Theme 5: Forests, Soil and Water Interactions

50 - Soil Processes and Sustainable Forest Management (IUSS)

KG I - 1199 (Uni Freiburg)

IUFRO17-2956 **Consequences of mineral fertilization and biosolid application on nutrient leaching over an entire rotation in Brazilian eucalypt plantations**

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Abstract: Large amounts of fertilizers are applied in tropical planted forests managed in short rotations to sustain high biomass productions in highly weathered soils. Our study aimed to assess the consequences of fertilizer and biosolid additions on groundwater quality and nutrient leaching in Eucalyptus grandis plantations. Soil solutions were continuously sampled in 9 plots using plate lysimeters and ceramic cups at depths of 15, 50, 100 and 300 cm. The solutions were collected every week over 6 years to determine the concentrations of the main anions and cations. Three treatments were studied in 3 blocks: no nitrogen addition (control), 120 kg N ha-1 applied as ammonium sulphate, and 30 t ha-1 of biosolid added containing 1260 kg N ha-1. The main biogeochemical processes controlling the chemistry of gravitational solutions throughout their transfer were identified. The chemical composition of soil solutions in the topsoil was driven by the mineralization of soil organic matter and harvest residues as well as the dissolution of the fertilizers. The peaks of nutrient concentrations reached a depth of 1 m about 9 months after planting but high concentrations never reached a depth of 3 m, except after the last biosolid application. E. grandis trees exhibited a remarkable filter capacity against nutrient leaching as a result of i) a relatively slow transfer of mobile ions in deep soil layers, ii) a very fast root growth (down to > 6 m at 1 year after planting) and iii) a high demand of trees in water and nutrients from 6 months after planting onward. Our results suggest that the number of fertilizations could be reduced in commercial eucalypt plantations growing in deep Ferralsols and that biosolid applications could be adjusted to reach high growth rates without polluting deep water tables.

soil solution, biogeochemistry, management, Brazil

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IUFRO17-2075 **Long-term fate of applied nitrogen in managed pine ecosystems of the southeastern United States using 15N**

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Abstract: A long-term study was initiated in 2011 to refine mechanistic understanding of ecosystem partitioning and retention of applied fertilizer nitrogen (N) in managed pine ecosystems of the southeastern United States using 15N. In addition, the efficacy of enhanced efficiency N fertilizers (EEFs) was compared to urea for different application seasons (winter, spring, summer) to increase fertilizer N use efficiency (FNUE) and sustainability of fertilization in these ecosystems. Fertilizer N loss from the system was determined using microcosm experiments, while ecosystem partitioning-retention was calculated with mass balance equations after sampling ecosystem components. Fertilizer N losses were significantly less for EEFs (4-26%) compared to urea (26-49%) for spring and summer, and NBPT was less than urea in winter. Lower fertilizer N losses for EEFs directly translated to increased fertilizer N ecosystem retention (77-84%) compared to urea (52-56%) for spring and summer, and for NBPT compared to urea in winter. Six years after fertilization, more fertilizer N remained in the soil for EEFs (10-25%) than urea (5-15%). This finding may translate to an increase in FNUE for current and subsequent stand rotations if the residual fertilizer N in the soil becomes bioavailable to desired tree species. This research highlights how EEF technology can increase FNUE and sustainability of N fertilization in managed forest systems.

15N, enhanced efficiency fertilizers

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IUFRO17-1720 **The impact of secondary forests conversion into larch plantations on C, N, P, K, Ca and Mg concentrations and stocks in forest floor and soils**

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Abstract: Larch plantation is widespread in northeastern China, however, knowledge of how and to what extent change macronutrient (C, N, P, K, Ca, Mg) concentrations and stocks in forest floor and soils after conversion of natural secondary forests to larch plantations is scarce. This study aimed to assess C, N, P, K, Ca and Mg in forest floor and soils under larch stands against the secondary forest stands. Four pairs of larch plantations and secondary forests were randomly selected from a mountainous area.

The conversion of natural secondary forests to larch plantations effects on macronutrient concentrations and stocks were mainly found in the forest floor and in the 0-10 cm soil depth. The forest floor litter stock significantly increased while the concentrations of K and Ca significantly decreased in the larch plantation. In the soil, the concentrations of C and N concentrations were significantly lower, and the concentrations of K and Mg were significantly higher in the larch plantation stands than in the natural secondary forest stands; whilst the concentrations of P and Ca were comparable between the two forest types in the 0-10 cm depth. The difference of tree species between secondary forest and larch plantation stands might influence litter nutrient concentrations, litter decomposition rates and plant uptake of macronutrients among the species and thus modify soil macronutrient concentrations.

The C, N and P stock in forest floor significantly increased in larch plantation stands than those in secondary forest stands. In the soil, the C stock decreased whereas K and Mg stocks increased in the 0-10 cm soil depth. There was not significant N, P and Ca stocks between two forest soils. Overall, conversion of secondary forests to larch plantations in the region is more likely to cause above- and belowground macronutrient reallocation than to result in reduction in overall macronutrient stock.

Larch plantation; Secondary forest; Macronutrient

BOOK OF ABSTRACTS

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