Submitted Abstract

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Abstract

Plant community stability is essential to the predictability and reliability of ecosystem functioning. Understanding the drivers of stability of diversity (hereafter referred to species richness) and productivity (biomass production) in face increasing climate fluctuation has emerged as a pressing issue, especially with the increasing frequency and severity of climatic extremes. However, the effects of climatic extremes on plant communities and the stability mechanisms under climate fluctuation remain poorly understood. Here, we investigate community composition, and species gains and losses in considering dominance, as well as temporal stability of species richness and biomass production of six representative grassland communities (ranging from lowland mesic, montane, subalpine to alpine) along an elevational gradient within the European Alps exposed to the impacts of 2018 summer drought event on Central European. We found that only three out of six grasslands experienced extreme drought and heat during the growing season. Climatic extreme significantly decreased the species richness through higher species losses and lower gains, but did not decrease biomass production compared with the pre-extreme year. For the sites without climatic extreme, there were no significant difference in species richness between 2018 and 2017, but significant differences of biomass production in montane and alpine grasslands were found. The transition between different dominance groups was achieved through the common species, and the direct transition between rare and dominant species was extremely low. Species gains and losses were mainly to and from rare species, however during the community recovery, newly gained species were mainly to common species. The temporal variability of species gains and losses did not influence the stability of different dominance groups, and the stabilities of different dominance groups did not directly influence the stability of biomass production. The stability of biomass production was directly determined by stability of species richness. Furthermore, species richness stability was positively determined by the stability of common species, and negatively determined by the variability of species losses. Our results demonstrated that rarity forecast disproportionate species losses and gains, and the presence of non-dominant species increases plant community stability against increasing climate fluctuations.