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Soil erosion and overland flow in Japanese cypress plantations: Spatio-temporal variations and a sampling strategy.

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Many studies have focused on soil erosion in unmanaged Japanese cypress plantations because the sparse understory vegetation and litter covering the forest ground enhance soil erosion. Many studies also indicated that soil erosion and overland flow have large spatial variation. However there are less studies focusing on sampling strategy to obtain the slope scale soil erosion and overland flow in forested slope area. In this study, soil erosion, litter, and overland flow measurements were conducted over 14 months (March 2016 to April 2017) to identify the spatio-temporal variation and examine the optimal sample size in an unmanaged Japanese cypress plantation located in Aichi Prefecture, Japan. We used small-sized traps to collect sediment, litter and overland flow simultaneously. These traps with dimensions of 0.15 × 0.25 × 0.20 m (height × width × depth) was made by stainless- steel. Each trap was connected to a storage plastic tank installed downslope of trap to store the overland flow. To capture sediment and litter, the outlet of downslope-facing trap was wrapped by 1 mm mesh. To estimate the sediment that passed this mesh, water stored in the plastic tank was sampled to obtain the sediment concentration. Fifteen traps were installed in line along the bottom of a 15-m wide slope. The sampling interval was approximately 1 month. The range across all traps in terms of soil erosion was 79.2 to 596.8 g m^{-1}, while for litter it was 132.8 to 246.4 g m^{-1} and for overland flow, 42.0 to 612.4 L m^{-1}. The temporal coefficient of variation of soil erosion and overland flow was highest during dry seasons, while smaller during wet seasons. These results indicated that soil erosion and overland flow had larger spatio-temporal variations as compared to litter. To examine the relationship between sample size (number of traps) and potential errors caused by the spatio-temporal variation of soil erosion, litter and overland flow measurements, stratified Monte Carlo random sampling was performed. This random sampling analysis showed that the rate of decrease in spatio-temporal variation became moderate as the sample size increased beyond six. This result indicated that the optimal sample size was five, the total width of which was equivalent to about 8% of the monitored slope width.