Project acronym: PyCARBO

Project title: Pyrogenic carbon in boreal forest ecosystems: fate and environmental impact

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Discipline: Earth Sciences & Environment: Other - Environment

Station(s): Värriö Subarctic Research Station (Finland), Hyytiälä Forest Research Station (SMEAR II) (Finland)

Pyrogenic carbon (PyC) plays a significant role in the global carbon (C) cycle. Boreal forests are increasingly threatened by wildfires as a consequence of climate change. PyC is a resulting product of incomplete combustion and accumulates on the soil surface during wildfires. A certain share of it is very stable in a natural environment and it shows interesting properties in the soil system. These properties are being intensively studied in context of biochar as a soil amendment. However, PyC does not necessarily represent a good proxy for biochar and vice versa, and hence little is known about the long-term fate and effects of PyC on the carbon and nitrogen cycle. In this project, we combine efforts of two other projects and complement these with additional soil sampling. To account for long-term developments, we use the chronosequence approach, where we assume convergent stand successional trajectories. A climate gradient from Austria to Hyytiälä and Värriö is established to account for climatic influence. A detailed chronose sequence of 150 years is available at Värriö and at least since 1962 in Hyytiälä, additional reviews in archives are conducted. Physicochemical analyses (including H:C and O:C molar ratios, Fourier-Transform Infrared Analysis (FTIR) and elemental analysis) of PyC particles in different soil horizons will provide evidence on stability and longevity, and interactions with the N-cycle; in particular they will help to answer the question whether PyC is capable of reducing NO3- losses, and what are key mechanisms. In addition to this, we will analyze, if temperature has an effect on these functions and the stability of PyC, which will be an important outcome in view of climate change and valuable information for regional and global C models. Therefore, we collaborate with ecosystem C modelers in Finland and Austria. Results will be published open access in key scientific journals, and we expect that this undertaking will substantially improve long-term collaboration between Austrian and Finnish experts.