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A conceptual framework of water and nutrient cycling in coniferous forests of the Pacific Northwest, USA

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Comprehensive conceptual frameworks of ecosystem processes benefit greatly from periodic redevelopment because continued refinement of basic disciplinary understanding can quickly render existing frameworks out of date. This process of revisitation is a key feature in the continued development of ecohydrology because it facilitates the identification and quantification of key ecosystem components involved in the interaction between water, solutes and landscape elements. This paper outlines recent work at the HJ Andrews LTER in the Pacific Northwest of the USA designed to synthesize, through a numerical modelling approach, knowledge pertaining to cycling of water, nitrogen, carbon and sediment.

This synthesis was undertaken primarily at the 10.2 ha catchment (WS10) where (1) there are clearly multiple processes and components involved ecosystem cycling, (2) multiple disciplinary scientists working in same catchment, with limited understanding of each others' work, (3) long-term records of inputs, outputs, and events are well documented, and (4) key components of cycling (including for example the role of DON in the nitrogen budget) are not included in standard ecosystem models. The ecosystem model structure that resulted from the synthesis effort (which included soil biogeochemistry, watershed hydrology, plant physiology, climate science, forest ecology, geomorphology, groundwater, and stream ecology) was calibrated against measured discharge and nitrogen export response, as well as against various internal measurements (both 'hard' and 'soft' data) of the system. Simulations were then utilized to evaluate a set of hypotheses related to temporal variations in the relative importance of system components in the processing of water, nitrogen, and carbon. In addition,

the model is utilized to help quantify existing process uncertainties, as a mechanism to direct future measurement needs.