Abstract

Recently, extensive research has been devoted to monitoring of carbon and nitrogen cycles in the terrestrial ecosystems. Carbon fluxes in the forest ecosystems are in the focus of research in the consequences of increasing carbon dioxide concentration in atmosphere and possible global climate changes. On the other hand nitrogen abundance affects the primary ecosystem production and together with changes in nitrogen fluxes affects also the carbon cycle in terrestrial ecosystem. It is important to understand the mechanisms of relationships among the forest ecosystem components: soil, plants, fungal and microbial decomposers. One of the first steps in this multidisciplinary research consists in searching markers or predictors of specific processes in forest ecosystem such as nitrogen mineralization or soil organic matter production and leaching.

The thesis was developed under the framework of joint NSF-MŠMT project of Dr. Albrechtová from the Department of plant physiology (Faculty of Sciences, Charles University in Prague) and Prof. McDowell from the Department of Natural Resources (University of New Hampshire, USA), therefore the sample collections were conducted in the White Mountains, NH, USA and majority of laboratory analyses were accomplished at UNH.

The aims of this thesis were to find possible relationships between forest floor chemistry of red spruce and balsam fir and soil chemistry; and test whether any of these links might be detected by reflectance-based remote sensing. The impact of needle anatomy on spectral properties and links between needle anatomy and needle chemistry was investigated as a minor aim. The effect of needle age and tree species was emphasized during all of the analyses.

There were found negative relationships between forest floor nitrate and lignin content in foliage, which corresponded with the hypothesis of lignin as an inhibitor of nitrate mobilization. Chlorophyll showed very strong negative relationship with DON and DOC in forest floor, which suggests that chlorophyll is not one of the main contributors into forest floor DOC and DON. Spectral index TCARI/OSAVI was strongly related to chlorophyll needle content and seemed to be potential predictor of forest floor DOC and DON. All the foliar-spectral relations were strong for young needles (well accessible for remote sensing imagery), which is very promising for the remote sensing application on nitrogen-carbon flux monitoring. Mechanisms and causality of relationships between forest

floor chemistry, foliar chemistry and anatomy and spectral properties of needles discovered in this study should be further investigated and hopefully applied in nitrogen-carbon cycles or forest health monitoring.