Abundance, activity and biodiversity of soil micro-organisms along an elevation gradient between 2700 and 3300 m and a thinning out alpine meadow

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Introduction

Mountain soils in alpine and nival zones are characterized by low temperatures, a reduced abundance of higher plants, a reduced input of organic matter, a greater vulnerability of the whole system and by a more distinct increase in temperature due to global warming. While the effects of increasing temperature on plants are well documented the effects on belowground soil microorganisms are still unclear. As microorganisms are not only (like plants and animals) passively influenced by climatic conditions but also actively affect them there is urgent need for respective investigations.

Material und Methods

We tried to examine if and to which extent abundance and activities of soil microorganisms are affected along an elevation gradient comprising alpine and nival zones. We used an gradient between 2700 m asl and 3300 m asl at Mount "Schrankogel" in the central Alps of Tyrol with a closed alpine meadow at the lowest and only sparse vegetation at the highest site. Soil samples were taken in triplicates every 100 m asl and a couple of soil chemical, and microbiological properties were determined .

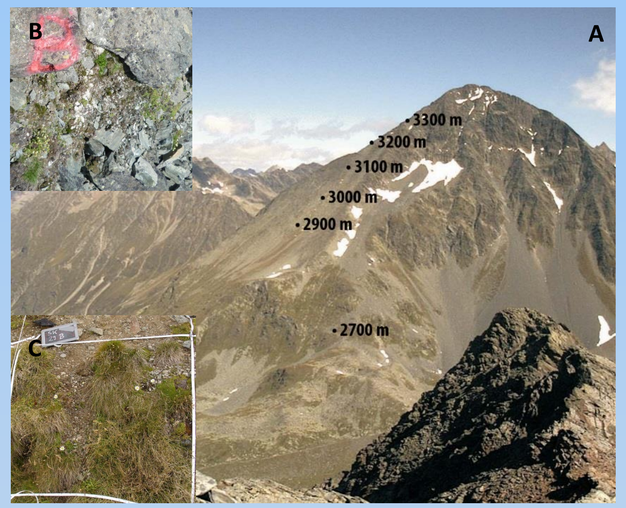

Figure 1: **A** Mount "Schrankogel" (3497 m asl) in the central Alps of Tyrol; **B** view of the vegetation at 3200 m asl and **C** at 2900 m asl

Results

Three different patterns as depending on altitude were determined: i) a continuous decay of abiotic parameters (e.g. total N, C, OM, water holding capacity) ii) peaks at an altitude of 3000 m asl (e.g. pH, HN4, EC, biodiversity) and iii) sigmoidal decay (all microbial parameters).
The inflection point, determined via the second derivation of the microbial response curves exactly matched the inflection point of the nivality index (proportion of nival to total plants species) and the curves exactly cross at the zero degree line (zdl) at 3010 m asl.
As zdl is increasing tue to global warming microbial activities including nutrient cycling and CO_2 and CH_4-production might also increase.

