PROJECT INFORMATION

Project title: **Understanding tree phenology in relation to climate**

Project ID: 128

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PROJECT DESCRIPTION

Description of the study

Plant phenology is one of the most reliable bioindicators of ongoing anthropogenic climate change (Menzel et al., 2006; Walther et al., 2010; Fu et al., 2015). Changes in plant phenology can strongly affect tree fitness, species distribution and ecosystem structure and functioning, and feedback to the climate system (Peñuelas et al., 2009; Zeng et al., 2017). Phenology studies have drastically increased over the past decades (Richardson et al., 2013), but were mainly concentrated on spring phenological events, while autumn phenology, such as leaf senescence, has been less intensively studied (Gallinat et al., 2015). Nonetheless, compared to spring phenology, leaf senescence may play a more important role in ecosystem nutrient and carbon cycles, because of its crucial role in determining nutrient recycling and in regulating the length of the photosynthetic period. Furthermore, previous studies have investigated the roles of various environmental cues, such as photoperiod, temperature and precipitation, in controlling the timing of leaf senescence, however how the nutrient affect senescence process has not been well investigated. Therefore, a better understanding of the leaf senescence process and its drivers is warranted.

In this project, we aimed to determine the direct effect of nutrient on the leaf-out and leaf senescence process using both manipulative experiments, remote sensing-

based phenology data and ground observations of natural mature trees. The scientific questions of our study are: how the environmental cues affect the leaf senescence process, and whether these responses of leaf senescence differ among species. The gridded climatic variable, such as air temperature, air humidity, photoperiod, will be involved with the analysis, and partial correlation analysis will be applied to remove the confounding effect of climatic variable.

Reference:

Fu YH, Zhao HF, Piao SL et al. (2015) Declining global warming effects on the phenology of spring leaf unfolding. Nature, 526, 104-107.

Gallinat AS, Primack RB, Wagner DL (2015) Autumn, the neglected season in climate change research. Trends in ecology & evolution, 30, 169-176.

Menzel A, Sparks TH, Estrella N et al. (2006) European phenological response to climate change matches the warming pattern. Global Change Biology, 12, 1969-1976.

Peñuelas J, Filella I (2009) Phenology feedbacks on climate change. Science, 324, 887-888.

Richardson AD, Keenan TF, Migliavacca M, Ryu Y, Sonnentag O, Toomey M (2013) Climate change, phenology, and phenological control of vegetation feedbacks to the climate system. Agricultural and Forest Meteorology, 169, 156-173.

Walther G-R, Post E, Convey P et al. (2002) Ecological responses to recent climate change. Nature, 416, 389-395.