

# Predicting the Potential Suitable Distribution of *Alsophila spinulosa* under Climate Change Scenario

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November 21, 2023

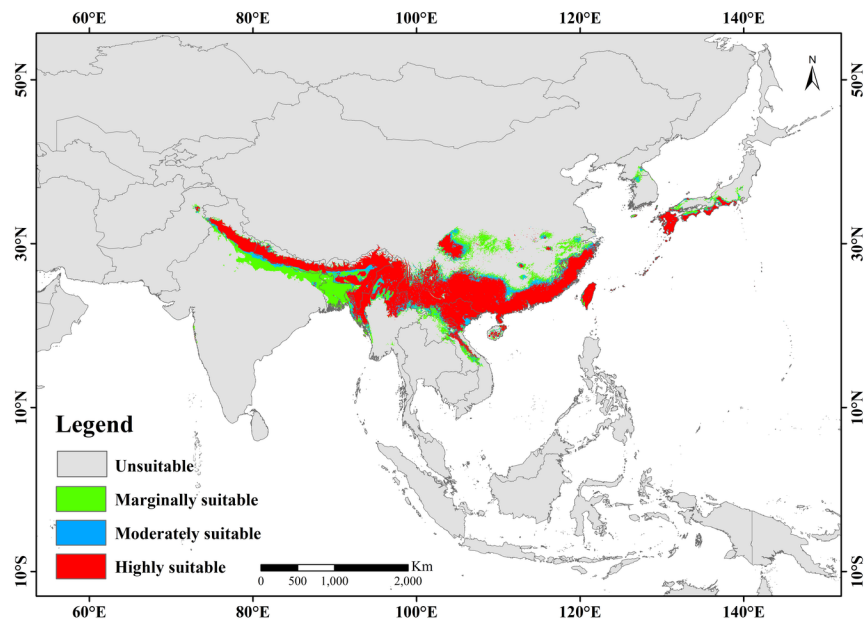
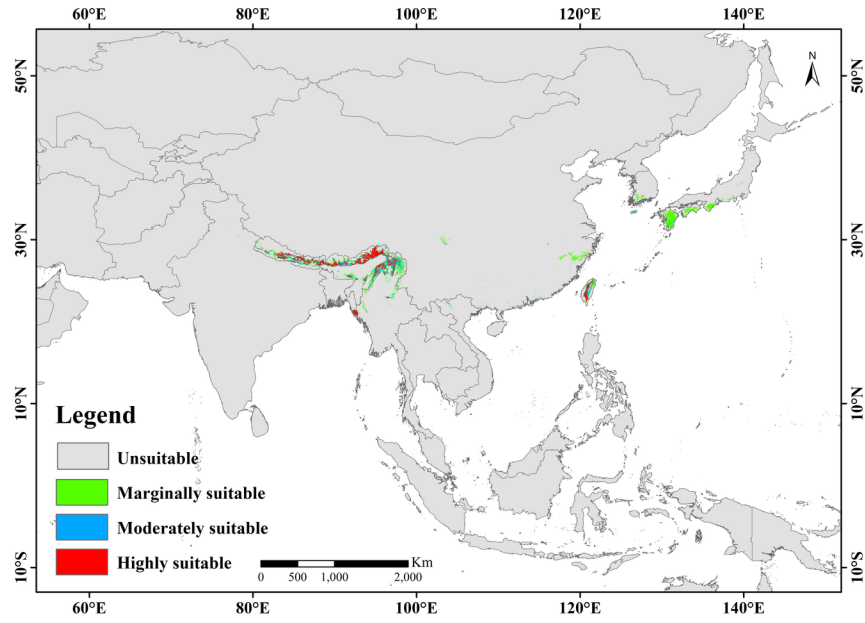
## Abstract

*Alsophila spinulosa* (Hook) Tryon, a relict plant of glaciers in the early tertiary, is one of the world's