UMEÅ UNIVERSITET

Optimal thinning
A Theoretical Investigation
on Individual-Tree Level

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av filosofie doktorsexamen framläggs till offentligt försvar i MA121, MIT-huset,
fredagen den 29 mars, kl. 09:00.
Avhandlingen kommer att försvaras på engelska.

Fakultetsopponent: Professor Per Lundberg,
Biologiska institutionen, Lunds universitet, Lund, Sverige.

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Title

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Abstract

Sweden's land area is estimated to 40 million hectares, out of which 28 million hectares are covered by forest (70%). With this fact in mind, it is no wonder that forestry plays a major role in Swedish industry. New technology and methods from remote sensing, such as LIDAR, are becoming more prevalent in forestry, the ability to assess information on a detailed scale has become more available. This type of data opens up for using individual-based models for practical precision forestry planning. In this thesis I constructed an individual-based growth model and fitted and validated the model against empirical data. I used the model to provide new insight into how the spatial evenness between trees after thinning and size selection impact the merchantable wood production and the net present value of a stand. I also present a new method to determine forest management planning on a single tree-level basis such that the economic return of a given stand is maximized. The main conclusion was that changing the spatial evenness and size selection improved the net wood production and net present value of the stand up to 8% and that the optimal management strategy was superior to a conventional thinning strategy (20% more in economic return). My results are derived assuming perfect information on the position of individual trees and growth according to the parameterized individual-based model; the extent to which they carry over to practical forestry remains to be determined. Although the main focus was an economic optimization, the same method can be applied for optimization of other or additional goals, such as environmental and social values.