



## Article

# Implementing Climate Change and Associated Future Timber Price Trends in a Decision Support System Designed for Irish Forest Management and Applied to Ireland's Western Peatland Forests

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**Abstract:** *Research Highlights:* Predicting impacts on forest management of Climate Change (CC) and dynamic timber prices by incorporating these external factors in a Forest Management Decision Support System (FMDSS). *Background and Objectives:* Forest managers must comply with Sustainable Forest Management (SFM) practices, including considering the long-term impacts that CC and the bioeconomy may have on their forests and their management. The aims of this study are: (1) incorporate the effects of CC and Dynamic Prices (DP) in a FMDSS that was developed for Ireland's peatland forests, (2) analyse the impact of global climate and market scenarios on forest management and forest composition at the landscape level. *Materials and Methods:* Remsoft Woodstock is a strategic planning decision support system that is widely used for forest management around the world. A linear programming model was developed for Ireland's Western Peatland forests while using Woodstock. Data from Climadapt, which is an expert-based decision support system that was developed in Ireland, were used to include CC effects on forest productivity and species suitability. Dynamic market prices were also included to reflect the changing demands for wood fibre as part of the European Union (EU) and global effort to mitigate CC. *Results:* DP will likely have more impact on harvest patterns, volumes, and net present value than CC. Higher assortment prices, especially for pulpwood, stimulate the harvesting of forests on marginal sites and off-set some of the negative CC growth impacts on forest profitability. *Conclusions:* Incorporating CC and bioeconomy prices in a forest decision support system is feasible and recommendable. Foresters should incorporate the expected global changes in their long-term management planning to mitigate the negative effects that un-informed management decisions can have on the sustainability of their forests.

**Keywords:** linear programming; optimization; bioeconomy; Woodstock; Remsoft spatial planning software

## 1. Introduction

Industrialism and a growing agrarian population had reduced Ireland's forest cover to 1.5% in 1908 [1]. The necessity of a domestic timber supply caused the Irish state to initiate an afforestation programme, which largely focused on purchasing agriculturally marginal land for public afforesting [2–4]. Since the late 1990s, afforestation has been primarily on private land and the forest cover in 2017 reached 11%, or 770,020 ha [5]. Inexpensive and agriculturally marginal land often meant mountainous blanket peat. Ploughing for draining and the application of phosphatic rock fertiliser for mineral nutrients enabled the establishment of hardy, fast-growing conifers from Western North America on the wet and nutrient poor blanket peat [6]. In 2012, 35.6% of the public forest and 30.2% of

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