

# ***ECOSYSTEM SERVICES IN FOREST SECTOR MODELS: A REVIEW***

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## **Overview**

Forests provide a number of ecosystem services, such as sequestration of atmospheric carbon, water regulation, and the cycling of nutrients. They also provide recreation and beautiful views and are home for a large number of plants and animal species. However, forests also provide valuable resources for the milling, paper, and energy industries. There are a lot of opposing claims to the resources of forests and not all of these would be heard on an unregulated market. A policy-maker looking to take all costs and benefits of forests therefore has many aspects to take into account.

A particular complication is that the many ecosystem services that a forest offers are difficult to value in monetary terms, as opposed to the more tangible goods produced by the forest industries. Without valuing them however, it is easy to overlook the benefits these services provide and intensive deforestation may be favoured. The valuation of ecosystem services is therefore an important topic in forest economics and one that was largely overlooked before the 1990's. Studies on the valuation of ecosystem services have become more common in recent years, and for forest based ecosystem services, such studies often ties to the emerging market for energy from forest biomass . A common focus of these studies is to examine the net carbon dioxide emissions of biofuels when the carbon sequestration of forests is taken into account (Bjørnstad and Skonhøft2002).

Besides carbon sequestration of forests, there have also been studies on other areas such as the impact of deforestation on recreation in forests or valuation on the preservation of biodiversity in old growth forests (Hagen, Vincent et al. 1992, Baerenklau, Gonzalez-Caban et al. 2010). However, while individual studies on ecosystem services have been done, there have been few attempts to integrate such assessments into more general models of the forest industry. A reason for this may be the differences between ecosystem services provided by forests in different areas, making detailed geographical modeling necessary to draw conclusions from the benefits provided by the services. Ecosystem services is likely to be an important factor in future research, at least if the current trends of increasing environmental awareness continues, and this paper aims to present the current research situation and suggestions on how to move it forward.

## **Methods**

The purpose of this paper is to analyze how ecosystem services and their value have been integrated into spatial forest sector modeling and determine the areas where future research is most needed. This will be achieved through a literature review which will focus both on how ecosystem services from forests have been valued, and on the extent such valuation has been addressed in economic models of the forest sector. Because the supply of many ecosystem services depends on the local geography in and around the forest that provides them, there will also be an examination of how the spatial dimension has been integrated in forest sector models.

## **Results**

Expected results include finding that there is a lack of studies that integrate ecosystem services into forest sector models. Early findings are indicating that this is the case. A specific finding is that most studies that consider ecosystem services of forests, mainly focus on carbon sequestration. A reason for not focusing more on other ecosystem services may be because they are difficult to value as well as they are dependent on the specific geography of the forest in question and that therefore it is difficult to generalize the value of these services into a larger scale.

## **Conclusions**

The main expected conclusion is that this is an area where more research is needed. The review hopes to find specific suggestions of what future research should focus on.

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