# 地上と衛星観測による周北極域の植生フェノロジーの時空間分布の変動の検出

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# Detection of spatio-temporal variability of plant phenology around the arctic region by *in site* and satellite observations

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To accurately evaluate the ecosystem function (e.g., photosynthesis, evapotranspiration) and service (e.g., carbon stock, control of climate) under rapid meteorological and climate changes around the arctic region, we require long-term continuous phenological observations with a high temporal resolution (i.e., daily) from plot to continental scales. Here, (1) we performed daily phenological observations with time-lapse digital cameras in evergreen needleleaf forest in Alaska and deciduous needleleaf forest in Siberia; (2) we detected year-to-year variations in the leaf-expansion and leaf-fall phenology of understory vegetation in Alaska by image analysis; and (3) we examined the spatio-temporal variability of the timings of start of leaf-expansion (SLE) and end of leaf-fall (ELF) around the arctic region by using daily and/or 8−10 days composite satellite-observed vegetation indices (i.e., normalized difference vegetation index; NDVI, enhanced vegetation index; EVI, green-red vegetation index; GRVI). We found that (1) seasonal patterns of the red, green, and blue digital numbers extracted from the time-lapse digital camera images could accurately detect the characteristics of spatio-temporal variability of timings of SLE and ELF in a plot scale; (2) large year-to-year variability of timing of SLE was detected in eastern Siberia and western Ural Mountains; and (3) the timing of SLE in Alaska gradually advanced (about 7.1 days decade$^{-1}$) during 1998 and 2011 (Fig. 1).

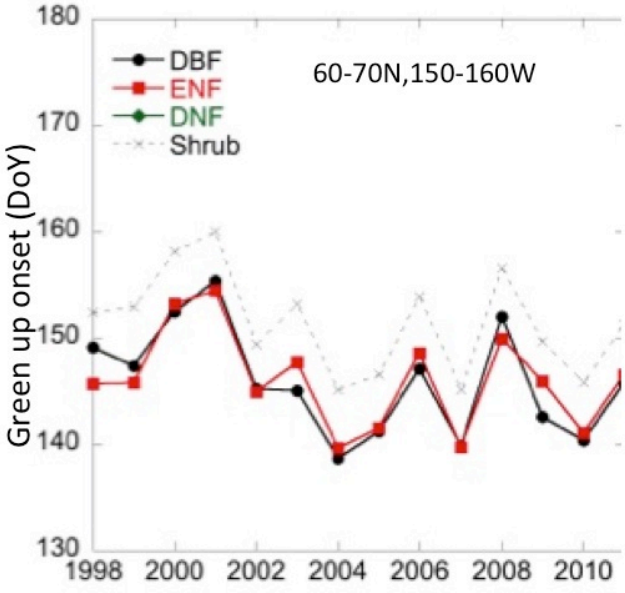


Fig. 1 Year-to-year variability of the timing of start of leaf-expansion (green up onset) in interior Alaska. DoY: day of year. DBF: deciduous broad-leaved forest. ENF: evergreen needleleaf forest. DNF: deciduous needleleaf forest.