Changes of rainfall erosivity by passing through tree canopies of Japanese cypress

Kazuki Nanko[1]; Yuichi Onda[2]; Akane Ito[3]; Hiromu Moriwaki[4]

[1] Forest Sci., Agr., Univ. of Tokyo; [2] School of Life&Envirom. Sci., Univ. of Tsukuba; [3] Grad. Sch. Life Environ. Sci., Univ. of Tsukuba; [4] NIED

http://nanko-kazuki.main.jp/

Poorly managed Japanese cypress plantations in Japan suffer from soil erosion because they have little surface cover. To clarify the process of inter-rill erosion in such forests, it is necessary to determine the raindrop size distribution and erosivity under the canopy because the canopy produces larger raindrops than natural rainfall and promotes the erosive potential of the raindrops by increasing their kinetic energy.

To assess the rainfall erosivity under the canopy, an indoor experiment was conducted with a transplanted Japanese cypress tree, 9.8 m tall, in a large-scale rainfall simulator in National Research Institute for Earth Science and Disaster Prevention (NIED). Throughfall was generated by passing the applied rainfall through the canopy. Throughfall amount and raindrop size and velocity were measured with 0.2 mm tipping-bucket raingauges and laser drop-sizing gauges (LD gauge) at thirty-two points under the canopy. These points were radially placed in eight directions; four points were placed at 40, 100, 150, and 200 cm from the trunk. The spatial distribution of throughfall was estimated from the comparison data among four different distances from the trunk. Furthermore, four kinds of canopy structures were created by staged branch pruning to estimate the influence of canopy structures, the first branch height was 2, 3, 4, 5 m, respectively.

The spatial distribution of throughfall erosivity was generally dominated by the distance from the trunk. As the distance from the trunk became larger, the time lag required to stabilize throughfall intensity decreased; the throughfall amount increased; throughfall intensities generally increased; the volume ratio of large drops with diameters exceeding 3 mm increased; but the ratio of drips with higher velocities decreased. Consequently throughfall kinetic energy generally increased with the distance from the trunk but the increasing trend was less clear than the throughfall intensities.

Throughfall erosivity increased with the branch pruning, in part because the velocities of drops falling from the foliage increased depends on the increase of falling height. Furthermore, throughfall amount increased depends on the decrease of canopy storage, and the volume ratio of large drops with diameters exceeding 3 mm increased with the canopy thickness decreasing. The rainfall erosivity under the canopy would determine by the canopy thickness and the distance from the trunk.