Biochemical, histochemical, structural, and macroscopic markers of damage in Norway spruce from the Krušné hory Mts. - background for interpretation of hyperspectral remote sensing data

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Introduction
The massive forest decline phenomenon in the Krušné hory Mountains, Czech Republic has been described since the early 1950s and is attributed to the combination of severe atmospheric pollution and climatic conditions. Current field evaluation methods of assigning damage classes to individual trees or forest stands are mainly based on visual assessment of macroscopic characteristics, e.g. foliar loss or altered tree architecture. Although this assessment can be precise, it is often biased being observer-dependent. Moreover, this approach does not reveal the early previsual stages of damage to conifers. Before macroscopic changes and needle loss occurs, alterations in metabolic pathways lead to changes exhibited at the anatomical level.

Material and methods
The model study area (Přebuz, Boží dar, Kovářská) along increasing gradient of documented atmospheric pollution in the Krušné hory Mts. was chosen exhibiting the whole range of forest stand damage. In August 1997 and 1998, fifty-one stands of Norway spruce were observed and characterized by common field methods. Sunlit branches from the middle third of the crown (from about 300 trees) were sampled for different analyses. Needle samples were processed in different ways for determination of photosynthetic pigment contents, needle structure, needle lignification and phenolic compound accumulation using histochemical and biochemical approaches.

Results and discussion
The presented NASA project (1997-2000) focused on the development of advanced remote sensing methods for monitoring Norway spruce forest health, specifically on separation of initial damage classes (DC0 and DC1) of forest decline [1]. The data on the above listed markers [2] served as a background for interpretation of hyperspectral remote sensing data in order to allow the detection of initial stages of damage. Based on previous research and this one (1991-1998) the above analyses indicate a trend of forest recovery particularly in the Northeastern part of the Krušné hory Mts. However, the forest ecosystems in the Krušné hory Mts. are endangered being on the edge of ecological stability for decades.

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References