Geophysical Research Abstracts
Vol. 12, EGU2010-7836, 2010
EGU General Assembly 2010


# Trees actively and directly influence biogeochemical processes in boreal forested watersheds

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It is increasingly realized that trees are directly influencing soil processes, and thereby significantly also biogeochemical processes at the scale of watersheds. For example, it is now well established that recent photosynthesis supports on average around 50% of the soil respiratory activity. It takes only a few days from tree canopy photosynthesis to the use of that C by plant roots and soil microbes. Importantly, not only does this represent a significant and rapid return flux of CO2 back to the atmosphere, but it also relates to a range of important biogeochemical processes. These occur not only in the soil, but also in streams and lakes, e.g., in nutrient-poor boreal forests areas labile C compounds produced by tree roots and their associated microorganisms constitute an important C source for lake biota. Furthermore, the tree belowground C allocation is under strong physiological control and responds to the supply of nutrients, especially to the supply of nitrogen. When this is low, as in most boreal forests, the belowground C allocation to roots and mycorrhizal fungi is large. This explains the very large N retention capacity of these forests. However, after large additions of N, this belowground C flux is reduced and consequently also the N retention capacity of mycorrhizal fungi. When this occurs, bacteria, organisms with a much lower C/N ratio, become dominant; but as these are C-limited, their capacity to sequester N is much lower than that of fungi. As a consequence, the N cycle opens up, and N is lost through leaching of nitrate and denitrification. However, if the N-load is removed, the trees start to allocate more C belowground to their mycorrhizal fungi again, and this important N-trap is restored. Thus, there are many examples of how trees actively and directly (with short time lags) involve biogeochemical processes in boreal forested watersheds.