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Global power production scenarios to 2050 and the dual role of forests: Accelerated climate damage or regulating and provisioning ecosystem services?

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The worlds' electrical power production is depending on the current energy infrastructure, and future investments in new power supply facilities using renewable and non-renewable energy sources. Continued growth in power production in the 21st century will cause global environmental change (GEC). GEC with climate change as an important driver will affect the environment and the economy in multiple ways that can be summarized as losses of biodiversity and changing ecosystem services (ES), but with very diverse temporal and spatial impacts. In a simple global growth model for power production, including non-renewable and renewable energy sources, the potential role of forest biomass is investigated. The demands for forest ecosystem services imposed by the global power production are assessed in the present study. Three global power supply scenarios to 2050 with different emphasis on bioelectricity from forest biomass and the associated environmental impacts are outlined using LCA unit process data. The power production is used as a simplified proxy for the global energy supply. It is assumed that the most suitable land under each scenario is reserved for food production, and that changes in human diets can satisfy the food demand in this way. It is further assumed that the transport system is electrified and that mobility is satisfied by the electricity produced. The scenarios outline the combined pressures from increasing atmospheric GHG concentrations, nitrogen enrichment, acidification, and land use changes on global forest areas. These pressures will increase the need for versatile forest management systems. The management options for provisioning ecosystem services (e.g. bioelectricity as a combined mitigation and adaptation strategy) and regulating ecosystem services delivered by forests are discussed under each change scenario.