

How do ground litter and canopy regulate surface runoff?—a paired-plot investigation after 80 years of broadleaf forest regeneration

ABSTRACT

Relatively minimal attention has been given to the hydrology of natural broadleaf forests compared to conifer plantations in Japan. We investigated the impacts of ground litter removal and forest clearing on surface runoff using the paired runoff plot approach. Plot A (7.4 m²) was maintained as a control while plot B (8.1 m²) was manipulated. Surface runoff was measured by a tipping-bucket recorder, and rainfall by a tipping-bucket rain gauge. From May 2016 to July 2019, 20, 54, and 42 runoff events were recorded in the no-treatment (NT), litter removed before clearcutting (LRBC), and after clearcutting (AC) phases, respectively. Surface runoff increased 4× when moving from the NT to LRBC phase, and 4.4× when moving from the LRBC to AC phase. Antecedent precipitation index (API₁₁) had a significant influence on surface runoff in the LRBC phase but not in the NT and AC phases. Surface runoff in the AC phase was high regardless of API₁₁. The rainfall required for initiating surface runoff is 38% and 56% less when moving from the NT to LRBC, and LRBC to AC phases, respectively. Ground litter and canopy function to reduce surface runoff in regenerated broadleaf forests.