Trade-off analysis of forest ecosystem services – A modelling approach

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Abstract

Forest is a resource that is increasingly utilized for multiple purposes. The balance between resource and energy demands and the long-term capacity of ecosystems to support biodiversity and other ecosystem services is crucial. The aim of this project was to increase the knowledge on and to develop methods and tools for trade-offs and synergies analysis among forest ecosystem services based on different forest management policies.

Paper I provides an overview of existing models for integrated energy-environment assessment. A literature review was conducted on assessment models and their ability to integrate energy with environmental aspects. Missing environmental aspects concern land use, landscapes and biodiversity. In Paper II a modelling framework was set up to link a landscape simulator with a habitat network model for integrated assessment of bioenergy feedstock and biodiversity related impacts in Kronoberg County. In Paper III we continued with the same management scenarios, while the analysis was expanded to five ecosystem services by developing the Landscape simulation and Ecological Assessment (LEcA) tool: industrial wood, bioenergy, forest carbon stock, recreation areas and habitat networks. In Paper IV we present two heuristic methods for spatial optimization – simulated annealing (SA) and genetic algorithm (GA) – to find optimal solutions for allocating harvest activities, in order to minimize the impacts on habitat networks. In Paper V, as response to the findings in Paper I, we linked the energy model MESSAGE with our LEcA tool for ecosystem services assessment, in a study of Lithuania.

We found trade-offs between industrial wood production and bioenergy on one side, and recreation values, biodiversity, and to some extent carbon storage on the other side. The LEcA tool integrated forest simulation and management with assessment of ecosystem services, which is promising for integrated sustainability assessment of forest management policies.

Key Words