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15 years of ecosystem development at Chicken Creek catchment: conceptual framework, surprises and conclusions

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The Chicken Creek catchment was constructed as a research platform to study initial ecosystem development at the landscape scale (Hüttl et al. 2014). The underlying conceptual framework was based on the idea that
1. patterns and processes evolving during the very first phase of development will have a long-lasting impact on later ecosystem stages,
2. defined boundary conditions and knowledge about subsurface structures of a constructed catchment would allow to better upscale and integrate processes compared to natural catchments, and
3. lower complexity of interacting components in young ecosystems allow to better understand the role of abiotic and biotic feedback mechanisms compared to mature systems.

After completion of the construction in 2005 (Gerwin et al. 2009), a major challenge was to develop and install a cross-disciplinary long-term monitoring program for the 6 ha area to record major environmental parameters adapted to the development of the site (Schaaf et al. 2013).
During its first 15 years, Chicken Creek showed a very dynamic development (Elmer et al 2013). Whereas the abiotic geosystem of the first 2-3 years was characterized by heavy erosion and sediment transport, primary succession by invading vegetation and the unexpected formation of soil crusts within few years resulted in more biotic-abiotic feedbacks that controlled catchment hydrology.
Our observations over a period of 15 years indicate that even minor variations in initial substrate characteristics (e.g. texture) can have lasting impacts on geomorphical, hydrological and biological development like erosion intensity, groundwater levels or establishment of vegetation patterns.
The time-series of monitoring data combined with a structure model of the catchment (Gerke et al. 2013) allowed the closure of the water balance by relatively simple calculations of water storage volumes and the estimation of evapotranspiration (Schaaf et al. 2017).
From these data three stages of ecosystem development were derived which are characterized by increasing influence of biota and increasing system complexity.

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