

Effects of Forest Litter Reduction on Soil Respiration Rates Across a Chronosequence of Black Pine Forest

Randell Keith Amarille^{1,2}, Renato S. Pacaldo^{1,2}, Miraç Aydın¹

¹Kastamonu University, Faculty of Forestry, Kastamonu/TÜRKİYE

²Mindanao State University-Main Campus, College of Forestry and Environmental Studies, Department of Forestry, Marawi City, Lanao del Sur/PHILIPPINES

✉Correspondence: randellkeith.amarille@msumain.edu.ph

Abstract: One of the strategies to alleviate forest fire intensity is the reduction of fuel loading through regular pruning and collection of forest litter. The critical question, however, is whether the regular removal of forest litter in a well-managed black pine (*Pinus nigra* Arnold) plantation significantly affects the soil respiration rates (Rs) as the forest plantation ages. This study aims to determine the Rs rates across a chronosequence of well-managed plantations of black pines, which have been subjected to regular pruning and collection of forest litter resulting in reduced forest litter inputs. A field experiment in a split-plot randomized block design with five replications was established to measure Rs rates using an automated soil respiration machinery (LI-8100 A). Results showed significant differences in soil Rs rates ($p < .0001$) across the chronosequence of *P. nigra* forest, with the oldest stand (60-year-old) showing a significantly highest Rs ($2.39 \mu\text{mol m}^{-2} \text{s}^{-1}$) compared to the 15-year-old ($1.87 \mu\text{mol m}^{-2} \text{s}^{-1}$), 30-year-old ($1.99 \mu\text{mol m}^{-2} \text{s}^{-1}$), and control ($1.98 \mu\text{mol m}^{-2} \text{s}^{-1}$). Significant differences in Rs rates were also detected across time ($p < .001$), but not with the interaction effects between age and time ($p = 0.85$). The Rs showed a positive correlation with soil temperature ($r = 0.67$), suggesting that it tends to increase with soil temperature. In contrast, the Rs negatively correlated with soil moisture ($r = -0.45$), suggesting an inversely proportional relationship. We concluded that the impacts of regular removal of forest litter to reduce fuel load are unlikely to significantly affect the soil Rs rates at younger to intermediate age classes. But the Rs tends to increase at a mature age (60 and up), suggesting the tendency of higher Rs rates in mature forests regardless of regular pruning and collection of forest litter removal.

Keywords: Forest fire, Forest litter, Soil temperature, Soil moisture, Well-managed plantation.