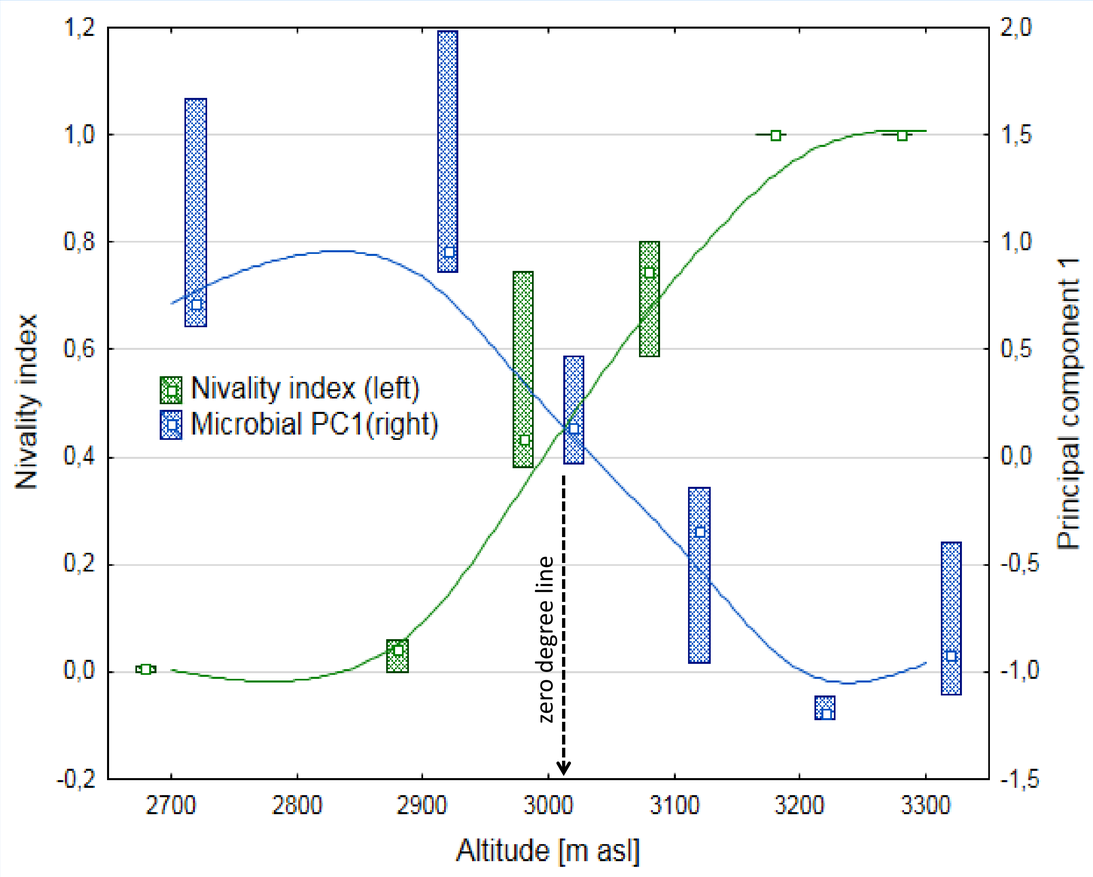

Figure 2: **Nivality index (proportion of nival to total species) and summary of microbial parameters (princinpal component) at an altitudinal gradient of Mt. Schrankogel Curves cross in their inflection points which is also the zero degree line at Mt. Schrankogel**

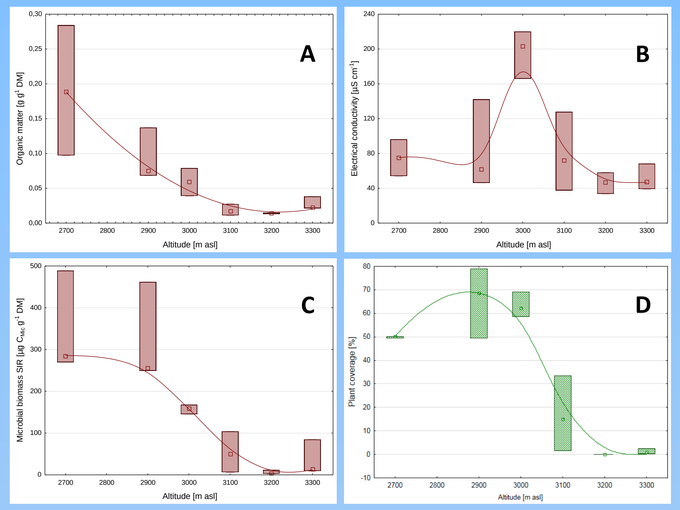

Figure 3: **Examples of different patterns as reactions to increasing altitudeat Mt. Schrankogel. A) continuous decay (OM content); B) Peaks at intermediate altitude of 3000 m asl (Electrical conductivity) C) sigmoidal decay (microbial biomass) D) sigmoidal decay of plant coverage.**

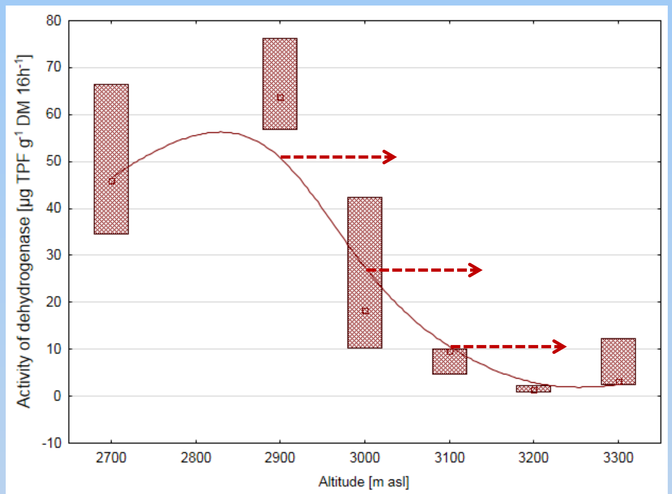

Figure 4: **Possible future scenario according to an increasing zero degree line and an also increasing microbial activity.**

Take Home Messages

- Vegetation and microbial parameters showed trongest changes at intermediate altitude of 3000 m asl.
- This altitude is also the zero degree line (zdl)
- With increasing zdl also the activity and abundance of Mo's are going higher (to the north) meaning an increase in turn over rates and gas productions.