oldest living fossils and a significant plant for studying ancient climates and species evolution in geographical distribution. We utilized 476 geographical data points of *A. spinulosa* and analyzed 15 climate, soil, and terrain factors using Biomod2 software to construct an ensemble model. The model was employed to simulate the potential distribution of *A. spinulosa* during the past (Last Glacial Maximum, mid-Holocene), current, and future periods (2041–2060, 2061–2080), while identifying the primary environmental variables influencing its distribution. The results demonstrated that the ensemble model, derived from four optimal individual models, yielded superior predictions of suitable habitats for *A. spinulosa* compared to the single models. The combination model achieved impressive true skill statistic (TSS) and receiver operating characteristic curve (AUC) values of 0.979 and 0.999, respectively, confirming the high accuracy of the simulated outcomes. Presently, the primary distribution of *A. spinulosa* concentrates within the region of 15° to 40° N in Asia, with a prominent presence in East Asia, northern South Asia, and Southeast Asia, covering a total area of approximately 1.7858 million km<sup>2</sup>. The major environmental factors influencing its distribution include isothermality, minimum temperature of the coldest month, and precipitation during the warmest quarter. During the Last Glacial Maximum, *A. spinulosa* was predominantly found in the eastern Himalayan region, and its potential geographical range during the mid-Holocene resembled the current distribution. Under future climate conditions, the suitable habitat of *A. spinulosa* is projected to expand northwestward, and its centroid is expected to shift northward as temperatures rise. This migration speed is positively correlated with the degree of warming. The findings provide valuable insights for the conservation, cultivation, and