Ground Spectrometry (GER2600) and Airborne Imaging Spectrometry (ASAS and DAIS) Instruments Evaluation and Data Comparison with Regard to Features Discrimination and Forest Stress Detection in Central Europe

P. Entcheva and B. Rock
CSRC, EOS, UNH, Durham, NH 03824

J. Albrechtova and J. Rajl
Charles University, Czech Republic and Nature Conservancy, Czech Republic

P. Strobl
DLR, Institute of Optoelectronics, Germany

J. Irons
GSFC, Washington DC

Applying logit regressions to Landsat TM data to classify forest damage previous studies were able to discriminate only three damage categories - healthy, intermediate and heavy. Foresters visually recognize a total of five damage classes. Field spectrometry investigations of spruce foliage during 1996 demonstrated that monitoring the red edge portion of reflectance spectra in 10nm bands allows discrimination of the full range of damage. Imaging spectroscopy could provide the potential for early damage detection not possible with broad band sensor systems.

In August, 1998 using the NASA Airborne Solid-state Array Spectrometer (ASAS) and the DLR Digital Airborne Imaging Spectrometer (DAIS) data were acquired for the same Norway spruce forest stands in the Czech Republic, representing the full gradient of damage levels within a narrow elevational range (900-1100m). Simultaneous with the airborne campaign, field spectra (GER2600) and a suite of forest attributes needed to link the remote sensing data to canopy physiological parameters, forest state and function were acquired. The ground data will serve also as training data for inference of leaf and canopy chlorophyll levels, as well as tree and forest health across the region.

The current study investigates relationships between spectral signatures acquired with airborne and field spectrometers, as well as forest stand parameters and health characteristics. Spectral sensitivity analyses of hyperspectral data were performed to determine the narrow bands optimal for stress detection when using narrow-band multispectral instruments. A number of reflectance ratios are suggested as indicators of forest stress. The imagery was evaluated with regard to forest stress discrimination capabilities. Algorithms were developed for early forest stress detection, and extrapolation of forest health from local to regional level.