Project acronym: T-REX

Project title: Tundra Ecosystem Responses to Extreme Rainfall Events

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Discipline: Earth Sciences & Environment: Ecosystems & Biodiversity

Station(s): Czech Arctic Research Station (Svalbard/Czech Republic)

Rationale: Heavy rainfall events will occur more frequently in a warmer Arctic, with implications for permafrost, vegetation and fauna. Our previous work (Siberia) shows substantial and long-term impacts of heavy rain on permafrost stability. How common is this adverse impact, with legacy effects, across the wider Arctic?

Aim: Assess impact of heavy rainfall events on (1) soil thermal regime, (2) vegetation productivity and phenology, (3) food source availability for herbivores and (4) abundance and phenology of arthropod communities in various Svalbard tundra ecosystems.

Approach: 5 locations (around longyearbyen and ny-alesund) with treatment and control plots: 50mm of additional water applied in late summer 2022 or early summer 2023. Comparison of environmental variables measured at regular intervals over the course of summer prior to, during and after irrigation treatment. Includes soil temperature, soil moisture, permafrost thaw depth, plot NDVI, photosynthetic activity, sampling of vegetation for chemical analysis, sampling of soils, soil fauna extraction, arthropod sampling using emergence traps, tracking of grazing evidence. Site characterisation of plots (soil texture, moss height, elevation, slope, vegetation composition) to link degree rainfall response to local site conditions.

Expected results: detailed mechanistic insight into impact of heavy rainfall events on various components of tundra ecosystems. Characterization of carry-over effects into later years. Insight into the role of timing of rainfall and potential cascading effects across trophic levels. Data sharing among a diverse team of collaborators who can use the experimental set up for various purposes. Early dissemination of protocols and data. Opportunities for field training (several msc students and an intern) for the next generation of Arctic ecologists.