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Editorial: Vegetation phenology and response to climate change

Xiangjin Shen

Yeqiao Wang
University of Rhode Island, yqwang@uri.edu

Binhui Liu

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*CORRESPONDENCE
Xiangjin Shen,
shenxiangjin@iga.ac.cn

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Editorial: Vegetation phenology and response to climate change

Xiangjin Shen[1]*, Yeqiao Wang[2] and Binhui Liu[3]

[1]Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun, China, [2]University of Rhode Island, Kingston, RI, United States, [3]Northeast Forestry University, Harbin, China

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Editorial on the Research Topic
Vegetation phenology and response to climate change

Climate change has a measurable influence on the growing season of terrestrial vegetation at mid- and high latitudes (Myneni et al., 1997). Vegetation phenology is the seasonal biological life stage driven by environmental factors. It is considered as a sensitive and accurate indicator of climate change (Menzel and Fabian 1999; Piao et al., 2006). Vegetation phenology not only indicates climate change, but also imposes impacts on ecosystem functions and services, ecological and evolutionary interactions, regional and global cycling of carbon and water, nutrients, and energy budget and with societal consequences (e.g., Schwartz, 1998; Peñuelas and Filella, 2001; Barichivich et al., 2013; Richardson et al., 2018; Zhou et al.). Vegetation phenology in spring has substantially advanced under climate warming, consequently shifting the seasonality of ecosystem process and altering biosphere–atmosphere feedbacks (Meng et al., 2020).

At present, vegetation phenology is mainly monitored through ground-based observations and remote sensing measurements. The traditional ground-based observation usually records the specific phenological events of individuals in the community. The remote sensing method is usually carried out in a large range of spatial coverage to study the pattern of vegetation phenology. The phenological period of vegetation is sensitive to climatic conditions (Piao et al., 2011; Richardson et al., 2013; Shen et al., 2018). Study the changes of vegetation phenology and their responses is of great significance in understanding the relationships between vegetation and climate change (Shen et al., 2022).

The main purpose of this Research Topic is to reflect some recent progress in knowledge and understanding of vegetation phenology and its response to climate change. Published articles include those about phenological changes in some species and their responses to climate change. For example, Xiao et al. studied the *Trends and climate response in the phenology of crops in Northeast China*. The study found that the increases in mean temperature during past 3 decades have significantly shortened the growth period of the vegetative in general, and the main crops of maize, rice and soybean in Northeast China during 1981–2010, but had slight and inconsistent effects on reproductive growth period. Škvareninová and Mrekaj investigated the impact of

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climate change on Norway spruce flowering in the southern part of the Western Carpathians. The study suggested that the temperature impact on flowering showed an effect of the cold period preceding the onset of the phenological phase on its delayed onset.

Recent studies suggested that photoperiod regulates spring phenology by delaying early leaf-out and advancing late leaf-out caused by temperature variations (e.g., Meng et al., 2021). In this special issue, Chen et al. studied the *Photoperiod and temperature as dominant environmental drivers triggering plant phenological development of American ginseng along with its quality formation*. The study reported that American ginseng from higher latitude locations presented delayed spring phenology and advanced autumn phenology than those from lower latitude locations. Laigle et al. reported that *in-situ temperature stations elucidate species' phenological responses to climate in the Alps, but meteorological and snow reanalysis facilitates broad scale and long-term studies*. The article revealed the phenological responses of mountain tree species to climate variability, and indicated that the choice of dataset for phenological monitoring ultimately depends on target bioclimatic variables and species, and also on the spatial and temporal scale of the study. Kőrenová et al. questioned about *Temperate alpine plants with distinct phenology more vulnerable to extraordinary climate events than their continuously flowering relatives in tropical mountains*. The study concluded that tropical alpine species were least synchronized and flowering peaks of different individuals in their populations were distributed across many months. Higher synchronicity in flowering of temperate and subtropical alpine plants resulted even in some of those species used only a part of the short growing season to reproduce.

The other articles in this Research Topic discussed the responses of vegetation phenology to climate change and compare the effectiveness of different data products at detecting the phenological characteristics at a regional scale. Ju et al. studied *Plant phenology and its anthropogenic and natural influencing factors in densely populated areas during the economic transition period of China*. It reported that warming temperature increases the length of the vegetation growing season in most regions of China, while increased precipitation has the opposite effect. In exploration of new type of sensing technologies in vegetation monitoring, Wang et al. reported a study in *Comparison of phenology estimated from monthly vegetation indices and solar-induced chlorophyll fluorescence (SIF) in China*. The study suggested that SIF is suitable for estimating the phenological characteristics of vegetation regardless of different latitudes, elevation grades, and land cover types.

The research in vegetation phenology and response to climate change is important and continuously evolving. We hope that the contents of this special issue can contribute in a broad scope of explorations for improved understanding of vegetation phenology and the responses to climate change.

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Conflict of interest

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