



Jul 1st, 12:00 AM

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Volk, Martin; Schulz, K.; Seppelt, Ralf; and Lautenbach, Sven, "Model-based identification and scaling indicators of landscape processes: State-of-the-Art and problem-oriented solutions" (2006). *International Congress on Environmental Modelling and Software*. 448.

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# Model-based identification and scaling indicators of landscape processes: State-of-the-Art and problem-oriented solutions

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**Abstract:** The ability to transfer processes, local conditions and assessment methods between different spatial scales plays an important role in various fields of environmental sciences and planning practice. Besides a fundamental lack of general scaling theories different approaches are currently used and investigated. First, local scale process understanding is simply used at larger scales and spatial explicit information are derived by suitable indicators or transfer functions. In order to represent small scale spatial variability at larger scales sophisticated aggregation methods have been developed, but due to very restrictive assumptions, have only successfully been applied in very few areas (e.g. groundwater hydrology). In some application down-scaling methods are needed in order to disaggregate coarser information (e.g. from remote sensing or climate forecasting). A second approach currently explored is the derivation of scale dependent process formulation and parameterisation from information at the scale of interest. Currently, most of the studies in environmental sciences are concentrated on up-scaling approaches defined by the translation or extrapolation of information from small scales to landscape or regional scales. The inverse approach of scaling down or disaggregating larger scale information is less commonly applied in research. However, both approaches - scaling down and scaling up - are necessary and have to be combined in order to achieve problem-oriented solutions for an integrated environmental analysis for all spatial scales. The presentation summarizes the recent main research questions to be answered and presents potential solutions with the view on the different perspectives in environmental assessment and modelling. Presented examples from regions of different sizes will include i) pragmatic scale-specific methods, ii) data-based and robust model approaches and iii) procedures combining semi-distributed and spatially explicit models.

**Keywords:** Scaling methods; landscape processes; Modelling