Thesis projects in plant- and belowground ecology

We are looking for students to join us in our research on above- and belowground changes northern ecosystems. These are suggestions for master thesis topics (60 or 30 ECTS) anchored in my current ongoing research projects, but we are also open for other interesting suggestions within plant- and belowground ecology; and even bachelor thesis ideas.

Contact: Gesche Blume-Werry, gesche.blume-werry@umu.se

1. **Linking root traits and methane emissions in a boreal fen**
   Wetlands are the largest natural emitter of methane worldwide, and plants play a key role in this through providing substrates for CH4-producing microbes, increasing CH4 consumption by oxygenating the rhizosphere, and transporting CH4 from soils to the atmosphere. It is likely, that root traits are particularly important for these processes, but they are not well studied. Our overall goal in this project will be to understand how root traits affect methane emissions across plant communities in a boreal fen wetland in north-eastern Finland and if root traits can be predicted from easily obtainable aboveground measurements or soil parameters.
   This project is a collaboration with researchers from Oulu University and you would join my PhD student Johannes Cunow in the field.

   Location: Oulanka Research Station, Finland

2. **Plant responses to warming and permafrost thaw in the Alaskan tundra**
   --Already assigned--

   Permafrost soils contain as much carbon (C) as the atmosphere and all plants on Earth combined. This C has accumulated over millennia, well-protected from decomposition by low temperatures. As the Arctic rapidly warms and more and more permafrost thaws, there is a growing concern about large amounts of C being released from permafrost soils into the atmosphere, further exacerbating climate change. However, the magnitude of this arctic carbon-climate feedback is hotly debated among scientists. Plants and in particular their roots are central to the debate as they can strongly modulate C input and decomposition rates. In this project, we will measure plant responses (above- and belowground) to warming temperatures (with open-top-chambers) and permafrost thaw (with snowfences) in a long-term field experiment in northern Alaska.
   For this project you would join my PhD student Vanessa Götz in the field.

   Location: Toolik Field Station, Alaska, USA

3. **Do fungi shape plant-soil interactions in Swedish tundra?**
   As climate warms, arctic vegetation is changing rapidly with shrubs and trees invading current tundra plant communities. This process is referred to as arctic greening and is expected to restructure above and below-ground processes. In tundra, most plants form associations with mycorrhizal fungi. Mycorrhizal fungi play a major role in the turnover of soil organic matter, as they provide their associated plants with nitrogen (N) by decomposing soil organic matter. However, different plant species associate with different types of mycorrhiza which differ in their

decomposition abilities. A growing concern is that the invasion of shrubs, such as dwarf and mountain birch or willow which are associated with ectomycorrhizae, may stimulate the release of C from tundra soils compared to the current vegetation dominated by dwarf shrubs with ericoid mycorrhizae. However, to date, this has not been experimentally tested but is rather based on empirical observations. In this ongoing experiment, we selectively remove plants with either ericoid- or ecto-mycorrhizal association, and a master student project could for example focus on changes in root traits and production, plant or mycelia growth, or CO2 fluxes.
We are an international team of researchers with a variety of expertise working together on this project.

Location: Abisko Scientific Research Station, Abisko, Sweden