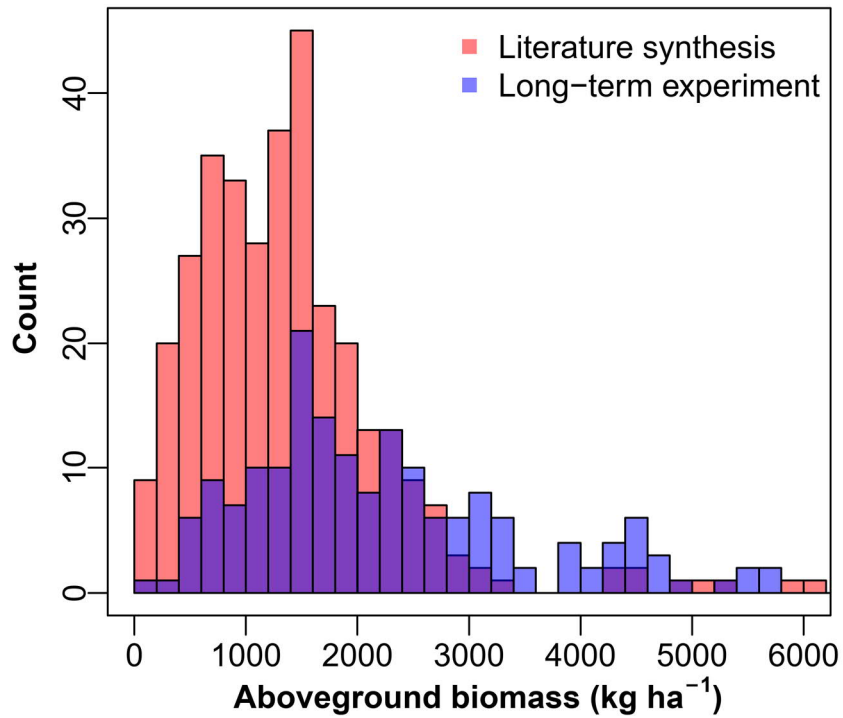Atmospheric
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Simulating the spatiotemporal variations in aboveground biomass in Inner Mongolian grasslands under environmental changes
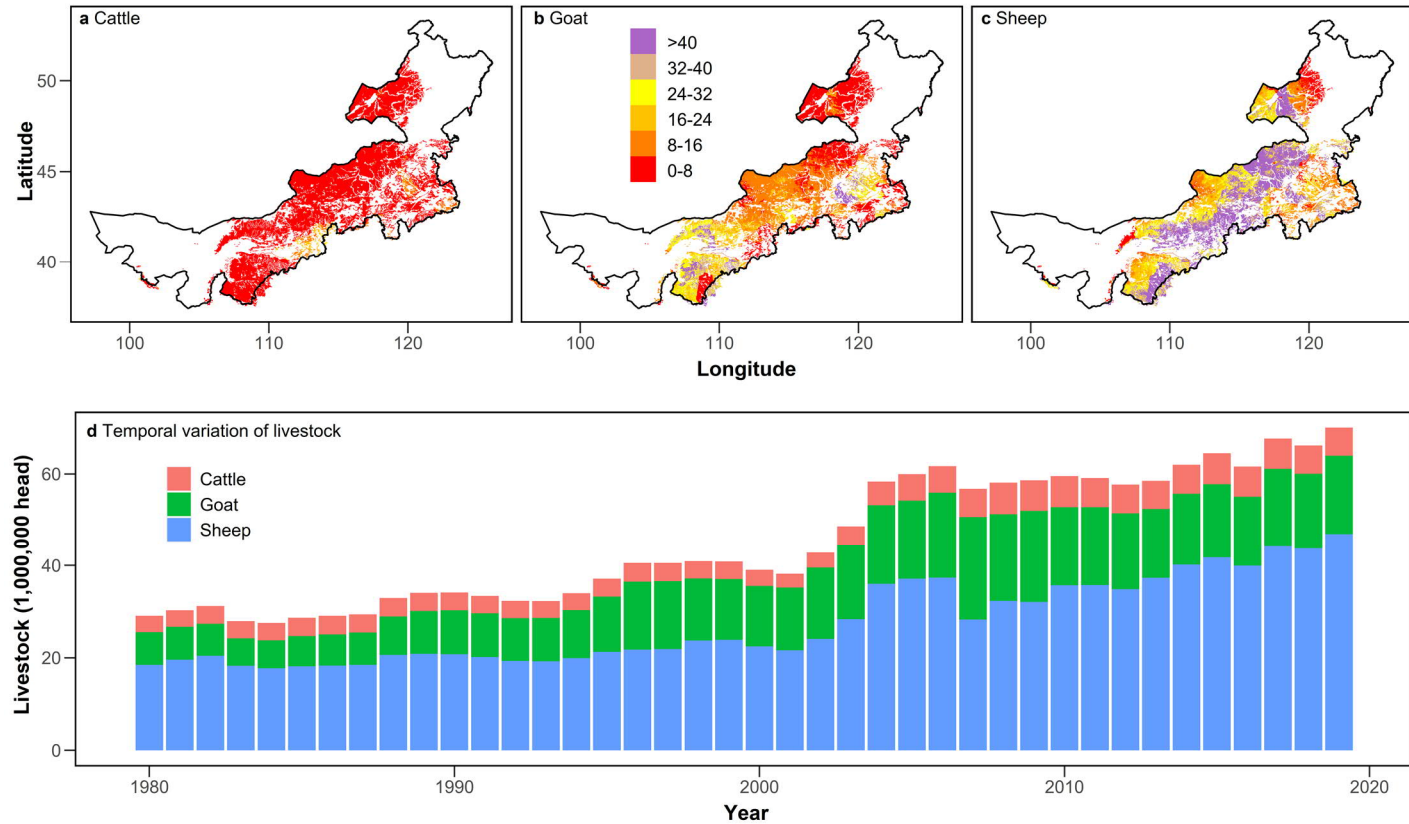
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Figure S1. Histogram of aboveground biomass in Inner Mongolian grasslands obtained from literature synthesis and the six long-term field experiments. See Section 2.1 for detailed descriptions of these two datasets.

