A broadleaf species alters and evenly distributes soil organic carbon chemical composition in a *Pinus massoniana* planted forest in southern China

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There are potential effects of planted forest type conversions from conifer to broadleaf or mixed-species on the soil organic carbon (SOC) chemical composition, and the evenness of its distribution remains uncertain. An afforestation experiment with different tree species (*Pinus massoniana*, *Erythrophleum fordii*, and mixed *P. massoniana* and *E. fordii*) was conducted in a clear-cutting site of *P. massoniana* planted forests in a subtropical region. Topsoil organic C quality and microbial diversity were assessed after eight years of afforestation. The proportions of alkyl C and carbonyl C in SOC, as well as alkyl C/O-alkyl C ratios and the evenness of the SOC chemical composition distributions were higher in monospecitic *E. fordii* and mixed-species planted forests than the monospecific *P. massoniana* planted forest. The positive relationship of SOC chemical composition distribution with litter as well as fine root C quality was observed. Microbial biomass C was positively correlated with the labile SOC. Fine root C had a closer correlation with the chemical composition of SOC than litter. The present results are not consistent with our previous findings in a 25-year afforestation site, in which soil microbial community composition rather than litter quality was linked with SOC chemical composition, suggesting plant C chemical composition would better predict belowground C sequestration functioning in the early afforestation system. These results highlight that mixing native N fixing broadleaf species into conifer forests probably enhance the SOC chemical stability and resistance to climate change by increasing the recalcitrant C components and the evenness of SOC distribution.

Allometric models to estimate biomass aboveground in forest recovery areas

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Quantify carbon stock on forest restauration areas is a global interest, since this area provide the important environmental service of mitigating climate change. It is crucial have more studies on allometry to help on predicting biomass and carbon stocking for those areas. Thus, the objective of this study was to quantify forest biomass and carbon content to a 5-year-old region under restoration process, so models could be fitted to the area and also used to similar sites. Three sites nearby Itu city, SP, Brazil, were studied, 5 years after the restoration process was implemented. In each site, three 900 m²-plots were installed, and a forest inventory was done, measuring tree height and circumference at breast height. Sub-plots (25 m²) were randomly selected in each 900 m²-plots and all trees inside it were cut and had its volume measured, stratified into foliage, roots and stem pools. Carbon content was determined on the Isotopic Ecology Laboratory for each species and pool. This data was used to fit models to estimate biomass. The best model was selected using the adjusted coefficient of determination (R^2), residual charts and Akaike's information criterion (AIC). Mean biomass for the area was 20.19±0.146 Mg ha^{-1}, mean Carbon stock was 9.73 Mg C ha^{-1}, and average carbon content was 45.3%.

N_2 fixing trees (*Acacia mangium*) introduce in eucalypt plantations modify rapidly the pools of organic P and low-molecular-weight organic acids (LMWOAs) in tropical soils contrasted for their C/P stoichiometry

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In this study, soil organic P (Po) and low-molecular-weight organic acids (LMWOAs) were quantified under different land uses in order to investigate the effect of N_2 fixing tree introduction on phosphorus cycle. Soils were collected from plantations of pure acacia (Ac), pure eucalyptus (Euc) or both species (50/50) and original savannahs (S) that were located in Brazil (low P, high N and high C soil) and in Congo (high P, low N and low C soil). Po and LMWOAs were identified in sodium hydroxide soil extracts with ion chromatography (IC). Phosphate monoesters as AMP and glucose-6-phosphate (G6P) were the main Po forms in both sites. Phytate, ATP and fructose-bisphosphate (FrucbisP) were also present as well as the mineral form of pyrophosphate (PrP). Malate, oxalate and malonate were the major components of LMWOA fraction in the two soils. Citrate was also present at low concentrations. Interresingly, phytate concentrations were always decreased under acacia plantations. This could result from a better mineralisation or lower inputs into these soils. In mixed stands, the effect of acacia introduction on Po and LMWOAs composition is more pronounced in high P than in low P soil, due to a much better N_2 fixation. Our results highlight that the introduction of a legume tree is able to strongly modify the composition of Po and LMWOAs in soil even after a first short-time rotation, especially when the rate of N_2 fixation is high.

Microbial enzymatic activities and community-level physiological profiles (CLPP) in subsoil layers are altered by harvest residue management practices in a tropical *Eucalyptus grandis* plantation

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Harvest residue management is a key issue for the sustainability of Eucalyptus plantations established on poor soils. Soil microbial communities contribute to soil fertility by the decomposition of the organic matter (OM), but little is known about the effect of whole-tree harvesting (WTH) in comparison to stem only harvesting (SOH) on soil microbial functional diversity in Eucalyptus plantations. We studied the effects of harvest residue management (branches, leaves, bark) of Eucalyptus *grandis* trees on soil enzymatic activities and community-level physiological profiles in a Brazilian plantation. We measured soil microbial

enzymatic activities involved in OM decomposition and we compared the community level physiological profiles (CLPP) of the soil microbes in WTH and SOH plots. WTH decreased enzyme activities and catabolic potential of the soil microbial community. Furthermore, these negative effects on soil functional diversity were mainly observed below the 0-5 cm layer (5-10 and 10-20 cm), suggesting that WTH can be harmful to the soil health in these plantations.

