TREES IN EUROPEAN CROP FIELDS: DETERMINING THE TRADE-OFFS IN PROFITABILITY AND ECOSYSTEM REGULATION

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In Europe, the density of trees in arable fields can affect both profitability and ecosystem regulating services such as groundwater supply, control of soil erosion, and carbon sequestration. Because of uncertainty concerning the effect of trees in arable fields, the European Commission funded a three-and-a-half year project entitled "Silvoarable Agroforestry for Europe" which finished in January 2005.

Computer models were developed in the project to evaluate both the biophysical and economic performance of arable, forestry and silvoarable systems under different European conditions. A biophysical model called "Yield-SAFE", based on daily light and water resource use, was developed to predict long-term arable, forestry and silvoarable yields for given sets of climate and soil conditions. The model can also be used to estimate crop cover, groundwater flow, nitrogen leaching, and carbon sequestration. A plot- and farm-scale economic model called "Farm-SAFE" was developed to determine profitability. These models were parameterised and used for selected sites in France, Spain and the Netherlands.

The economic analysis suggests that walnut and poplar silvoarable systems can provide a profitable alternative to arable and forestry systems in France. At the Spanish sites, where the tree species were restricted to oak and stone pine, agriculture was usually the most profitable system. However a simple financial analysis ignores the potential environmental benefits and costs of implementing agroforestry. The use of the "Yield-SAFE" model with the Revised Universal Soil Loss Equation predicts that introducing trees into arable fields would reduce soil erosion. The initial use of the model also indicated that introducing trees would reduce nitrate leaching and groundwater recharge and increase carbon sequestration. Although these results require validation, the model provides a systematic framework for quantifying such effects.