**Figure S2. Spatiotemporal changes in livestock in Inner Mongolian grasslands over the past four decades.** The spatial patterns of cattle, goat and sheep (head km^{-2}) were derived from Gilbert et al. (2018), who reported the global spatial patterns of livestock during 2010. The annual livestock data in Inner Mongolia is obtained from National Bureau of Statistics of China (https://data.stats.gov.cn/).
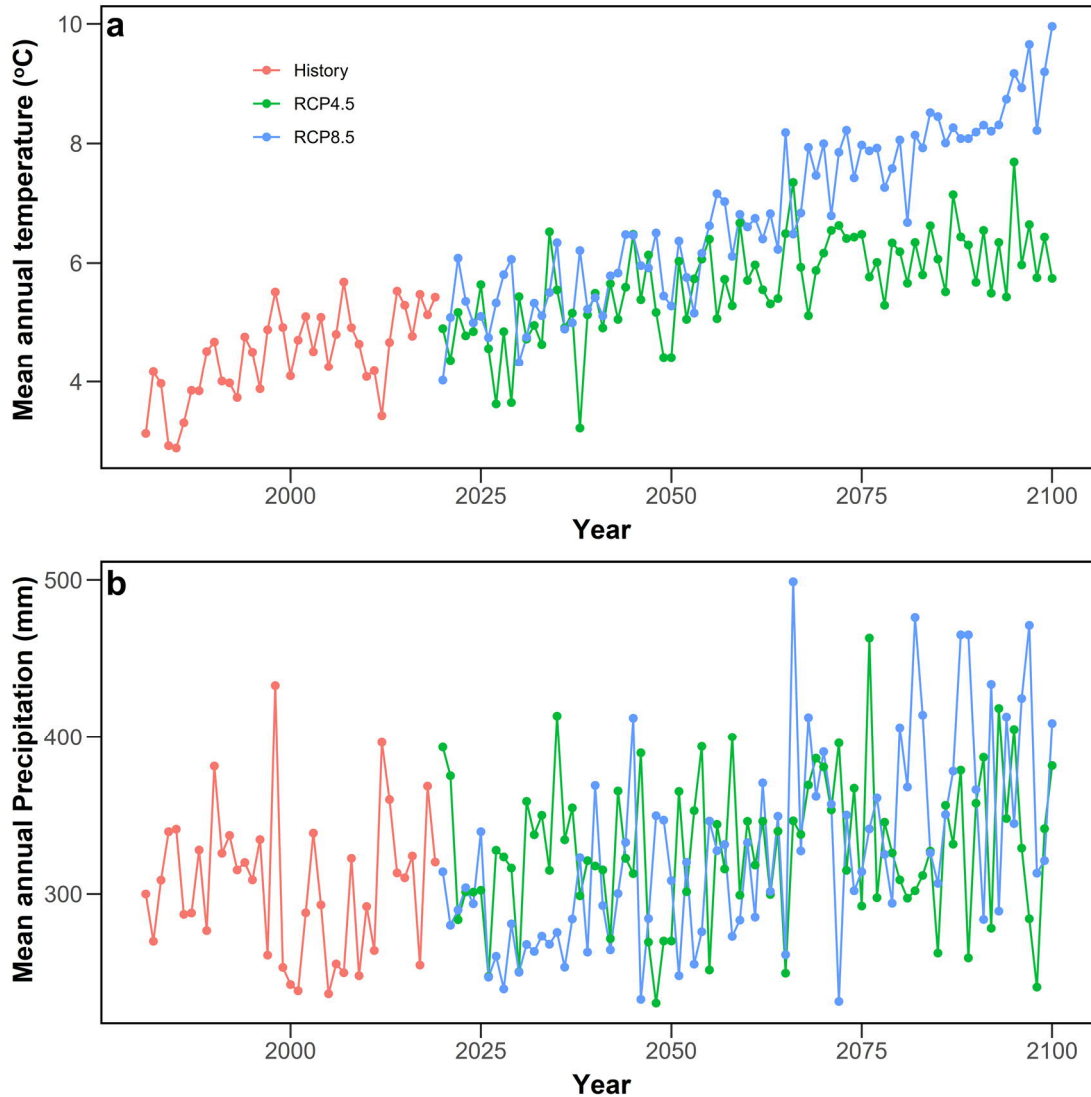
Figure S3. Mean annual temperature (a) and precipitation (b) in Inner Mongolian grasslands. The historical (1981-2019) temperature was determined from the daily climatic records obtained from the ground observations (Fig. 1). Future (2020-2100) mean annual temperature were calculated from the projections by CESM1-BGC model using two representative concentration pathways (RCP4.5 and RCP8.5). The future climate data were derived from Karger et al. (2020).
