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## The reinforcement effect of vegetation on live cribwalls

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Live cribwalls are Nature-based solutions consisting of timber-based structures acting as retention walls at the toe of slopes and embankments subjected to instability and erosion events. The structure of live cribwalls resembles a multi-level crib made of timber logs from different plant species (e.g. pine, spruce, hazelnut, etc.). The crib structure is then backfilled with earth materials in which locally-available plant cuttings and/or saplings are inserted to establish a dense cover of native vegetation, providing added reinforcement and stability to the cribwall over time; particularly after the complete decay of the timber structure is reached. However, the effect of vegetation on the reinforcement of live cribwalls has not been examined systematically. Information on how vegetation can contribute to reinforce cribwalls hydrologically and mechanically is essential to evaluate the long-term performance of these Nature-based solutions against hydro-meteorological hazards. In this study, we propose a novel conceptual, numerical model based on empirical knowledge to evaluate the reinforcement effect of vegetation on live cribwalls over time. We also demonstrate how the proposed model can be applied to other Nature-based solutions concerned with slope protection and erosion control, such as live gratings or palisades.