Transformation to continuous cover forestry in Ireland: the effect of gap size on growth of underplanted trees in Sitka spruce plantations

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INTRODUCTION

Most Irish forests are even-aged plantations managed under the clearfelling silviculture system. National and European forest policy promotes the transition to more environmentally sustainable forest management systems such as Continuous Cover Forestry (CCF), which typically relies on natural regeneration to restock trees. In cases where natural regeneration is unsuccessful or management aims to introduce new species, underplanting represents a viable method to introduce the greater tree species richness. However, there are currently no established guidelines in Ireland on the appropriate levels of overstory canopy retention to ensure the success of underplanted tree species.

Fig. 1: Study sites locations in the Dublin mountains. The red dots show the locations of coupes, the cluster on the left is Cruagh forest and the cluster on the right is Ballyedmonduff forest.

The ContinuFor project aims to address this knowledge gap through a multi-species underplanting study. This aim of this study is to assess the relationship between canopy openness in stands of Sitka spruce and the survival, growth, and health of underplanted trees.

AIMS

1. Determine the influence of canopy openness on the survival and growth of underplanted trees.

2. Determine the physiological adaptation of the underplanted tree species to different light environments.

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METHODS

- 4 species of trees with varying shade tolerances were chosen: *Quercus petraea, Fagus sylvatica Pseudotsuga menziesii and Thuja plicata.*
- 20 coupes of broadleaf & 20 coupes of conifers were established in gaps of varying sizes within Sitka spruce plantations managed under CCF principles.
- Canopy openness above coupes was measured using hemispherical photography.

Figure 2: Hemispherical photos showing contrasting canopy openness levels.

- Dark- adapted chlorophyll fluoroscence data was collected using the Fluorpen FP100
- Leaf thickness of all species and SPAD data for broadleaves was collected using a MultispeQ instrument.
- Leaf samples of conifers were collected on dry ice and frozen at -80°C for chlorophyll content analysis by acetone extraction.

Fig. 3: example of coupe of 8 saplings in Cruagh woods, protected by trees guards.

INITIAL RESULTS

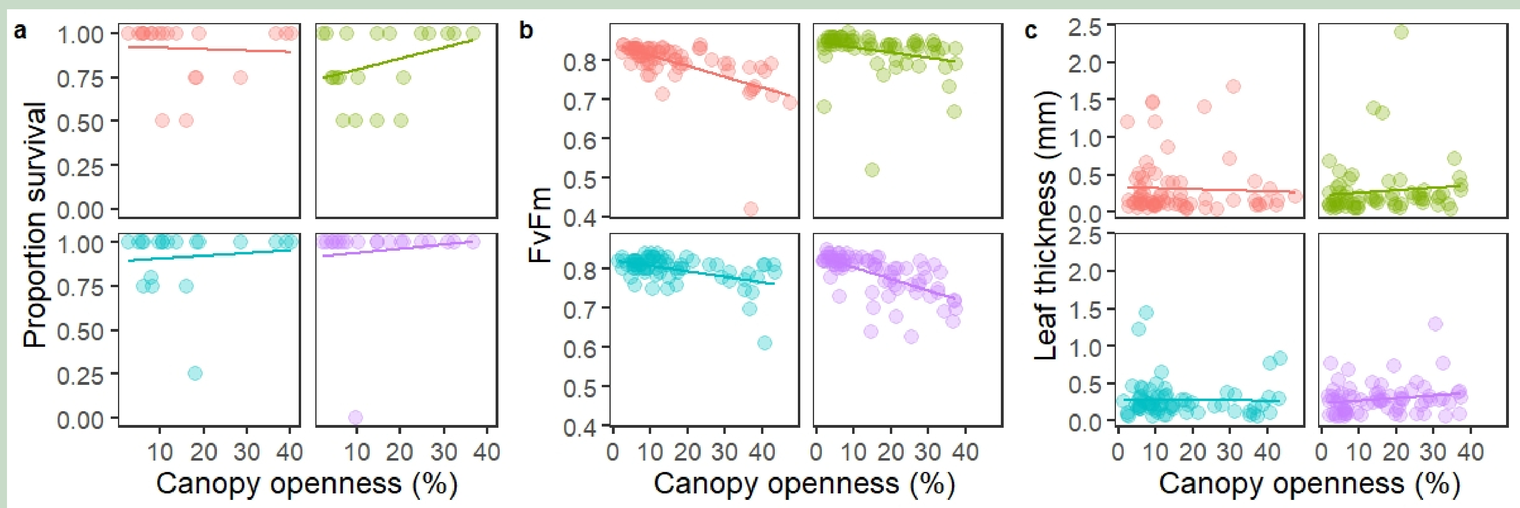

Fig. 4: The relationship between canopy openness & a) proportion survival, b) maximal yield of photosystem II (Fv/Fm), & c) leaf thickness

- Canopy openness ranged from 1.5% to 47.37%.
- Four months after planting - high overall survival rate of seedlings (87%)
- Trend towards greater survival of seedlings in larger canopy gaps, especially Douglas fir.
- Fv/Fm decreased as canopy openness increased
- At this early stage, little evidence of leaf morphological adaptation to canopy openness

EXPECTED OUTCOME

Determining the levels of canopy openness that promote optimal growth & survival of these underplanted trees will offer valuable insights into the use of underplanting to enhance the resilience in Sitka spruce stands in the face of climate change.