Using R for systems understanding – a dynamic approach

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The *R* system is not only a statistics and graphics system. It is a general-purpose high-level programming language that can be used for scientific computing in general. It is increasingly superseding conventional spreadsheet computing and became one of the standard environments for data analysis and modeling in ecology. An increasing collection of packages explicitly developed for dynamic modeling (**deSolve**, **simecol**, **FME, ReacTran,** cf. Soetaert et al 2010) and a growing number of textbooks teaching systems understanding by using R examples (Bolker, 2008; Soetaert and Herman, 2009; Stevens, 2009) are just an indicator for this trend.

The contribution will focus on practical experience with implementing and using dynamic models in R from an ecological modeler's perspective who works together with field and lab ecologists. Here, dynamic models play an essential role for improving qualitative and quantitative systems understanding. Aspects of two different case studies with increasing level of complexity are presented to demonstrate different application scenarios and modeling techniques:

- A model of semi-continuous laboratory cultures using package **deSolve** and the event mechanism,
- A water quality model for a polluted river using package **ReacTran** for transport and a compact representation using stoichiometric matrices (Peterson matrices) for matter turnover (cf. Reichert and Schuwirth, 2010).

The examples are organized in package **simecolModels**, a collection of simulation models that cover the range from teaching demos up to the ecosystem level. It is discussed how model implementations can be organized in a readable and computation-efficient way and how the model outcome can be visualized.

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