Forestry machinery chain productivity in stands hit by the Vaia storm: first results for the Camonica Valley

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**Keywords.** Forestry operations, machinery chain productivity, working times.

**Abstract.** Estimating the productivity of forestry operations (OP) is essential to quantify both the economic costs and the environmental performances of the forestry machinery chains. This, in turn, is crucial to improve the overall sustainability of the forest-based sector. The aim of the work was to compute the productivity of a forestry machinery chain applied for wood collection in mountainous stands (1500 m asl) of Picea Abies L. of the Camonica Valley (Lombardy Region, Italy), damaged by the Vaia storm in October 2018.

The machinery chain was made up of the following OPs: (OP1) biomass extraction to the landing (“Full-Tree” method using a cable crane with a mobile drive station; distance: 500 m); (OP2) wood intermediate transport (from the landing to the delimbing and sectioning point using an earthmoving machine equipped with hydraulic clamp); (OP3) delimbing and sectioning into commercial assortments (the stem is separated from logging residues using a chainsaw); (OP4) stacking (roundwood and residues are separately accumulated by the machine used for OP2); (OP5) residues chipping; (OP6) loading&transport of roundwood (final destination: sawmills) and woodchips (final destination: local district heating plants).

For productivity estimation, for each OP and over a period of 10 days (Autumn 2021 – Spring 2022): (i) working times (h) and (ii) extracted volume of roundwood (m3) and residues (stucked steric meters; stcm) were detected.

The working times were subdivided according to the Comité International d’Organisation Scientifique du Travail en Agricolture (CIOSTA) definitions, specifically adapted for forestry operations. The roundwood volume was daily computed at the end of each extraction trip using a volume calliper and a tape measure, whereas the stucked volume of residues was estimated at the end of the day using a tape measure.

The working productivity was then computed for roundwood and residues and expressed as both volume basis (m3·h-1 and stcm·h-1 for roundwood and residues, respectively) and mass basis (t·h-1 of fresh matter; t·h-1 of dry matter). Starting from these results, the average productivity of the machinery chain was calculated for each day and for the whole monitored period.

Despite being preliminary, these results are useful to understand machinery chains performances under complex and dangerous working conditions and can be used to support logging companies and forestry consortia in setting proper operations tariffs.