Soil chemistry has a greater impact than climate on fungal community attributes and their interaction

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Climatic change is critically important for soil fungal communities, since it can both directly and indirectly affect community composition and richness. However, how climatic factors affect fungal interactions with each other remains undetermined. Here, using a mountain elevation gradient as a proxy of climate change, we investigated the relationship between climatic/soil variables and soil fungal community attributes and interactions in NZ's tussock mountain grassland. We collected 405 soil samples across a continuous ridge on Mt. Cardrona, New Zealand (every 100 m across an elevation gradient of almost 1,500 m). We generated approximately 2 million rarefied fungal gene sequences using a next-generation sequencing platform to identity 12,105 distinct fungal taxa. Climatic factors (i.e., temperature and soil moisture), soil physicochemistry (i.e., pH, total C, total N, available nitrate, available ammonium and organic phosphorous) and plant community data (i.e., above-ground plant biomass) were also measured at every location. We found significant variation in fungal community composition along the whole elevation gradient, but not richness. Our statistical measures of network attributes show the interaction of fungal communities and the complexity of the network structure decreased with elevation. For example, the size of the network and the number of community network linkages increased at lower elevation. Interestingly, differences in fungal community composition and interactions were mainly affected by soil chemistry, namely, ammonium, nitrate and phosphorous, than by climatic or plant community factors. These findings indicate that even average soil temperature increases of up to 7°C as observed across the elevation gradient might have a smaller impact on vital soil fungal community interactions than the effect of land management.