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Center European Forest Soil's Biological Activity Affect the Long-Term Treatment of Organic Matter

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Introduction

The decline in the amount of organic matter (SOM) in soils is a substantial contributor to the increase in atmospheric CO_2 entering the environment. This is due in part to the clearing of forests and the subsequent change in land usage from growing areas to agricultural land. Since intensive farming began to spread, SOM now only represents roughly 70–80% of that time. In 2000, we set up experimental plots for litter manipulation in order to conduct a long-term evaluation of the impact of various SOM concentrations [1].

Our hypothesis states that, after ten years, the biological activity of soil will change as a consequence of the removal and treatment of organic matter and will change for the better as a result of the doubling. Over a period of ten years, the removal of organic matter caused the soil's pH value to move in an acidic direction, whereas the addition of organic matter had no effect. In the first year, we were unable to identify any appreciable variations in the enzyme activity values. Our later findings showed that a significant decrease in leaf litter had a higher impact on soil enzyme activity and soil respiration than an increase in litter formation above natural values [2].

Description

As SOM contributes to the establishment of soil pH conditions, cation exchange capacity and soil structure, soils capacity to accumulate and store carbon is crucial to the global carbon cycle. SOM also forms ecosystems N reserves. The fact that organic matter serves as the most crucial substrate for hetero-organotrophic soil microorganisms is another significant characteristic of this substance. Raich found that decaying litter (including root materials) accounted for almost 70% of the entire carbon outflow from soils, which was calculated to be 68 Gt annually. Through the production and absorption of greenhouse gases, chemical and biological activities in soils have an impact on the global climate. In different ecosystems, the quantity and quality of litter added to the soil vary substantially.

The input-output mechanisms, which combined influence the decomposition of organic matter and abiotic release of nutrients from soil, heavily depend on climatic variables and soil organisms. The respiration of living things, the weathering of rocks and volcanic activity all contribute significantly to the carbon cycle, whereas anthropogenic industrial activity is responsible for 5–15% of the CO_2 emitted into the atmosphere. The latter figure is only ostensibly small since it appears to be more atmospherically present than gases created by natural processes. Snowmelt and significant rainfall at the start of the vegetation period are often to blame for the similar soil moisture values between the treatments. According to the literature and our earlier findings, soil moisture only very seldom influences soil respiration. Accordingly, the greater soil moisture content exhibited a stronger connection with soil respiration in the case of the Co and DL treatments due to the unusually high precipitation. The annual precipitation in the forest in our case was consistent with the long-term average, therefore it had no discernible impact on the metrics under consideration. In a related experiment including the modification of litter, also discovered that, unless the water content is extremely high, there is no significant correlation between soil respiration and soil moisture. Bowden and co [3].

According to the local conditions, a specific amount of time must pass after litter manipulation before changes in the stock and dynamics of organic matter manifest. Following their establishment, there was initially a larger CO_2 emission in the litter removal plots because the plant roots' remains in the soil from their decomposition served as an easily accessible and useful nutrition supply for the microbes, in line with previous research. This research found that if the root zone bacteria do not have access to enough nutrients soon after treatment, they swiftly enter the dormant stages [4]. Contrary to what we anticipated, there was no rise in CO_2 emissions as a result of the enhanced aboveground organic matter production in the region and soil we studied. On the other hand, the loss of organic matter led to a reduction in overall soil respiration. Abiotic factors do not significantly affect the intensity of soil respiration unless they change between extreme limits, according to data from the literature. However, if they do not change between extreme limits, the increase in CO_2 emissions from heterotrophic respiration can indeed cause positive feedback on climate change due to the relatively long residence time of the carbon in the soil. Similar findings were reported that the degree to which the carbon cycle and climate interact will depend on how bacteria respond to climate change [5].

Conclusion

We come to the conclusion that variations in soil enzyme activity brought on by plants and soil microbes are predominantly driven by climatic conditions, with the addition of aboveground organic matter having a minor influence. We discovered that ß-glucosidase was sensitive to variations in soil pH as well as exceptionally high soil moisture levels, suggesting that it may be a viable biological indicator for determining ecological changes brought on by soil acidification. In the long term, we discovered that the withdrawal therapies had a bigger impact than the double litter treatments. Contrary to what we anticipated, there was no rise in CO_2 outflow in the study region due to the increased production of aboveground organic matter. In contrast, the withdrawal of organic matter (lower intake of litter) resulted in a reduction in overall soil respiration.

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