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Instream wood in a steep headwater channel: geomorphic significance of large and small wood

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Besides the well-known significance of large wood (LW), also small woody pieces (SW; here defined as pieces with dimensions at least 0.5 m length and 0.05 m diameter), can play an important role in steep narrow headwaters. We inventoried instream wood in the 0.4 km long Mazák headwater channel, Moravskoslezské Beskydy Mts, Czech Republic (2<W<4.5 m; 0.20<S<0.40 m/m) with very steep adjacent hillslopes (0.6<S<1.1 m/m), where the parameters of wood dimensions, orientation, decay status (four classes), stability (unattached/contact with hillslopes/attached by bed sediments or other wood), % of influenced channel width by a wood, the geomorphic function of a wood (step, wood jam) and % of length of a wood in channel were assessed. The total number of inventoried instream wood was 90 LWs and 199 SWs. In addition, dendrogeomorphic dating of 36 LWs and 17 SWs was performed to obtain residence time of local instream wood and to provide some insights into its mobility. Practically all investigated pieces were European beeches (Fagus sylvatica L.); only two pieces were Norway spruces (Picea abies (L.) Karst.).

First results showed an increase in the number of LWs in channel-reaches confined by the steepest adjacent hillslopes (especially at 0.15-0.20 km). Increasing downstream amount of SW most likely reflected transport processes in the stream, and the later deposition of SWs on the lowest channel gradients. Also LWs and SWs in the downstream channel-reaches were more decayed than wood presented in the upper reaches. The orientation of instream wood was connected with its length and stability, and LWs longer than 5 m were usually attached to adjacent hillslopes. Pieces longer than 2 m, which were unattached or were somehow stabilized in the channel bed, had often orientation of 0° or 337°. LWs were mostly unattached in the upstream channel-reaches, while often stabilized by adjacent hillslopes in the middle part. At 0.05-0.10 km, there were also many logs stabilized by bed sediments. By contrast, SWs were mostly unattached in the whole longitudinal profile. We observed higher % of influenced channel width by SWs than LWs. Also, SWs were usually entirely located in the channel, which was significantly different when compared to LWs. Nine small steps (step height ∼0.5 m) were created by instream wood; six of them were formed by SWs. Dendrogeomorphic cross dating supported the observed decay status for LW/SW within the longitudinal profile: at the lowest channel gradients with wider higher active channels, the potential for storage of instream wood increased. In these downstream reaches we observed older LW and SW, with pieces from the 1960s and 1970s. Practically all instream wood was dated from the 1990s and 2000s in the uppermost 150 m of evaluated stream. This observation is in agreement with the hypothesis of a higher intensity of transport processes in the upper parts. Obtained results pointed up on the importance of SW on geomorphic processes in steep narrow channels, when these relatively smaller pieces spanned more frequently the active channel width when compared to LWs.