker compared to tree rings and did not show the influence of topography at any scale probably because vegetation greenness (photosynthesis) is less climatically driven compared to radial stem growth. Overall agreement between the time series of tree rings and NDVI decreased with elevation, which is probably a result of their diverging climatic constraints.

Climatic drivers of extreme growth reductions agreed with the general climatic signal, however, the importance of drought significantly increases for both species along the large-scale elevational gradient from mountains to lowlands. Tree rings showed growth depression up to two years after drought events, while NDVI increased, probably to gain more assimilates and buffer the damage. Responses to extreme events were not affected by topography at the landscape level, while at large scale the influence of elevation was obvious.

Our results suggest that climate-growth responses of stem and leaf biomass of two main Central European conifers are decoupled at specific spatial and temporal dimensions under ongoing climate change. These findings should be considered in studies forecasting the carbon storage in stems and foliage of boreal and temperate forest ecosystems and in attempts to extrapolate tree rings to the landscape level using remote sensing data.