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## Vegetation Simulation from the Colonization of Land Plants to the Present

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Climate affects vegetation growth and distribution, and vegetation affects climate by modifying the exchange of carbon, water, momentum, and energy between atmosphere and land throughout evolution history. Therefore, reproducing the vegetation distribution is of great significance for understanding climate evolution, vegetation evolution, and their interaction. However, a systematic map of global vegetation distribution since the colonization of land plants (about 480 million years ago; Ma) has remained to be determined. Here, Community Earth System Model (CESM) version 1.2.2 and BIOME4 vegetation model are applied to simulate vegetation during the past 480 million years based on modern vegetation parameters. First, the simulations reveal multiple maps of global vegetation from 480 Ma to pre-industrial (PI) period with a 10-million-year interval. 28 biomes show different distribution characteristics with the evolution of climate, and parts of characteristics are supported by palaeobotanical evidence. Second, the potential biomass as a measure of plant growth is analyzed to explore causes of vegetation variations here. The results illustrate plant growth and expansion is significantly affected by terrestrial temperature and CO<sub>2</sub> concentration, followed by terrestrial precipitation. Besides, more land area in the middle and low latitudes can be more conducive to plant flourish in geological history. The simulations provide a reference for paleo-vegetation data and some insights into the interaction between climate and vegetation evolution.