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PhenoCam network update: public release of a processed dataset, and potential applications

Koen Hufkens (1) and Andrew D. Richardson (2,3)

(1) INRA, UMR ISPA, Villenave d'Ornon, France, (2) School of Informatics, Computing and Cyber Systems, Northern Arizona University, Flagstaff, AZ, USA, (3) Center for Ecosystem Science and Society, Northern Arizona University, Flagstaff, AZ, USA

Vegetation phenology controls the seasonality of many ecosystem processes, as well as numerous biosphere-atmosphere feedbacks. Phenology is also highly sensitive to climate change and variability. Here we describe a series of publicly-available (http://phenocam.us) datasets, together consisting of almost 750 years of observations, characterizing vegetation phenology in diverse ecosystems across North America. Our data are derived from conventional, visible-wavelength, automated digital camera imagery collected through the PhenoCam network (https://phenocam.sr.unh.edu). The underlying PhenoCam imagery, and the derived data products, are released under the Creative Commons CC0 Public Domain Dedication and are permanently archived at the ORNL DAAC.

From the high-frequency imagery, we derived time series characterizing vegetation colour, including "canopy greenness", processed to 1- and 3-day intervals. We provide estimates, with uncertainties, of seasonal variability in canopy greenness. The data can be used for phenological model validation and development (e.g., through the phenor R package https://github.com/khufkens/phenor), evaluation of satellite remote sensing data products, benchmarking earth system models, and studies of climate change impacts on terrestrial ecosystems.

Additionally, however, applications of PhenoCam data go beyond phenology and extend to environmental monitoring and management. For example, the high frequency of PhenoCam imagery allows precise identification of the onset and duration of disturbance events, even months or years after these events have occurred. Notable events observed in PhenoCam imagery include: extensive forest fire damage, controlled burn, forest tent caterpillar outbreak and defoliation, spring frost damage, defoliation by Hurricane Irene, and progressively worsening forest mortality in California's Sierra Nevada. With fine-resolution PhenoCam imagery, these disturbance events can be visualized – and identified –in a way that is typically not possible with satellite data, or with near-surface radiometric instruments. PhenoCam data can therefore uniquely provide context for interpretation of anomalies and outliers in time series of satellite vegetation indices.