

Contributions of tree stand and understory phenological development to seasonal development of forest floor respiration and its spatial variation

Boris Tupek, Aleksi Lehtonen, and Mikko Peltoniemi

Natural Resources Institute Finland, Vantaa, Finland (boris.tupek@luke.fi)

Forest floor respiration is a major component of the forest ecosystem C balance. Forest floor respiration is often estimated using non-linear regressions between soil CO₂ emissions and soil temperature and/or moisture measurements. Although it's known that plant's autotrophic respiration contributes to CO₂ emissions, the role of phenological phases of vegetation to soil respiration components has been rarely evaluated. We evaluated the impact of the understory vegetation cover and phenology of forest stand and understory vegetation to forest floor respiration at 72 plots situated within two Norway spruce forests in Finland. Understory vegetation cover and its phenology estimates was derived from time series of camera images taken weekly during vegetative season. Tree phenology was recorded hourly at stand scale with digital cameras focused to tree crowns (<http://monimet.fmi.fi>), and with dendrometer bands monitoring circumference growth of the trees. From time series of digital images, we visually analyses growth phases of vegetation and also a green color fraction that was used as a quantitative estimate of potential vegetation contribution. Preliminary results suggest that soil temperature and/or moisture are stronger predictors of the forest floor respiration than the plant phenological developments of color indices of vegetation. However, direct observations of phenological contribution based on color development of vegetation indices stood out when i) soil moisture was not at extremes, ii) the variation in greenness helped to explain spatial patterns of respiration at measurement plots, and iii) leaves helped to identify contribution of autotrophic respiration to the total forest floor respiration.