

Advancing Phenological Understanding of Plants/Trees Through Phenocam Digital Time-lapse Images

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Abstract : Phenology, a crucial discipline in ecology, offers insights into the seasonal dynamics of organisms within natural ecosystems and the underlying environmental triggers. Leveraging the potent capabilities of digital repeat photography, PhenoCams capture invaluable data on the phenology of crops, plants, and trees. These cameras yield digital imagery in Red Green Blue (RGB) color channels, and some advanced systems even incorporate Near Infrared (NIR) bands. This study presents compelling case studies employing PhenoCam technology to unravel the phenology of black spruce trees. Through the analysis of RGB color channels, a range of essential color metrics including red chromatic coordinate (RCC), green chromatic coordinate (GCC), blue chromatic coordinate (BCC), vegetation contrast index (VCI), and excess green index (ExGI) are derived. These metrics illuminate variations in canopy color across seasons, shedding light on bud and leaf development. This, in turn, facilitates a deeper understanding of phenological events and aids in delineating the growth periods of trees and plants. The initial phase of this study addresses critical questions surrounding the fidelity of continuous canopy greenness records in representing bud developmental phases. Additionally, it discerns which color-based index most accurately tracks the seasonal variations in tree phenology within evergreen forest ecosystems. The subsequent section of this study delves into the transition dates of black spruce (*Picea mariana* (Mill.) B.S.P.) phenology. This is achieved through a fortnightly comparative analysis of the MODIS normalized difference vegetation index (NDVI) and the enhanced vegetation index (EVI). By employing PhenoCam technology and leveraging advanced color metrics, this study significantly advances our comprehension of black spruce tree phenology, offering valuable insights for ecological research and management.

Keywords : phenology, remote sensing, phenocam, color metrics, NDVI, GCC

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