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Ammonia-oxidizing archaea are more resistant than denitrifiers to seasonal precipitation changes in an acidic subtropical forest soil

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More frequent droughts and storms will occur globally in the prediction of global climate change model, which will influence soil microorganisms and nutrient cycles. Understanding the resistance of soil functional microorganisms and the associated biogeochemical cycles to such climate changes is important in evaluating responses of ecosystem functioning. In order to clarify the responses of soil functional microorganisms involved in nitrogen (N) cycle to the predicted precipitation scenarios, two contrasting precipitation manipulation experiments were conducted in an acidic subtropical forest soil. One experiment manipulated drier dry-season and wetter wet-season (DD) by reducing dry-season rainfall and adding the equivalently reduced rainfall to wet-season. Another experiment manipulated extending dry-season and wetter wet-season (ED) by reducing spring-season rainfall and adding the equivalent rainfall in the late wet-season. The resistance index of ammonia-oxidizing archaea (AOA) amoA and denitrifying (nirK, nirS and nosZ) genes abundance, soil net N mineralization and nitrification rates were calculated during experiments to examine their responses to precipitation changes. As the results, the resistance index of functional microbial abundance (-0.03 $\pm$ 0.08) was much lower than that of net N transformation rates (0.55 $\pm$ 0.02), indicating more sensitive of functional microorganisms in response to precipitation changes than the related N processes. Extending dry-season showed greater effects on both AOA amoA and denitrifying genes abundance than drier dry-season, with significant increases of these microbial abundance after extending dry-season. This was mainly due to the interaction effects of soil water content (SWC), dissolve organic carbon (DOC) and NH4+ concentration during rainfall reduction in spring-season. Interestingly, the resistance index of AOA amoA abundance was significantly higher than that of denitrifying gene abundance, indicating more resistant of AOA to precipitation changes. This was mainly because AOA have higher resource utilization efficiency and can acclimate to environmental changes more rapidly than denitrifiers, as indicated by less effects of N, C substrates and SWC on the resistance index of AOA abundance. This study demonstrated substantial disturbance of drier spring-season to soil nitrifying and denitrifying microorganisms, and greater stability of AOA community abundance in resistant to such disturbance.