Flashtalks 6th TBI symposium

Effects of warming on plant litter decomposition
Sarah Schwieger

Climate change is expected to accelerate the decomposition of plant litter and increase carbon emissions. However, empirical studies have shown that the effects of warming on litter decomposition are highly variable. To test the overall effect of warming, we conducted a meta-analysis on experimental warming studies from all seven continents, using natural and standard plant litter. The results showed no significant effect of warming on litter decomposition overall. However, experiments with larger warming intensities had significantly greater effect sizes. Lower precipitation at warm sites resulted in lower decomposition with warming, but had no effect at colder sites. For graminoids, decomposition decreased with warming. While root litter decomposition increased, shoot and leaf litter decomposition decreased with warming. As drought frequency and intensity increase with climate change, decomposition rates may decrease. Conversely, ecosystems with higher below-ground biomass may face higher decomposition rates with warming. However, research on root decomposition is sparse.

Tea Bag Index and C/N ratio in a Mediterranean olive orchard with and without the application of a commercial biofertilizer
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Olive is an economically and socio-culturally important tree crop for Mediterranean area countries, like Italy, but its management is becoming unsustainable because of the lack of young farmers, increasing soil degradation and excessive cost of mineral fertilizers. Among the sustainable practices that can reverse this negative trend, soil conditioners able to restore soil fertility are fundamental. In 2022, we conducted a trial on a mature olive orchard in Puglia (Italy) with and without the supply of a commercial biofertilizer (BioVegetal*, made from agribusiness chain by-products and pruning clippings, an example of circular economy). Chemical analyses (mainly C, N and C/N) of soils and soil conditioner allowed to follow the incorporation of the conditioner into soil and its decomposition rate. Tea Bag Index was calculated using green and rooibos tea to study litter degradation and stabilization. Different litter dynamics were found in the two soil treatments.
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TBA,
Elsa Medhane,

During ecological succession, vegetation cover changes, and this change may impact the rate of litter decomposition. Furthermore, abiotic factors such as moisture and temperature can explain up to 70% of the variation in decomposition rate. To assess the influence of these variables on the rate of litter decomposition, we conducted a study by burying tea bags (i.e., litter) at six sites at different stages of secondary succession following agricultural abandonment. At each site, we implemented four blocks with two drought and one control treatments to manipulate precipitation thus, soil moisture levels. Our results show a significant effect of treatments on decay rate (k), with drought slowing it down relative to control, while sites had no effect. Interestingly, the effects on the stabilisation factor (S) were different from to the effects on k, with the late successional site, Denencamp, having the highest S, while drought had no impact.

TBA
Najam e Sahar,

Ombrotrophic peatlands are important long-term sinks for atmospheric carbon as plant productivity exceeds litter decomposition. Changes in plant community composition may alter decomposition rates through alterations in microbial communities and activity. Such plant community driven changes in decomposition rates may however differ between microhabitats. Nevertheless, the microhabitat-context-dependency of plant community composition effects on decomposition remains poorly understood. We used a long-term (> 10 year) plant removal experiment to study how vascular plant functional types (PFTs, i.e. graminoids and ericoids) influence decomposition processes in wet lawns and hummocks. We employed the Tea Bag Index (TBI) as an indicator for early litter decomposition and carbon stabilization and assessed the potential activity of five hydrolytic extracellular enzymes (EEAs) as indicators for microbial activity. PFT removal had no effect on the TBI decomposition rate constant (k), nor on the stabilization factor (S). Yet, k increased slightly when both PFTs were absent. In the lawns, we observed higher values of k and S as compared to hummocks. PFT composition influenced four out of five hydrolytic EEAs that can drive decomposition. Yet, this influence was non-pervasive and microhabitat dependent. Our results suggest an important role for vegetation change, through their influence on enzyme activity, along the lawn-hummock gradient in regulating decomposition processes in northern peatlands.

TBA,
Marcus Schiedung,

Permafrost-affected mineral soils of the high-latitudes contain large amounts of the global soil organic carbon (SOC). The cycling of SOC is not fully understood. At the same time, these regions a projected to experience major changes in temperature and ecosystem properties

with global climate change. Here, we incubated tea litter (green and reg tea) and labelled grass organic matter and pyrogenic carbon (PyC) for two years in permafrost-affected forest soils of northern Canada (60-68° north). Soils under continuous permafrost showed larger losses of green tea (70% loss) than red tea (27% loss) compared to warmer soils under discontinuous permafrost (losses of green: 60% and red: 45%). Surprisingly, 30% of total added PyC were decomposed in continuous permafrost soils, challenging the persistence of PyC. Our results show that SOC cycling in permafrost-affected soils is predominantly limited by nutrients (such as N) and thus sensitive to fresh inputs with climate change.

An approach to extend the soil monitoring network by tea bag initiative: a case study of six vegetation zones in European Russia
Kristina ivashchenko,

The TeaComposition Initiative and Teatime4Science project with a common protocol and standard litters have given impetus for assessment of soil microbial decomposition across the globe. Nevertheless, "white spots" on the tea bag index map are still there. For instance, European Russia wasn't covered in such global assessment. Possibly it concerns with unavailability of the required tea types / brands in loco. Therefore, we have tested the analogs tea bags available in loco and to calculate the conversion indices between analogs and standardized tea bags in order to extend the network for soil decomposition assessment for broader territories, allowing the involvement of the citizen science in data collection. The study represents 3,000 km latitudinal gradient of European Russia, which includes six vegetation zones. Moreover, considering that climate – urbanization interaction remains largely overlooked, the natural and urban sites within each vegetation zone were included as well.

Using TBI for soil functionality analysis in grasslands under varying management
Rosa Boone

To sustain the transition towards sustainable agriculture, it should become evident how a farmer can benefit from soil biodiversity, through soil functionalities like improved nutrient cycling. In agroecosystems where soil is intensively managed and fed with chemical inputs, soil microbial communities can show decreased biodiversity and less connected soil community networks, altering its functionality.
To assess decomposition rates in grasslands soils under varying management, tea bags were installed in the spring of 2022. After around 90 days, teabags were retrieved, and soil samples were taken for biological and chemical analysis. The tea was freeze dried to determine mass loss.
Mass loss for Rooibos tea appears to be highest in the extensive grasslands, while Green tea lost most mass in the arable fields. However, some of the fields received irrigation. This could bias results, due to enhanced microbial activity. Further analysis will be necessary to determine the size of this effect.