Over the past few decades, human activity has exerted a large negative impact on the natural environment. This impact has included, among other things, the continuous deposition of excess nitrogen (N) from industrial and agricultural sources into forest ecosystems. Most terrestrial ecosystems, including temperate and boreal forests, are constrained by N-limiting conditions; one of the most essential elements needed for plant growth. Free-living, saprotrophic soil fungi decompose organic matter making the minerals contained in the organic matter available for plants and the microorganisms that inhabit roots as symbionts, including mycorrhizal fungi. Therefore, both soil and root-associated fungi play an essential role in nitrogen turnover and uptake.

Excessive inputs of N, beyond some threshold, can affect forest ecosystems, creating an imbalance in soil and root functions. The effect of chronic deposition of N loads on forest ecosystems varies from improved tree productivity to tree death (Fig. 1).

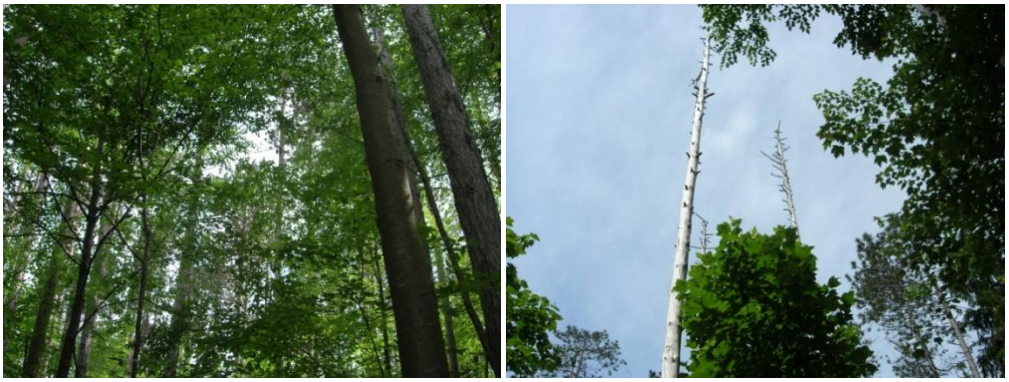

Figure 1. Harvard Forest (MA, USA); control plot, ambient N (left) and N-deposited plot (right). Chronic N input results in an increase in tree mortality. Photo by L.K. Trocha.

Very little is known about the impact of chronic N-loads on the composition (number and abundance) of soil and root-associated fungi and their function in plant and soil processes. This includes the activity of free-living soil fungi that decompose organic matter into soluble minerals, making them available to trees through their root symbionts. In the present project proposal, we will determine the extent to which chronic N-deposition alters the composition and functioning of soil and root fungal communities, how the fungal communities change and adapt to excessive N levels, and what impact the changes in the structure and function of the fungi have on tree growth.

The proposed research will be performed in 7 unique sites with a range of ambient levels of N (control plots) and applied N (experimental plots), located in the northeastern US. Determining the effect of chronic N-deposition on soil fungal communities is essential to understanding the role of soil and root fungi in forest ecosystems. Identifying the functional adaptations and taxonomic shifts that occur in response to increased levels of N will help to develop specific strategies that support specific interactions among the fungi and roots that lead to sustained health and growth of forest trees, or in other words, a healthy forest ecosystem.