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Economic Simulation of Plantation Forestry

Summary

If a financial incentive for sequestering carbon in planted forests was put in place, how would it influence the economics of forestry? To answer this important question, a prototype model was developed that simulates individual land owner responses, and scales this up to a national level. The tool is designed to aid land owners and policy makers, and provides projections of land use, timber supply, carbon sequestration and forest management changes under alternative carbon price scenarios.

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Economic Simulation of Plantation Forestry under a Scheme to Reward Carbon Sequestration

Introduction

The Emissions Trading Scheme (ETS) – or any scheme to reward carbon sequestration – is important to forest owners as it represents a new (and potentially high value) source of income (e.g. Maclaren et al., 2008). To aid forest owners – and guide policy makers – a prototype model was developed to simulate the potential outcomes of a scheme such as the ETS, in terms of changes to land use, carbon, and timber supply.

Development of the Economic Simulation Model

The model was based on an approach developed in Turner *et al.,* (2008), which assessed the economic viability of alternative forest management options under an ETS. A workshop was held with stakeholders from industry and research institutes to identify key issues around the ETS that would be translated into modelling variables. The model optimises land use (plantation forestry and agriculture) and forest management (rotation and silvicultural regime), to maximise economic return (measured by land expectation value) in each period.

The economic model is combined with a statistical model of land owner reluctance to change land use; represented as 'stickiness'. Stickiness encapsulates the multitude of decisions that affect land use which cannot be expressed on an individual basis, but may be approximated statistically on a national scale. If we assume that nationally, a large area of land is profitable in an alternative use then stickiness dictates that only a given proportion will actually convert in a given year.

Uses of the Economic Simulation Model

The tool's primary purpose is to demonstrate the potential implications of an ETS on the forest value chain. Alternative scenarios can be run around carbon and timber prices, and the implications for land use, carbon and timber supply, examined. This information is useful for forest owners, as it shows the potential trends in carbon and timber supply under a carbon regime and the economically-optimal management that achieves these. The information is also useful for policy makers in assessing the potential impacts of regulations on land use and management decisions, and hence carbon sequestered.

Results

Validation of the model against historical planting data (MAF 2007) suggests that the model is 74% successful at predicting new planting rates from 1997 to 2008, as well as predicting the trend away from clearwood to sawlog regimes. The model shows that New Zealand is due for a large carbon deficit as stands planted during the 1990s boom reach maturity. However, this effect is delayed and spread out if the price of carbon were to increase (Figure 1) leading to a lengthening of rotations. In subsequent years additional carbon is sequestered due to a change to higher carbon regimes (less silviculture) and expansion of the area in planted forest.

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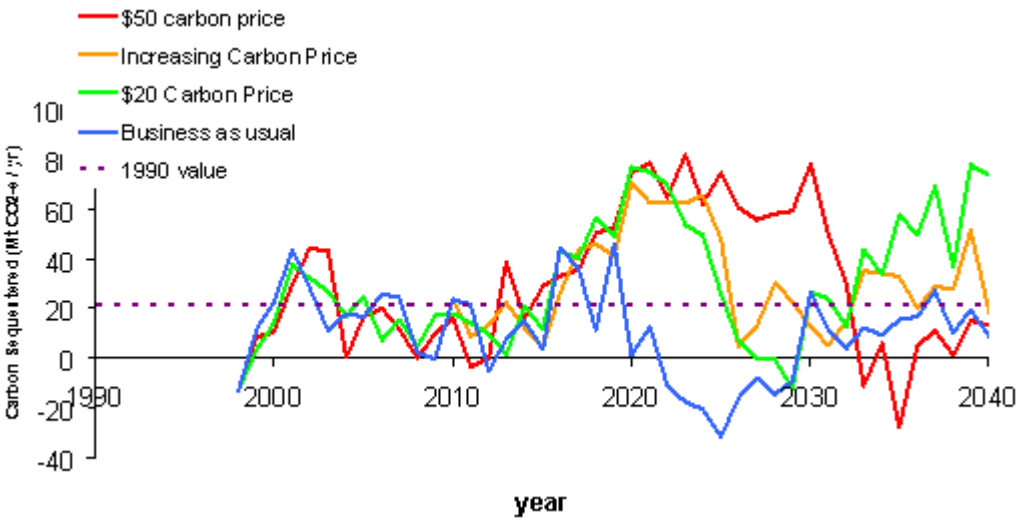

Figure 1 – Projected Carbon Sequestration from 1998 to 2040 incorporating Land Use Change under four different scenarios

Conclusions

The model shows that it is economically better to change land use from low-value pastoral to forestry at higher carbon prices, but the reluctance to change, represented by 'stickiness', dampens this land use change. For New Zealand to sequester significantly more carbon, a decrease in the reluctance to change land use into forestry is required. If this is achievable, New Zealand has a large capacity to sequester carbon and profit from an ETS.

References

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