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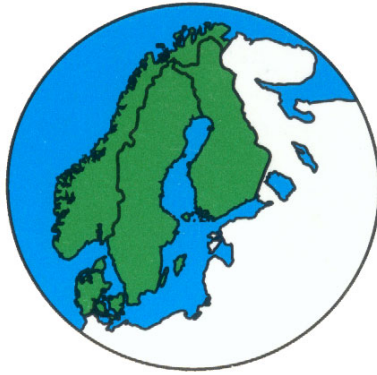
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**Finn Helles and Petrine Steen Nielsen (eds.)
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ABSTRACTS

The Fuel for Land Use Change

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There are three major forces causing land use changes: exurban housing, rising developing country income, and biofuels. All three of these causes can trace their roots to increased income. Exurban housing uses upwards of 2 hectares of land per family and becomes feasible with a very modest taste for rural life and increased income. Developing countries demand for food and for protein drove a boom in commodity prices and threatens to do so again as the recovery takes hold. Biofuels themselves are partially a reaction to record petroleum prices driven by increased demand. All of these factors increase the demand for land for productive uses and threaten to replace natural uses both in developed and developing countries.

Volvo Theorem Revisited

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The “Volvo Theorem” provides an alternative harvesting model to the standard Faustmann Model of optimal harvesting. Under the Volvo Theorem landowners harvest timber when faced with non-forestry expenses such as the purchase of a new Volvo, rather than choosing to harvest at the age that maximizes NPV. The plausibility of forest landowners adopting a Volvo management regime increases when credit is constrained. The recent financial crisis has resulted in constrained credit in the U.S. and Europe. Here a simple model that incorporates some of the characteristics of the recent financial crisis into a Volvo model of forest harvest is presented. These characteristics include an expected tightening of credit, asymmetrical credit tightening among forest landowners, and negative real interest rates.

An Economic Analysis of Forest Rotation without Interest Rate – Setting the Scene

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Since 1849 the Faustmann model – in its basic or extended form – has been bedrock in forest management decision making regarding when to cut timber. Interest rate is one of the decisive variables in the Faustmann model. In a zero interest rate situation or an Islamic economy, the Faustmann model can no longer provide solution to the rotation problem. The purpose of this paper is to find a solution to the forest rotation problem when the interest rate is zero or from Islamic perspective. This is a theoretical study with ethico-economic approach to socio-economic issue like forest rotation problem. It begins with a review of literature on mainstream financing and Islamic financing. Suitable modes of financing will be identified in each case. The study will show that venture capital seems ideal for conventional financing, while musharakah and mudarabah seem promising for application of Islamic finance in forestry.

Keywords: profit and loss sharing, forest rotation, venture capital, Islamic finance, interest rate.

An integrated MCDA software application for forest planning: a case study in Southwestern Sweden

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Forest owners have often several objectives for their forest property. In Sweden, economic profit from timber production is usually the most prominent one. Forest planning translates thus usually to planning of timber production. Other objectives, such as biodiversity, maintaining pleasant sceneries or recreation possibilities, are more rarely included in the planning process. Multi-criteria decision analysis (MCDA) methods provide a way to take also these non-monetary values into account in planning.

In this study, we introduce a new MCDA software application PlanEval, which is part of Heureka, a recently developed forest decision support system. The software helps the decision maker to evaluate forest plans against his/her objectives in a structured and analytical manner. As a result, the analysis provides a ranking of the alternatives based on individual preferences of the decision maker. As PlanEval is integrated in the forest planning system, all data of the plans is available during the MCDA process and how it is presented may be adjusted during the analysis.

The main purpose of this study was to assess the potential of PlanEval as a tool for practical forest planning. This was done with a case study, where a manager of large forest estate in Southwestern Sweden used the program to compare different forest plans made for the estate. The objective hierarchy against which the plans were evaluated included variables for tree species diversity, timber production and recreation. During the comparison we observed the MCDA process and performance of PlanEval with respect to data treatment, MCDA method and usability of the program.

The case study helped to identify both strengths and weaknesses in the software, which is still under evaluation. Direct database access made it possible to investigate an objective from several perspectives. The decision maker found the possibility for different data views, such as maps and charts, useful and it was quite easy to navigate between different them. However, the abundance of data also posed problems as the user was not familiar with all data available in the planning system and found it sometimes difficult to find desired variables. The MCDA method itself was relatively confusing for a user with no previous experience with the process. The analysis provided a ranking of alternatives which satisfied the decision maker, but it may be questioned if the same results may have been obtained also without the MCDA process. On the other hand, the process helped the decision maker to understand his objectives and the trade-off between them in detail.

Varying levels of information and strategies for adapting forest management to climate change

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Adaptive management has for a few decades been analysed within forestry and it has been shown that relatively large gains are possible. Nevertheless, we often see that managers do not take a fully forward looking perspective

when managing under uncertainty. This could be because the risk is too unknown as may be the example with climate change, or because it is too complex to handle, or because it is easier to relate to what is on the table than what may potentially come. Consequently, inoptimal decisions are likely to occur – even if they are optimal for the given level of information considered.

In this paper we focus on climate change and the possibilities for adjusting tree species as climate develops and other species may outrank than the presently best performing ones. We identify four categories of adaptation behaviour ranging from the manager who keeps with what is best to the one who is fully forward looking, taking all present knowledge into account. We discuss under which conditions the different agents are likely to be present. We analyse the economic impact this may have based on a stylised example and use this as a basis for discussing on a regional level.