selection of protected areas for *A. spinulosa* in response to climate change.

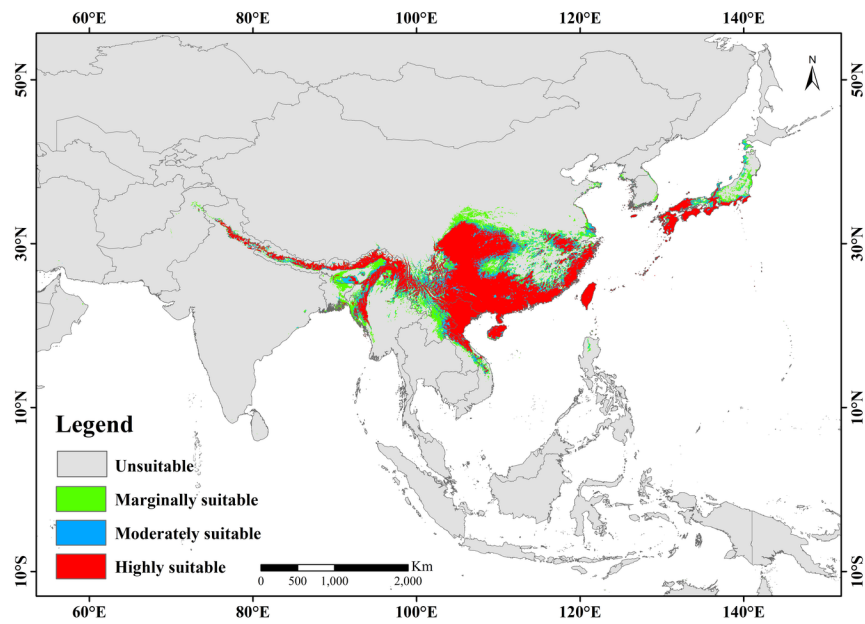
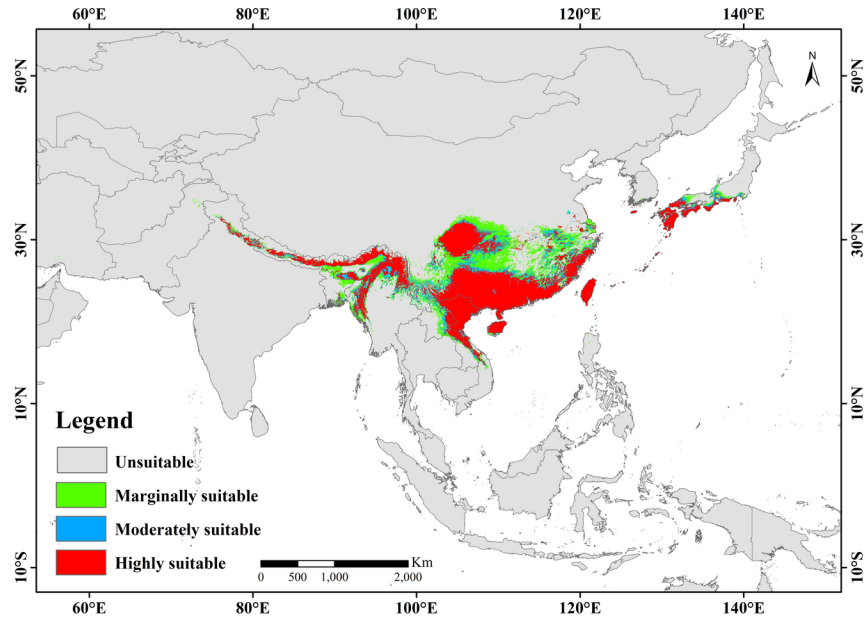
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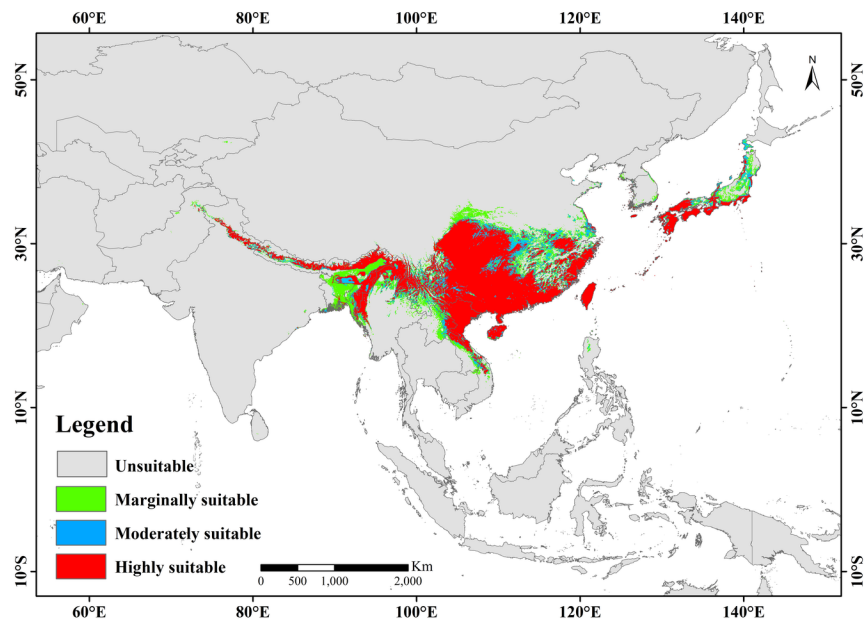
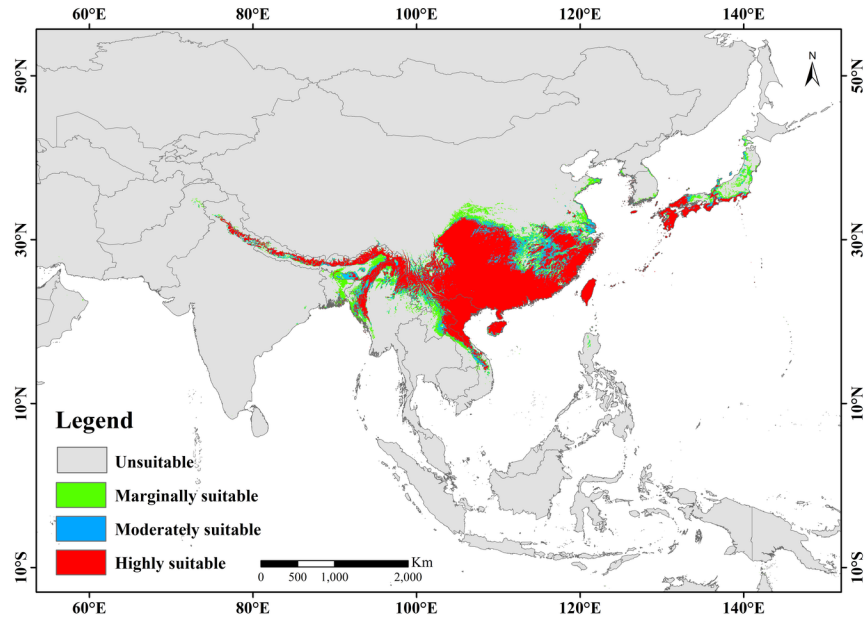




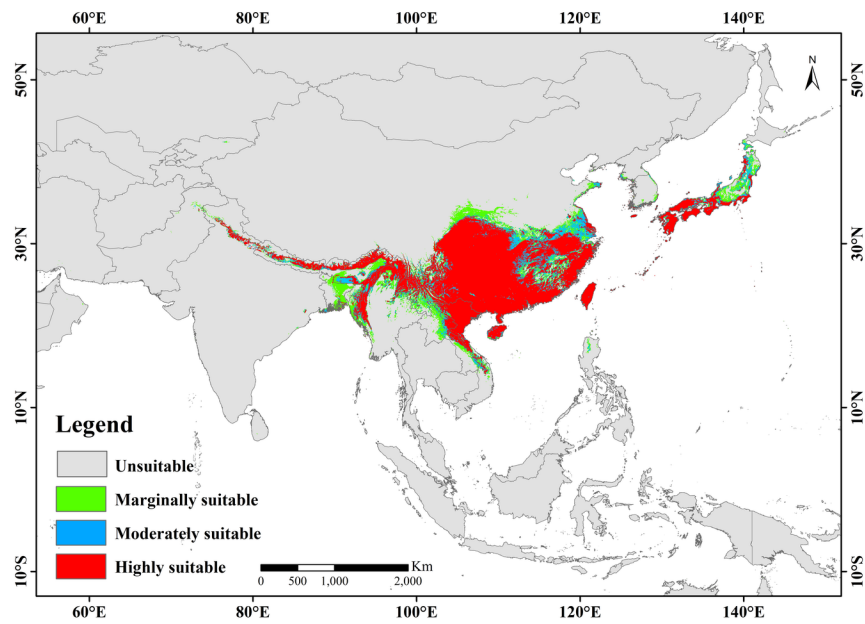
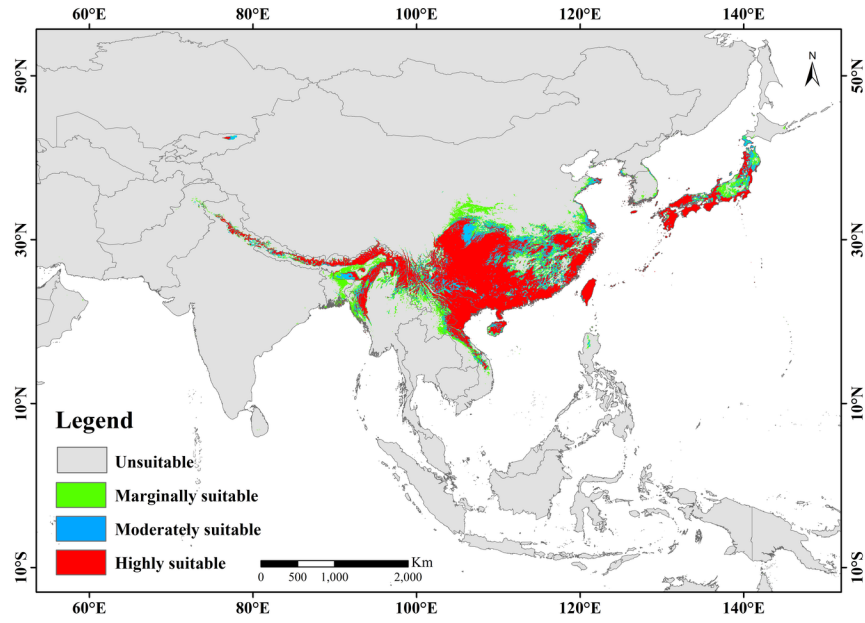




