Assessing Phenological Patterns of Rubber Tree Plantations (*Hevea brasiliensis*) in Xishuangbanna with Landsat Satellite Imagery

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Abstract

The timing of phenological events of trees, such as leaf onset and senescence, has essential implications for hydrological and biogeochemical cycles as well as for organisms, populations and ecological communities. For rubber trees in Xishuangbanna, Yunnan, China, it is assumed that the timing of the leaf onset is related to the trees' susceptibility to powdery mildew disease, a disease caused by the fungus Oidium heveae that predominantly infests young and tender leaves after sprouting. Leaves and twigs of infested trees die-back affecting photosynthetic efficiency, and hence, reducing seed and latex production. There are indications that late wintering trees, i.e. trees which regrow leaves at a later point in time, are particularly affected by the disease. Therefore, information on the timing of the leaf onset is crucial for the scheduling of disease control including sulfur fumigation. In the context of monitoring and assessing plant phenology, ground-level surveys are very time consuming and expensive so that remote sensing techniques may be employed for indirect observations. This study describes the possibilities and limitations of using Landsat satellite imagery with a temporal resolution of 16 days and a pixel size of 30 m to model and investigate the temporal and spatial variability of phenological events across China's second largest rubber growing region – Xishuangbanna. We used Landsat time series data from 1991, 1995, 2003, 2014, 2015 and 2016 to map phenological patterns of rubber plantations and analysed relationships between the timing of phenological events and topographic variables. Analyses revealed that the timing is among other factors influenced by the geographic location and, at a finer scale, by the topographic position of the rubber plantation. Earlier leaf onset was observed on upslope positions and at higher elevations. The described relationships between leaf onset and topography provide meaningful information to predict the timing of leaf onset of future years and to support a more focused control of the powdery mildew disease in rubber plantations.

Keywords: Landsat, leaf onset, phenology, Xishuangbanna

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