Generating top-level plans in hierarchical forest planning – the case of Metsähallitus

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This study presents alternative approaches to producing top-level plans in a geographically hierarchical strategic forest planning situation. Alternative plans are first produced at the bottom level (regional level) and subsequently, top level plans are generated from them by adopting principles from the bottom-up, top-down and integrated approaches. The top-down approach allocates resources optimally with respect the organization's top-level objectives. In the bottom-up approach, local decision making plays a remarkable role, and the top-level solution can be produced by simply summing up the selected local-level plans. The integrated approach, in turn, combines elements from both the top-down and the bottom-up approaches.

The approaches were tested and evaluated in a multi-objective natural resources planning case study conducted at Metsähallitus, the organization that administrates forests owned by the Finnish state. Data from the most recent regional natural resources planning processes (carried out during years 2004–2008) were utilized in creation of alternative country level

forest plans. The data included a small number of predefined strategy alternatives for each of the six planning areas. In addition, the effects of these alternatives were described through a small number of decision criteria.

The results show that the currently applied bottom-up approach, which provides regionally optimal and accepted strategies, does not result in the most efficient utilization of the resources of Metsähallitus. However, the bottom-up approach carries a lot of process advantages, including wide approval of the plans by regional stakeholders and local residents. For future planning projects, at least illustrative calculations using the top-down approach would offer decision support for the country level target setting. In addition, adopting a more integrated approach to actual regional natural resources planning processes is recommended for the development of a new Metsähallitus level strategic planning approach. This, however, indicates that the regional planning processes should be conducted at the same time so that the decisions of and the interdependencies between the regions could be better taken into account at the top-level.

Keywords: strategic forest planning, top-down approach, bottom-up approach, integrated approach

Cost-efficient small-diameter wood harvesting method in early thinnings

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The integrated harvesting of industrial roundwood and energy wood by the “two-pile cutting method” has increased steadily in young forests of Finland during the past two years. Field studies carried out by Metsäteho Oy and TTS Research have: i) determined the time consumption and productivity of cutting work when using integrated cutting of first-thinning wood, ii) clarified the development of the total removal in integrated harvesting operations, and iii) investigated the quality of pulpwood logs when using integrated cutting with multi-tree handling. The studies indicated that the total removal with integrated wood harvesting increases significantly compared to that of conventional, separate roundwood harvesting from early thinnings. When the total removal of the harvesting site increased

considerably, there was a significant increase in the productivity of cutting work of integrated wood harvesting compared to the situation in separate pulpwood harvesting. In addition, the delimbing quality and bucking accuracy of the pulpwood logs obtained in multi-tree processing were comparable to those produced in single-tree handling. As the field studies indicated, promising results from integrated wood cutting and integrated harvesting are likely to continue to increase in all thinning operations.

An optimization model for a mixed species stand management with determination of the harvest sequence under uncertainty

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Economic management conditions such as the interest rate or the risk aversion of a decision maker should be analyzed, and then a decision about a mixed species stand management or a pure stand management can be recommended. On the one hand the pure stand management could have the possible financial benefit to create a higher yield. On the other hand the mixed species stand management could decrease the risk of the investment. The model for a mixed species stand management includes risks regarding timber price volatility and failure by natural hazard. A diversification effect may be created by mixing different tree species as well as different age classes harvested such as a thinning or a final cut. The decisions about the allocation of proportions of the stand area to tree species and to sequence of final harvests will be optimized. For an evenaged stand management, these results also determine the optimal rotation period of the total stand. Choosing a mixture of different tree species and different harvesting operations will initiate a change to a near-natural development after some generations. With such a procedure the stand is more independent from the risks of the natural hazards and the timber price volatility.

Potential impacts of international regimes for biodiversity protection and carbon sequestration in forestry – a quantitative approach

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We apply a quantitative bio-economic forest optimisation model to analyse (i) the potential *impacts* on a Norwegian forest of two international regimes (the Convention of Biological Diversity, CBD, and an extended version of the Kyoto Protocol), and (ii) the weak and strong points in using such modeling in this type of impact studies. The impacts of CBD is included through three pre-defined biodiversity protection scenarios reflecting three levels of potential influences from the regime, and the impact of the Kyoto Protocol version is incorporated by introducing prices for the value of net fixation of atmospheric CO₂, ranging from 0 to 1000 NOK per ton of CO₂.

This approach makes it possible to quantify in a consistent manner several interesting impacts of the regimes related to sustainable forestry, like the forest's distribution over time on species, age classes, growing stock, and deadwood, as well as income generation. The model results indicate that each of the two regimes may have strong impacts on forestry and the forest ecosystem, and that a mutual relationship exists between the two regimes in the meaning that the stronger one of them is implemented, the lower marginal impact has the other. The results are most sensitive to the following factors, which should be investigated further in future research: the forest biological growth and mortality functions, the behavioural assumptions and the market impacts of large changes in harvested volumes. We conclude that this modelling approach seems promising for *ex ante* quantification of potential national impacts of international regimes, but due attention should be given to the underlying assumptions.

Keywords: Bio-economic modelling, international agreements, regime effectiveness, forest policy, Kyoto Protocol, CBD