Resumo 19

Tracking vegetation color changes using digital cameras: applications for conservation

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The application of digital cameras to monitor the environment is becoming global and changing the way of phenological data collection. Digital cameras monitoring vegetation phenology (“phenocams”) have an important role by filling the “gap of observations” between satellite monitoring and the traditional on-the-ground phenology. The technique of repeated photographs to monitor plant phenology (Fig. 1 A-G) has increased due to its low-cost investment, reduced size, easy set up installation, and the possibility of handling high-resolution near-remote data. Considering the widespread use of phenocams worldwide, our main goals are: (i) to provide a step-by-step guide for phenocam setup in the tropics, reinforce its appliance as an efficient tool for monitoring tropical phenology and foster networking, and (ii) to discuss phenocam applications for biological conservation, management, and ecological restoration. The use of imagery data over the traditional phenological observations allows simultaneous multi-sites and long-term monitoring, collecting high-frequency data (daily, hourly), and reduced human labor fieldwork for data acquisition. We show phenocams applications for conservation as to document disturbances and changes on vegetation structure, such as deforestation, fire events, flooding and the vegetation recovery. The association of a long-term imagery data with local sensors (e.g., meteorological stations and surface-atmosphere flux towers) allows a wide range of studies, especially linking phenological patterns to climatic drivers; and the impact of climate changes on plant responses. Networks of phenocams are growing globally and represent a potential tool for conservation and restoration, as it provides hourly to daily information of monitored systems spread over several sites, ecosystems, and climatic zones. Lastly, phenocams could be easily integrated as a monitoring tool at any conservation unity, aggregating invaluable information of wide use for researchers and managers, from phenology to ecosystem dynamics and changes over space and time. (FAPESP #2013/50155-0; #2014/00215-0; #2016/01413-5)

Palavras-chave: leaf phenology, repeated photograph, RGB color channels, conservation biology, e-Science.

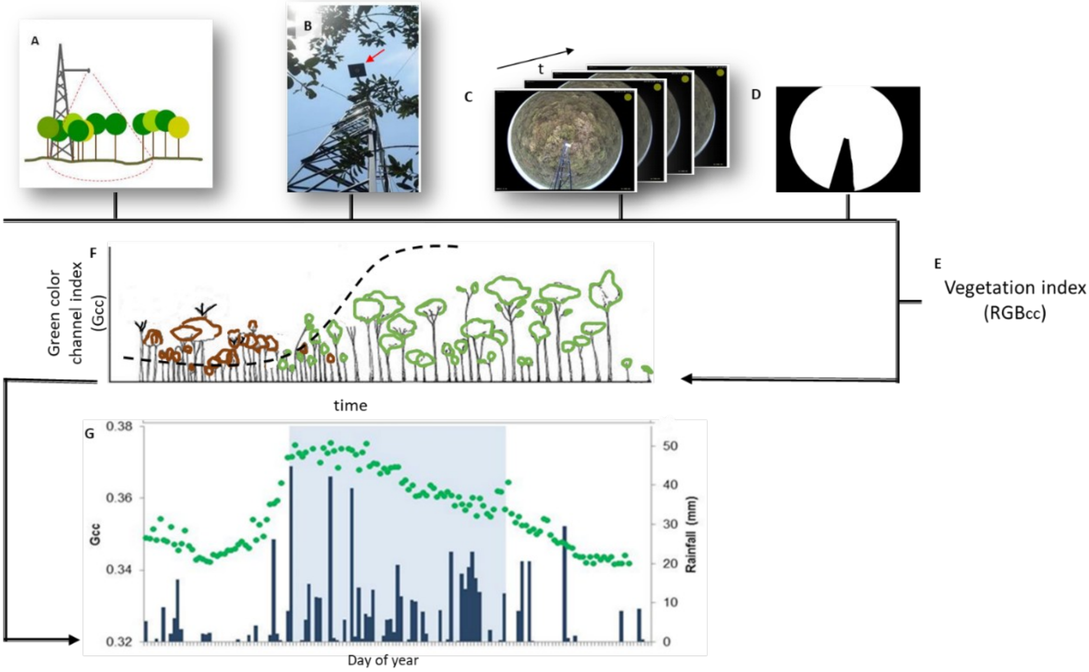

Figure 1: Digital repeated photograph technic: (A) canopy phenology monitoring scheme; (B) camera setup in the field (red arrow); (C) data input represented by daily images taken from 6 a.m. to 6 p.m.; (D) region of interest (ROI) selection represented by a portion of the image for analysis, in this case a vegetation community profile; (E) vegetation index extraction calculated from the RGB pixels values within each ROI; (F) scheme view of camera-derived color index tracking leaf phenology changes; (G) camera-derived color index (Gcc) tracking a community green-up (leaf flushing phenophase) in a cerrado *sensu stricto* vegetation (Southeastern Brazil), blue bars and blue area in the graphic represent cumulative daily precipitation and wet season length, respectively.