Submitted Abstract

ID IMC22-FSAbstr- 206

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Country	United Kingdom
Region	Western Europe
Title	Going Underground: Unleashing The Power Of Citizen Science And Edna To Explore Alpine Soil Biodiversity.
Keywords	Fungi, Soil Biodiversity, Citizen Science, Edna
Type	List Of Focus Session
Focus Session ID	43

Abstract

Knowledge of alpine soil biodiversity and its functioning has historically been limited by difficulties in detecting belowground organisms, a shortage of skilled taxonomists, and the logistic challenges of accessing remote terrain. However, recent advances in DNA sequencing technology and reductions in costs have made eDNA approaches increasingly viable for large-scale assessments of soil biodiversity. Additionally, and particularly since the start of the Covid-19 pandemic, there has been a rising trend in recreational access to mountain areas, as people seek the benefits of time in nature. These trends provide an opportunity, both to advance our scientific knowledge of mountain soil biodiversity, and to engage and educate the public about its importance. Here, we describe the results of a project, run in collaboration with the UK NGO Plantlife, which used a citizen science approach to explore fungal diversity in the alpine zone of the Cairngorms National Park. The Park is the UK's largest, containing one third of the UK's alpine zone (land above 600 metres). It includes 58 mountains with an elevation greater than 3000 feet (914 m) which are known as Munros and are a popular target for walkers and mountaineers. During the summer of 2021, volunteer citizen scientists visited 55 of the 58 Munros in the National Park and collected soil samples for DNA analysis of fungal communities from under grassland, dwarf-shrub heath and moss heath communities on each summit. We used a metabarcoding approach utilising the ITS region and recovered 2748 fungal taxa across 219 sampling locations. These data vastly increase our knowledge of the fungal diversity in the alpine zone, including several species new to the UK. Overall, there was high spatial congruence between plant and the associated fungal communities, which were significantly different between habitat types. We also explored turnover in fungal community composition along soil chemical and environmental gradients. These data demonstrate the potential for citizen science and eDNA approaches to enable large-scale biodiversity assessment in mountain soils and provide a baseline assessment of alpine fungal communities in the Cairngorms, against which the effects of future climate and environmental change can be measured.