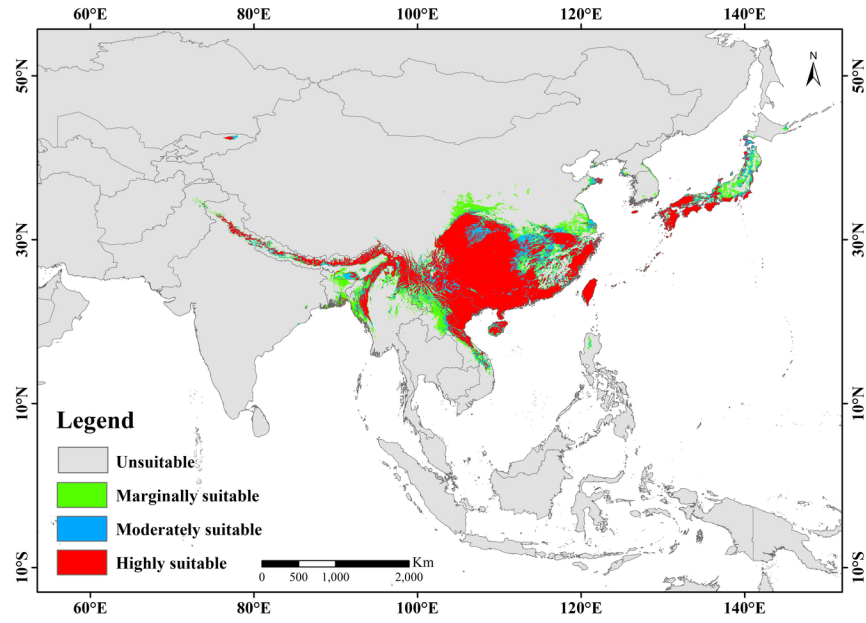




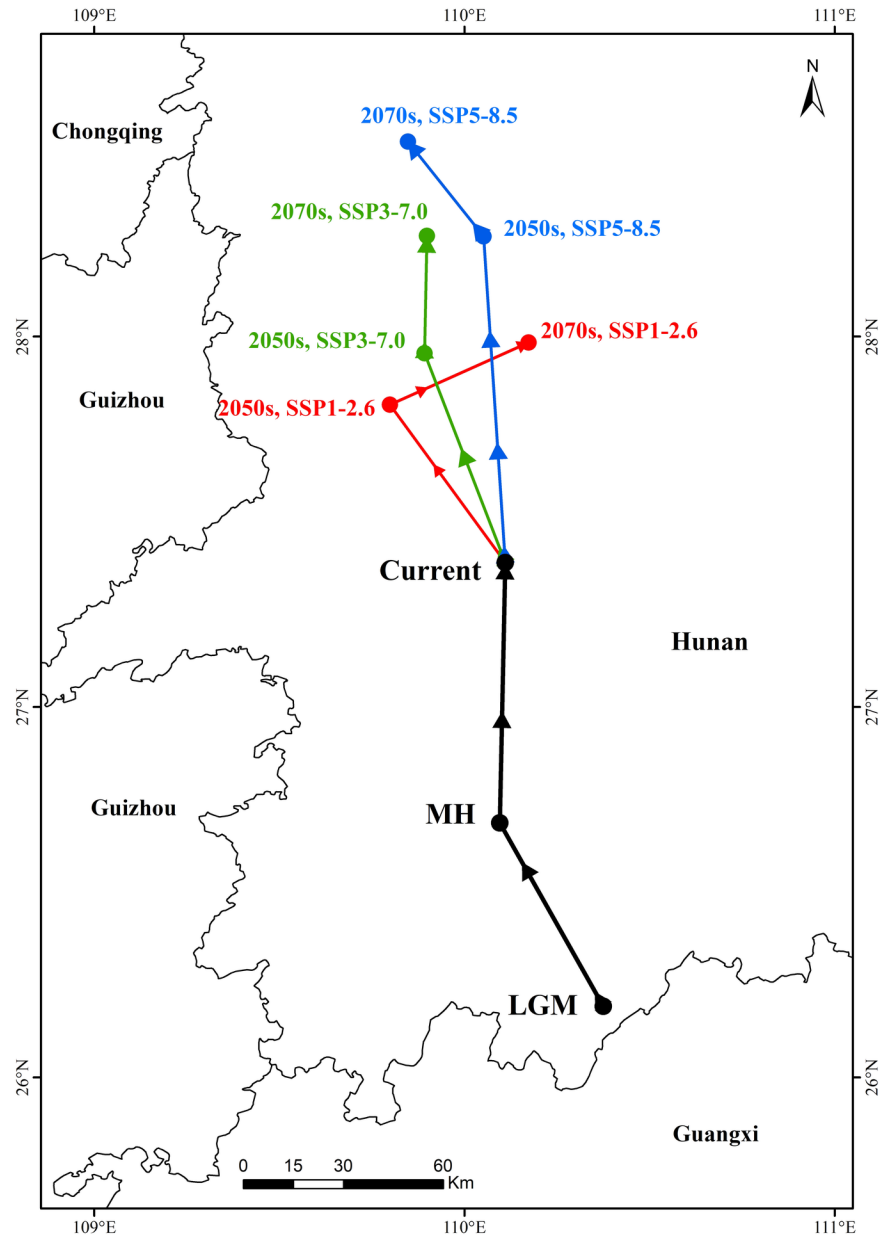




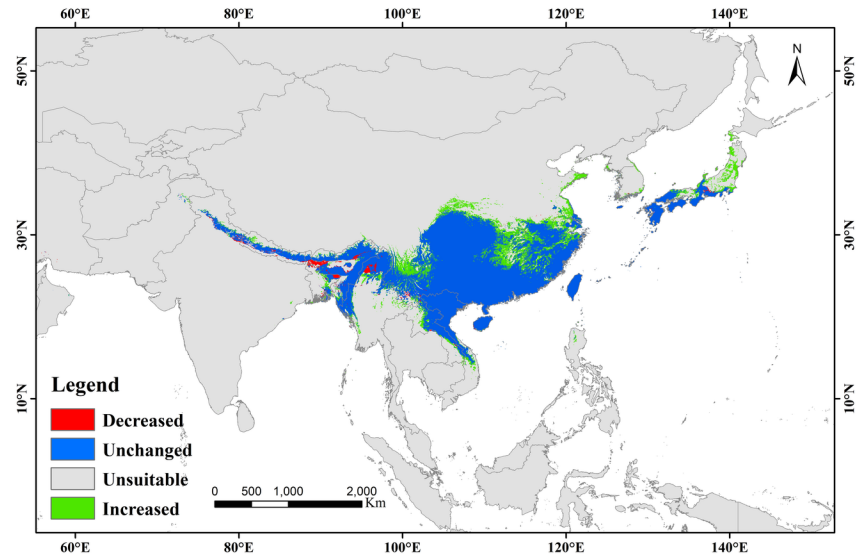
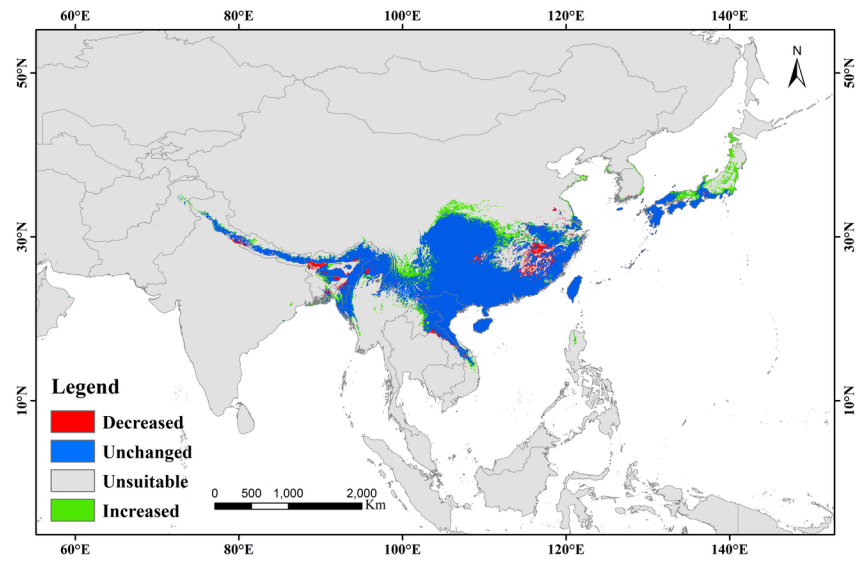




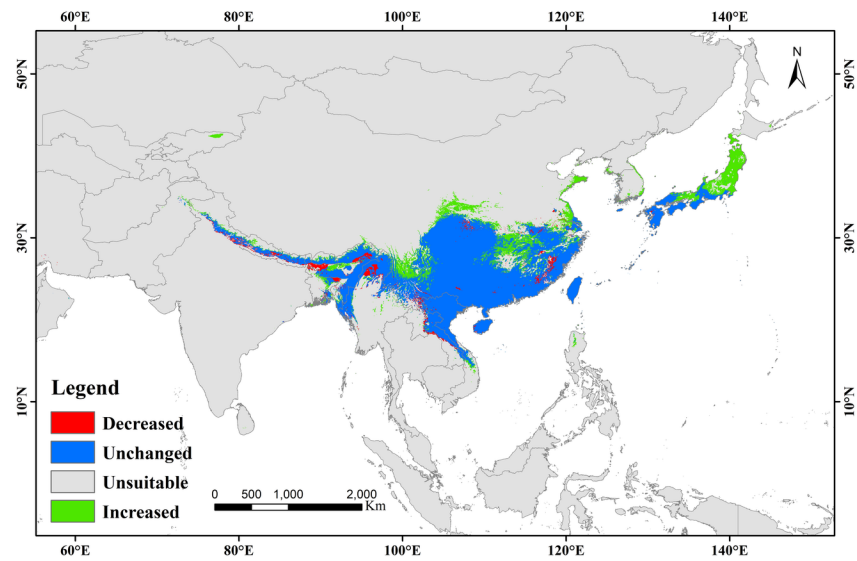
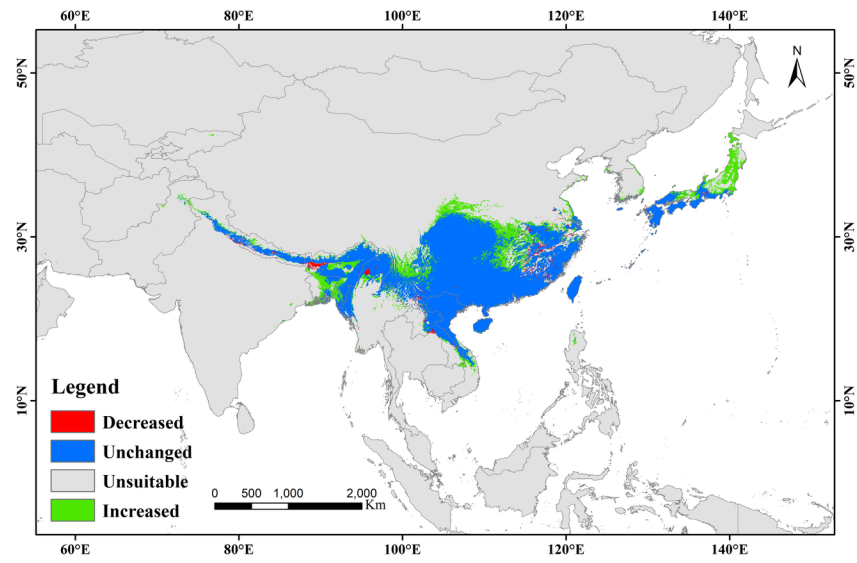




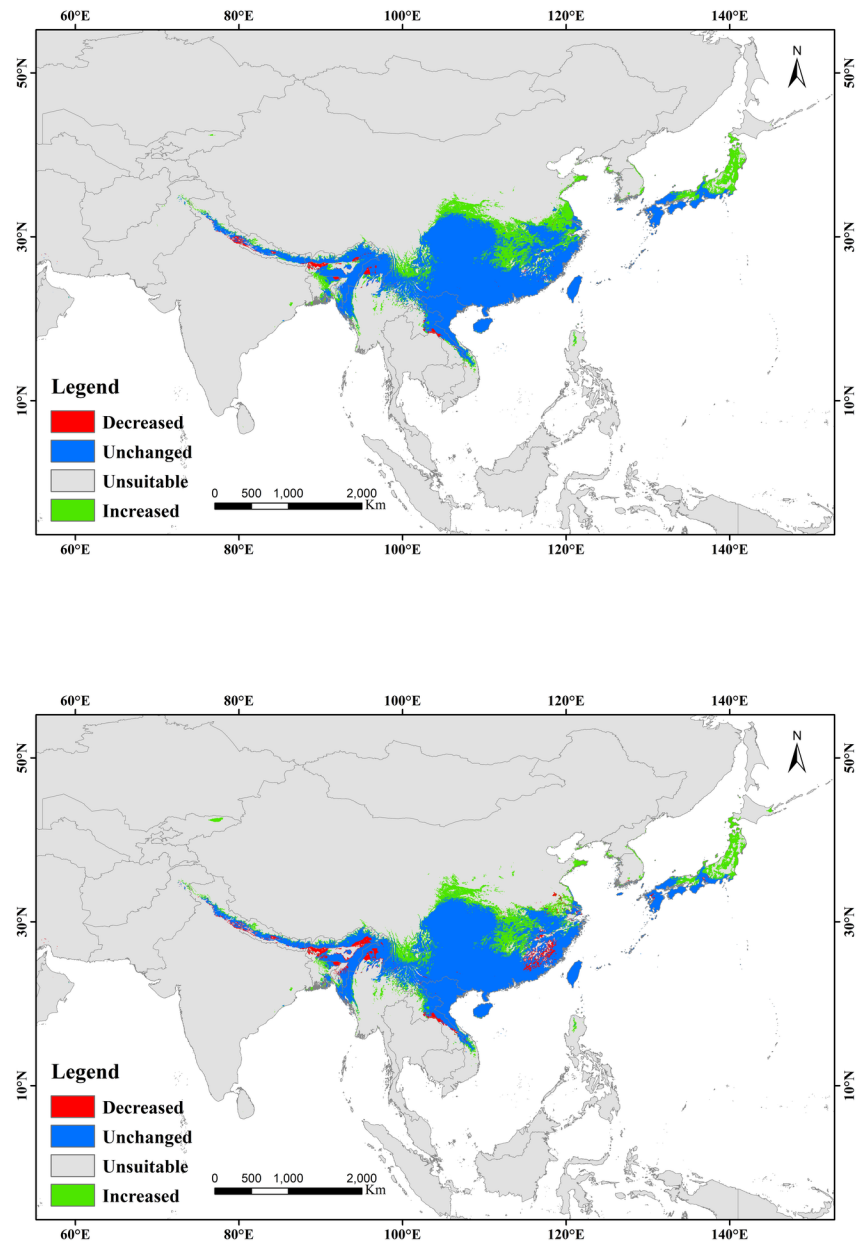












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