Summary

Global climate change is threatening the sustainability of forest ecosystems. The observed increase in atmospheric temperature has been unparalleled in the past two thousand years. The ongoing changes are expected to have a significant impact on all elements of forest ecosystems. In Poland, the Norway spruce (*Picea abies* (L.) H.Karst) is a species particularly sensitive to changing environmental conditions. The process of spruce decay in mountain areas has been the subject of numerous studies and observed for several decades, but little attention has been paid to the relationship between climate warming and the chemical properties of the topsoil and ground vegetation in spruce stands. The undertaken study analyzed changes in the chemistry of ground vegetation (using European blueberry *Vaccinium myrtillus* L. as an example), soil organic matter and mineral topsoil under warming conditions. To achieve this, a 656-day experiment simulating soil warming of 0.5°C at a depth of about 5 cm was conducted using open top chambers (OTC). The study, which was conducted in a mature spruce stand in the Silesian Beskids, showed a significant effect of warming on the chemistry of the topsoil and blueberry. Warming caused a decrease in the content of total and labile forms of carbon and nitrogen in the soil, as well as total phosphorus, proving faster mineralization of soil organic matter. A significant increase in the content of ammonium in the warming soil was observed, which was the prime reason for the significant increase in the pH of the warming soil. The increase in soil pH under warming was related to a decrease in the strength of organic acids and an increase in the proportion of aluminum in the sorption complex. The aboveground parts of blueberries subjected to warming were characterized by increased leaf carbon content and decreased magnesium, manganese, copper, sodium and iron contents. In addition, the warming caused changes in the stoichiometric relationships of carbon:nitrogen:phosphorus in the soil and plants, indicating a significant relationship between temperature and biogeochemical processes. Simulated warming was complemented by a laboratory experiment, in which it was shown that the ability of soil to sorb dissolved organic matter from spruce litter is dependent on the pH and ionic composition of the soil sorption complex. The observed increase in pH under warming may negatively affect the soil's ability to stabilize dissolved organic carbon. The results confirm the significant impact of the increase in the Earth's air temperature on the chemical properties of the studied forest floor. The observed symptoms of changing habitat conditions will negatively affect the health of spruce stands. The results obtained in this dissertation can serve as a basis for silvicultural planning in mountainous areas where Norway spruce is still the dominant species.

Keywords: soil organic matter, global warming, Norway spruce, blueberry, forest soils, climate change