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Controls on longitudinal variability of large woody debris in submontane river - an axample from the Moravka River, Czech Republic

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Large woody debris (LWD) is recently acknowledged as an integral component of stream and river channels in forested watersheds. LWD influences physical and ecological processes such as channel hydraulics, sediment routing and deposition, changes of channel morphology, creation of aquatic habitats, and nutrient spiralling. Nevertheless, majority of work has been done on a reach scale, in small watercourses, and in streams flowing through old growth forests. Less information is available about abundance and functions of LWD on watershed scale and in medium and large rivers flowing through developed landscapes with managed forests. We address the problem of quantity, spatial distribution and properties of LWD along the entire length of the submontane Moravka River in the industrial region of the north-eastern Czech Republic. The main objective of the study was to identify controls of LWD occurrence in terms of channel geomorphology, floodplain vegetation and anthropogenic influences. The Moravka River has been chosen as an example of the watercourse with exceptionally high geomorphic variability with alternating natural and highly modified reaches. The river spans the environments including mountainous terrains upstream (elevation above 900 m) to gently rolling terrain downstream (elevation below 250 m); the length from source to mouth is 30.9 km. Bedrock river reaches alternate with alluvial reaches of various geomorphic style (cascade, step-pool, multiply-channel gravel bed, incising plane bed). The human modification of the channel and floodplain is also quite significant (water reservoir in the upstream section, bank stabilization, check dams and weirs, water diversion, control of sediment transport on tributaries). We registered following variables for LWD: geographical coordinates, diameter, length, orientation, decay status, position within the channel, and recruitment mechanism. Survey of LWD was accompanied by mapping of overall geomorphic style (type) of the channel, inventory of bed forms, recording anthropogenic channel modifications and describing the type and extent of riparian woody vegetation. Altogether eleven reaches (zones) with distinct geomorphic style and different assemblages of bed forms was distinguished along the river channel. The quantity and properties of LWD varied considerably among these zones. There is a distinct maximum of LWD abundance in the middle course of the river and secondary maxima upstream (source section) and downstream (close to the mouth). The highest quantity of LWD was recorded within wide gravely active zone with multiply wandering channel. The steady supply of LWD is enabled by bank erosion of the deciduous floodplain forest. Upstream maximum is located in the section with cascade and step-pool geomorphic styles in the mountain coniferous forest. Relatively high supply of LWD is sustained by wind throws and icings. Downstream maximum of LWD is a result of accelerated (human induced) incision of the channel bed causing destabilisation of banks that are up to 7 m high. Subsequent bank sliding brings trees from the surrounding deciduous forest to the channel. The transport of LWD in the upstream reach is limited due to the large dimensions of fallen trees and incompetence of the river to export it downstream (large LWD piece length to channel width ratio, small discharges). The export of LWD in the middle reach (with maximum LWD abundance) is constrained only to smaller pieces. LWD pieces are generally large there, rather stable and easily trapped on numerous gravel bars and islands. Mobility of LWD may be high, but transport occurs only for short distances. The most active transport of LWD is in the downstream deeply incised channel that is lacking obstructions for trapping floating wood. Regulated river reaches have generally low quantities of LWD with rather small dimensions due to sparse riparian vegetation and channel stabilization; both limit the recruitment of wood from riparian zone. Within the regulated channel reaches most frequent recruitment category are wood pieces floated from upstream.
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