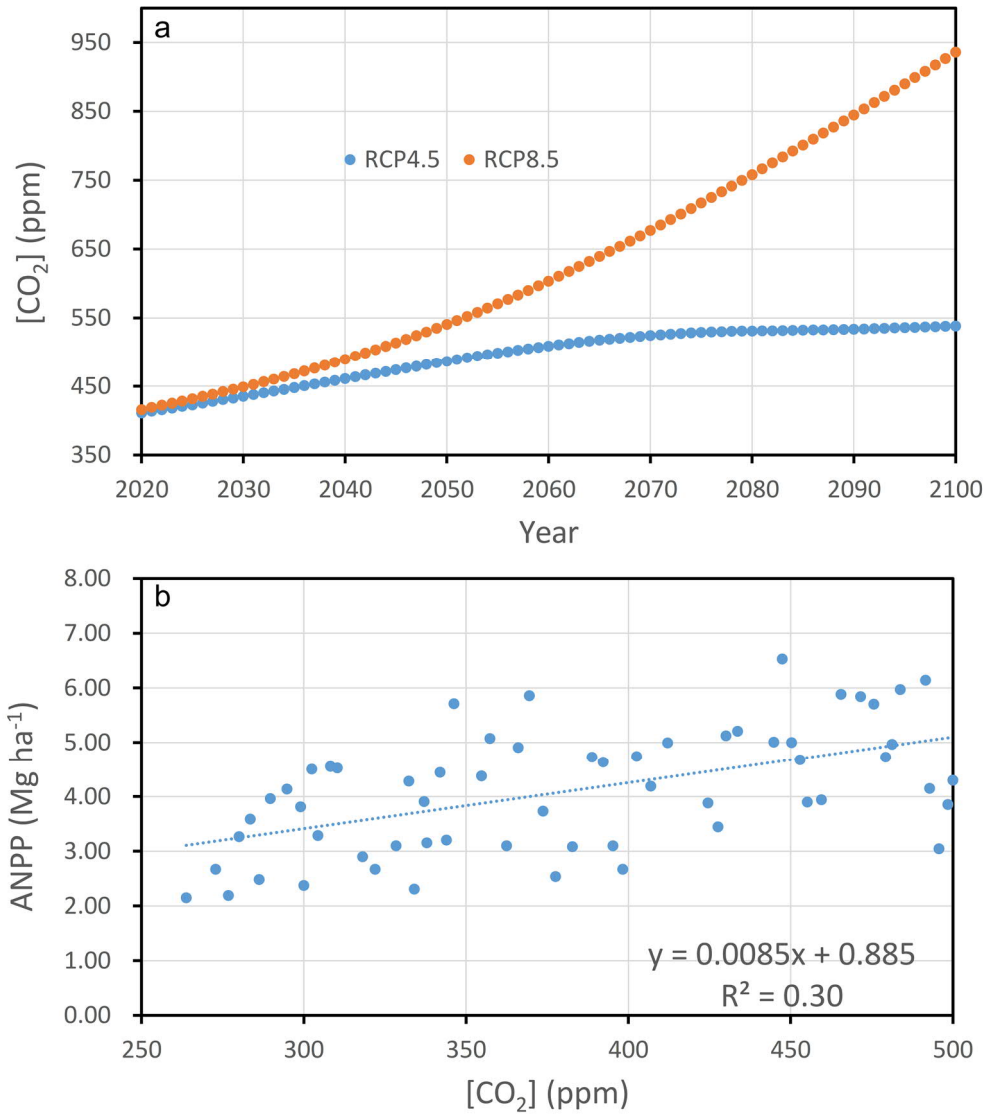
Figure S4. Future CO₂ concentrations under RCP4.5 and RCP8.5 (a) and the effects of CO₂ on aboveground net primary productivity (ANPP) in grasslands (b). Data in **a** is derived from Wise et al. (2009) and Riahi et al. (2007), which is obtainable at: http://tntcat.iiasa.ac.at/RcpDb/dsd?Action=htmlpage&page=welcome. Data in **b** is derived from Polley et al. (2019).
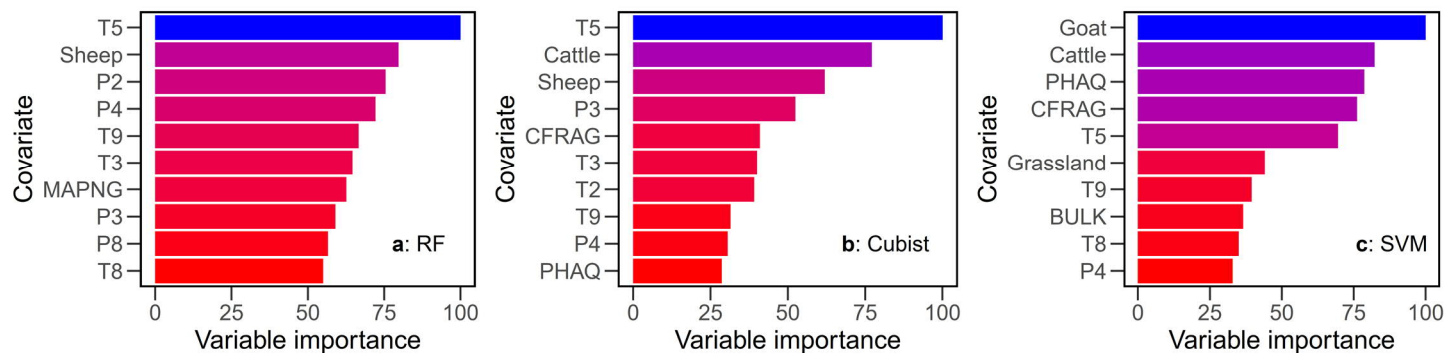
Figure S5. Variable importance indicated by the three individual machine learning-based models. a, random forest; b, Cubist; c, supporting vector machine.
