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The role of soil-vegetation feedbacks for early ecosystems development

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Artificial or highly disturbed catchments may undergo rapid changes due to the interaction between vegetation and soil that play a pivotal role for the water balance. Based on a review of how vegetation growth affects soil hydraulic properties, we propose a simple compartment model that captures the feedbacks between soil water storage in soil and soil hydraulic behaviour and vegetation biomass. The feedbacks that we considered are (i) vegetation biomass and soil water storage, (ii) root growth and infiltration capacity, (iii) vegetation biomass and bare soil evaporation and (iv) root growth and soil water drainage. In water limiting environments these feedbacks lead to oscillating behaviour of soil water storage and vegetation biomass. Biomass overshooting as result of initially high soil water content is predicted which is consistent with observations made in forested catchment after clearing or during re-vegetation of mine tailings. Implications of these feedbacks for predicting the early development of artificial catchment will be discussed.