Carbon sequestration and soil fertility in dryland *Acacia senegal* plantations of varying age in Sudan

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African drylands are extensively degraded as indicated by reduced soil organic carbon (SOC) contents. Restoration through management practices that increase tree cover can be expected to increase SOC contents and soil fertility. We investigated the potential of *Acacia senegal* trees for increasing SOC and improving soil fertility at two sites in Sudan. Biomass C and SOC stocks, contribution of trees and herbs to SOC, soil nutrient (N, P, available P, K, exchangeable K) contents and potential N_2 fixation by *A. senegal* in plantations of varying age (7 to 24 years) and in adjacent grasslands were determined. Total biomass C stocks increased with plantation age. While most of this increase was due to the trees, the ground vegetation C stock also increased (facilitation effect). SOC stocks (0-50 cm) increased with plantation age and were greater than in the grasslands. δ13C partitioning values indicated that the age-related increase in SOC stocks was derived not only from the acacia trees but also from an increase in ground vegetation biomass. While soil concentrations of the studied nutrients were relatively low, they were positively correlated to SOC concentrations, highest in the topsoil (0–10 cm) and increased with plantation age – all indicating the importance of SOC to soil fertility. High acacia foliage δ15N values indicated that N_2 fixation was not an important contributor to soil N. Our findings showed that increasing tree cover in African drylands can increase SOC stocks and thereby improve soil fertility for the benefit of local communities besides sequestering atmospheric CO_2.

Role of nitrogen availability on enhancing soil carbon sequestration in typical subtropical planted forests in Southern China

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Planted forest ecosystem is becoming a key component of the China's forest resources and timber storage and plays a key role in the context of potential carbon (C) sequestration and sustainable forest management. Information on the effects of tree species composition and diversity on soil nitrogen (N) availability and organic carbon (C) sequestration remains limited. The investigation and long-term manipulation experiment were carried out in typical subtropical planted forests. Soil under Eucalyptus mixed with N_2-fixer accumulated more soil organic C and N, and had lower CO_2 emission than in pure stands by increasing total organic C and microbial biomass C, as well as through increased soil microbial community diversity and abundance. SOC and N stocks in the Pinus massoniana and Castanopsis hystrix mixed plantation were higher than in *P. massoniana* monospecific plantation. The admixing with the higher-quality *C. hystrix* litter hastened mass loss for recalcitrant C chemical compositions and nutrient return of conifer litter. Our results also showed that tree species mixture significantly altered the soil bacterial community composition and structure, compared with single-species plantations. The C/N ratios of soil and litterfall, TOC, NH4-N, litterfall mass and NO3-N were key factors affecting the soil microbial community. There was a negative relationship between SOC mineralization rates and the abundance of K strategists and a positive relationship for r-strategists. These results indicated that N availability plays an important role on enhancing SOC sequestration through changing soil microbial community composition in subtropical plantations.

Forest management strategies to safeguard water supply in karst regions under climate change

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Worldwide, karst aquifers developed on calcareous bedrock are important sources of drinking water. Large karst areas of the montane and subalpine vegetation belts in the Calcareous Alps are dominated by forests. The increasing frequencies and intensities of disturbances, partly a consequence of climate change, may alter the water storage, filtering and buffering capacity of forest ecosystems, thereby threatening the continuous provision of pristine water. Safeguarding water supply from karst regions therefore requires the adaptation of forest management strategies. In the presentation, forest management and disturbance effects upon soil condition and water quality in karst regions are discussed based on case studies from the Alps. Stability- and vulnerability- indicators of karst systems and its subsystems, from tree species, the vadose zone, in particular soils, to karst water, are incorporated in a conceptual framework for adaptive forest management strategies in view of water protection.

E8q: EFFECTS OF FOREST MANAGEMENT PRACTICES ON SOIL PROPERTIES AND ECOSYSTEM PROCESSES

Teor de carbono e nitrogênio no solo em função da adubação em um sistema de integração Lavoura-Pecuária-Floresta e Plantio Direto

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A prática de adubação, quando necessário, promove ganho de produtividade até três vezes maior em comparação a sua não adoção. O uso de fertilizantes orgânicos pode resultar em ganhos econômicos e ambientais, potencializando a diversidade do sistema. Este trabalho objetivou avaliar o teor de carbono e nitrogênio no solo no sistema de produção integração lavoura-pecuária-floresta (iLPF) e plantio direto (PD) após 3 anos com fertilizantes orgânicos ou minerais. O experimento foi conduzido no município de Concórdia-SC, onde o delineamento experimental foi blocos casualizados, com 3 repetições, em fatorial 2 x 4, sendo dois tipos de sistemas de produção (iLPF e PD) em interação com três tipos de fertilizantes (dejeto de suínos, cama de aves e mineral) e o controle (sem adubação). As amostras de solo foram coletas até 100 cm, e analisadas através do analisador elementar (CNHOS). Não houve efeito da adubação sob o teor de carbono nas diferentes camadas para o sistema iLPF, enquanto que para o PD houve diferença para a adubação cama de aves e mineral nas camadas superficiais.