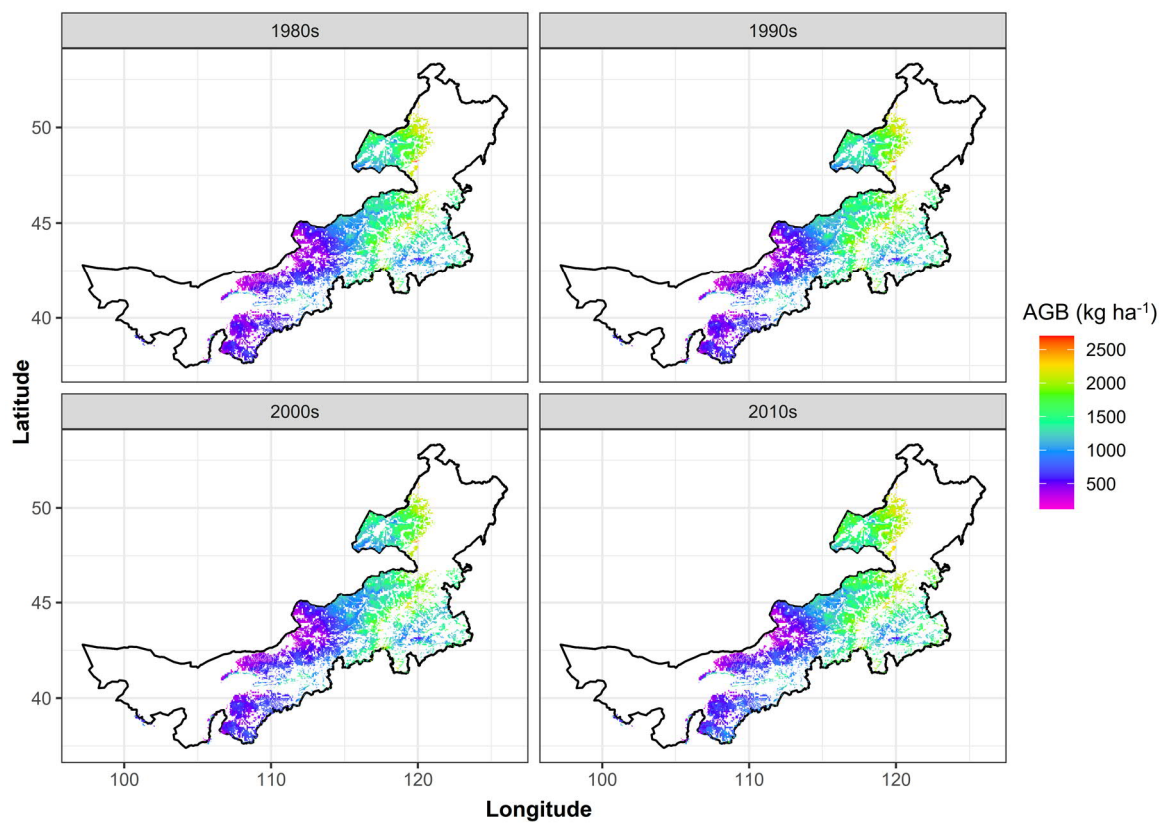
Figure S6. Spatial patterns of Inner Mongolian grassland aboveground biomass (AGB) estimated by the remote sensing derivations. The remote sensing based data are reproduced from the results published by Jiao et al. (2019).

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