Bamboo in the Face of Climate Change: Insights from Giant panda-feeding Bamboo Communities in Southwest China and Recommendations for Future Protection

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Introduction

The response pattern of natural bamboo communities to climate change holds significant implications for the functions of forest ecosystems, particularly in the habitat of giant pandas in southwest China. Numerous bamboo species in this region exert dominance in subalpine plant communities. Understanding how these bamboos response to climate change is vital for the giant panda's primary food source as well as the subalpine forest ecosystem. Here, We employing the MaxEnt model to predict the response of 20 bamboo species to climate change under different Global Climate Models (GCMs) and Shared Socioeconomic Pathways (SSPs). The innovation lies in considering diffusion ability of bamboos. We are prepared to investigate whether the dispersal capacity of bamboo can meet its tracking of suitable habitats under climate change. These findings will serve as a reference for the conservation of future giant panda habitats and the maintenance of forest ecosystem stability.

Results & Conclusion

On average, the overall suitable habitat area for bamboo communities is projected to increase by 20.75% (SD=0.12). In contrast, the average potential distribution area is expected to decrease by 35.71% (SD=0.11) in the future. Consequently, the maximum species diversity is predicted to decline from the current 11 species to a range of 6 to 10 species. It's important to note that limited dispersal capacity will constrain bamboos' ability to adjust to suitable climatic conditions. We recommend a heightened focus on the protection of bamboo species within panda habitats. Additionally, if necessary, we propose the implementation of artificial interventions to facilitate the dispersal of bamboo communities to suitable habitats. Preserving bamboo communities in southwest China is vital for giant pandas, subalpine forests, and the well-being of mountain and downstream residents in the face of climate change.

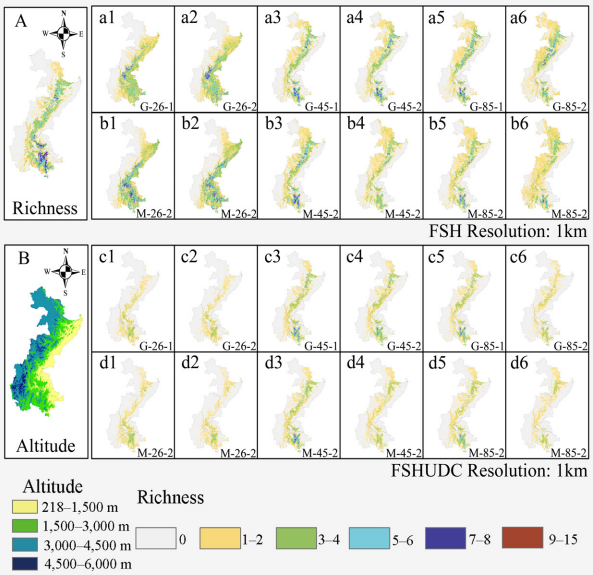

Figure 1 The species richness and community habitat responses within mountainous regions inhabited by giant pandas in response to climate change. Panel A depict the distribution of species richness for these 20 bamboo species between 1970 and 2000 at 1km-resolutions, respectively. Panel B shows the elevation segmentation maps of the giant panda habitats. Within this figure, "G" represents GISS-E2-1-G, "M" represents MRI-ESM2-0, and "25," "45," and "85" correspond to the Representative Concentration Pathways (RCPs). "1" denotes the mid-century (2050), and "2" signifies the end of the century (2100). We used "FSH" to denote future suitable habitat and "FSHUDC" to represent future suitable habitat under diffusion constraints. Subfigures a1–a6 and b1–b6 show the future distribution of suitable habitats for the 20 bamboo species at a 1 km resolution.

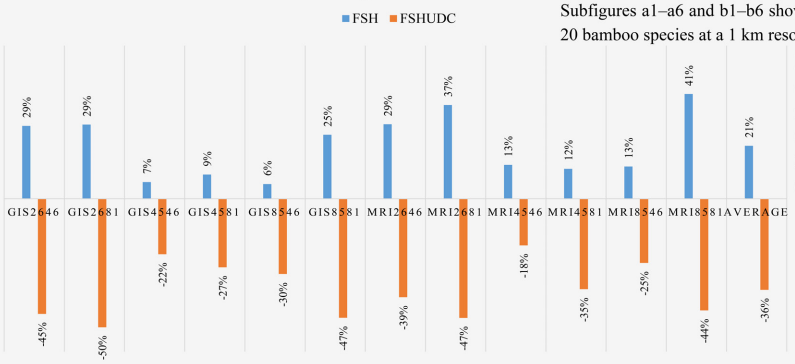

Figure 2 Illustrates the proportional changes in the area of Giant panda-feeding bamboos communities under different GCM models. '46' refers to the years 2041-2060, while '81' pertains to 2081-2100. The meaning of MRI and GIS is the same as in Figure 1.