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Shifts in microbial biomass indicators track changes in carbon and nitrogen cycles during tree plantation development to 20 years

In the context increasing atmospheric CO_2 concentration, there is a growing interest for using afforestation and reforestation to claim emissions reductions. Establishment of plantations necessarily involves silvicultural treatments that affect environmental conditions and hence soil microbial communities, influencing carbon and nitrogen cycles and potential soil carbon sequestration. We have monitored soil microbial indicators during a twenty year period of ecosystem recovery from disturbance at the Petawawa Research Forest (Ontario, Canada), in plantations of white pine (*Pinus strobus* L.) and white spruce (*Picea glauca*). The first ten years was marked by important changes in C_{mic}:C_{org} and C_{mic}:N_{mic}, related to vegetation control that provoked modification of bacteria:fungi ratios, accelerated N cycling and loss, as well as shifts in vegetation composition that are still quite marked after twenty years. After another 10 years (at 20 yrs) we note a closing of the N cycle and again important shifts in microbial indicators. In the humus, biomass C has recovered over time, but the C_{mic}:N_{mic} is decreasing constantly from 4 to 20 years, with increases in the N_{mic} pool; in the surface mineral soil, this increase in the N_{mic} pool is even more striking. Plots treated to control vegetation are dominated by conifers versus deciduous vegetation after twenty years, provoking a higher C_{mic}:N_{mic} in the humus layer. We attempt to interpret differences in the labile carbon fraction in the humus and mineral soil at twenty years in light of these observed dynamics.