

The Recent Increase in Spring Vegetation in Korea, Increased Risk of Drought, and Potential Impact on Air Quality

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During recent decades, East Asia—South Korea in particular—has experienced a global-scale intensification of spring vegetation greening. This vigorous growth, fueled by rising spring temperatures, promotes substantial photosynthesis and evapotranspiration (ET). Critically, enhanced ET accelerates soil moisture depletion, leading to severe moisture deficits and heightened drought risks during the late spring to early summer transition. Such water-stressed conditions further alter plant metabolic pathways. While plants close stomata to minimize water loss under moisture limitations, they simultaneously increase the emission of Biogenic Volatile Organic Compounds (BVOCs) as a stress response, potentially fueling ozone production. This is supported by long-term air quality data in Korea, which shows rising HCHO levels and peak ozone concentrations during the pre-monsoon period, despite steady declines in anthropogenic SO_x and NO_x. This study utilizes observational analysis and coupled land-vegetation model experiments to elucidate the mechanisms by which spring greening exacerbates soil moisture depletion and subsequently influences ozone elevation in early summer.

Keywords: Drought, Ozone, Vegetation, Earth system, Land-surface process