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Identifying Tipping Points in the Supply of Ecosystem Services in Rural Environments of South-East Asia

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Abstract

The expansion of large-scale plantations has a major impact on tropical and subtropical landscapes, and in turn on their inhabitants. Especially in rural south-east Asian regions, characterised by agriculture and forestry, people are highly dependent on the supply of ecosystem services (ESS) and the preservation of ecosystem functions (ESF) in order to maintain their livelihoods in the long term. The assessment of ESS has considerably gained momentum concerning both scientific studies, but also political decision making processes. We use the ESS concept to analyse the impact of potential future land use trends on a wider range of interdisciplinary topics. In this context, we introduce a methodology for incorporating multidisciplinary modelling and statistical analysis in order to identify tipping points in the provisioning of ESS. The tipping point analysis includes hydrological, agronomical and climate-regulation services, as well as multiple facets of biodiversity. The evaluation of temporal trajectories in the provisioning of ESS and their potential tipping points allows us to estimate Safe Operating Spaces (SOS) within our example dataset. The geographical focus of this dataset is the Naban River Watershed National Nature Reserve (NRWNNR) in the Xishuangbanna prefecture, Yunnan province, PR China. By combining multiple SOS, according to each of the modelled ESS, we define a framework of multi-topical Safe Operating Spaces. Structured approaches for the integration of transdisciplinary aspects into assessments are currently not well adapted to the needs and abilities of interdisciplinary modelling. The development and field testing of such a methodological framework for information transfer from stakeholders to science and vice versa is therefore an integrated part of this study. We offer researchers a tool to analyse potential critical thresholds and assess the socio-ecological resilience related to land use change, both ex-ante and ex-post. Our results contribute to an improved understanding on how to identify, evaluate and communicate the effects that human interventions have on the provisioning of ESS/ESF in the analysed systems considering questions of scale, modelling bias, resilience and off-site effects.

Keywords: Ecosystem services, environmental thresholds, safe operating space, socio-ecological resilience, tipping points