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# Modeling the Impact of Carbon Trading Legislation on New Zealand's Plantation Estate

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- Final Year students at School of Forestry

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# Management Case Study

- Course done by all final year BForSc students.
  - Students act as consultants to a forestry company
  - 2008 clients
    - Ministry for Agriculture & Forestry
    - Blakely Pacific Limited
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# Outline

- New Zealand's Kyoto obligations
  - Post-1989 "Kyoto Plantations"
    - Carbon benefits & liabilities
  - Impact of carbon trading on forest profitability
  - Potential impact on
    - Forest management
    - Afforestation
  - Consequences for meeting NZ obligations
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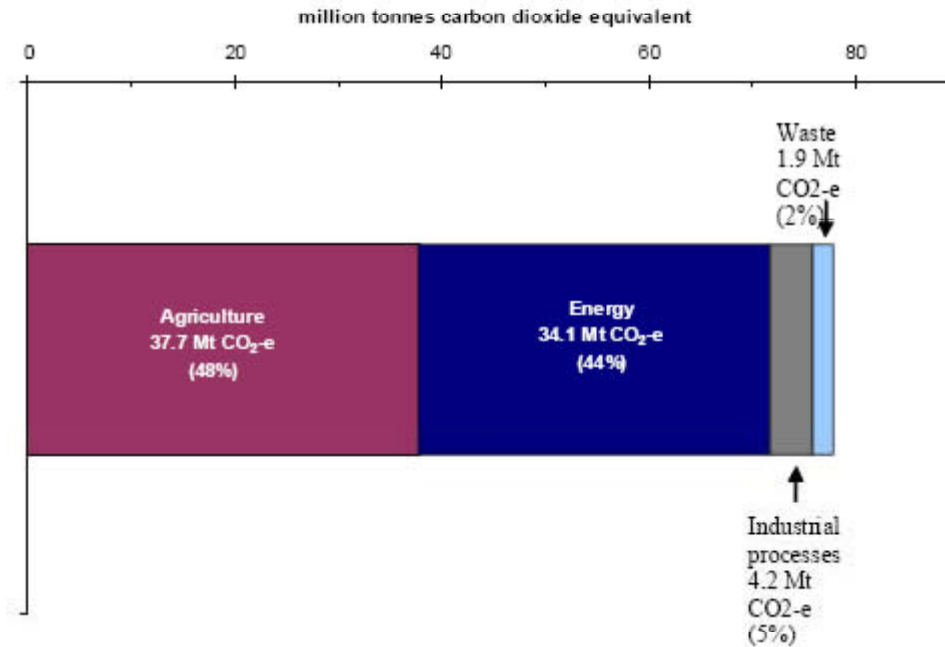
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# Kyoto Protocol

- NZ has made commitments to reduce its net emissions during CP1 (2008-2012) to the level of its gross emissions in 1990.
  - NZ gross emissions in 1990 were 61.9 million t CO<sub>2</sub>.
  - Net emissions target for 2008-2012
  - = 5 \* 61.9 = 309.6 million t CO<sub>2</sub>
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**Figure 2: New Zealand's sectoral emissions in 2006**

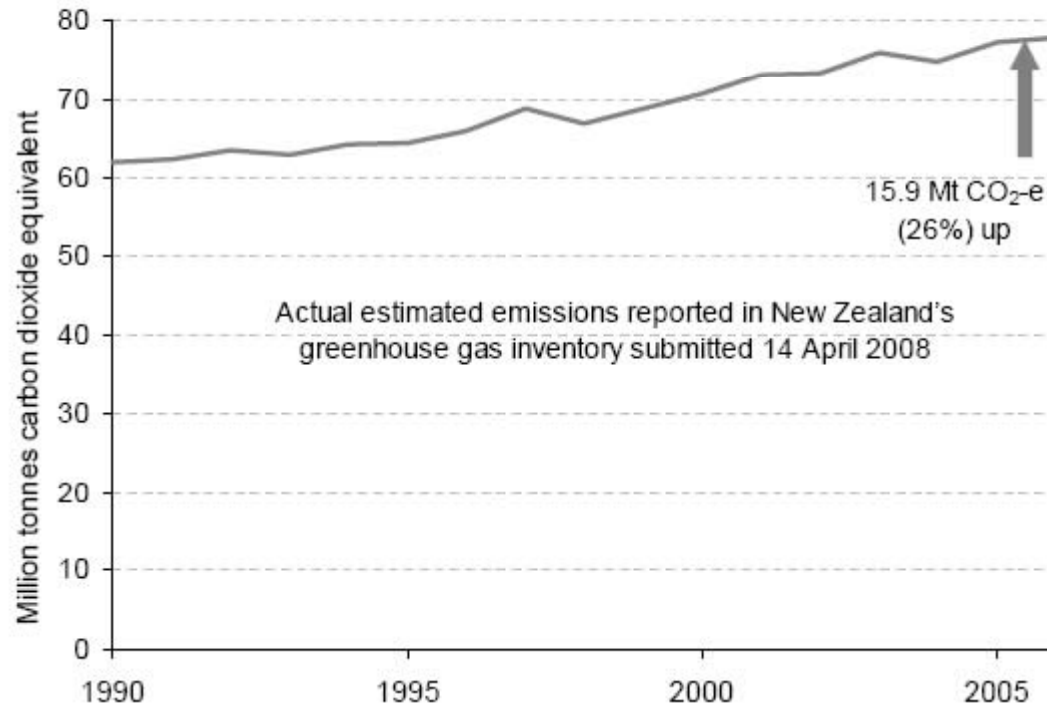
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Source: Ministry for the Environment (2008 a)

**Figure 1: New Zealand's total emissions 1990–2006**

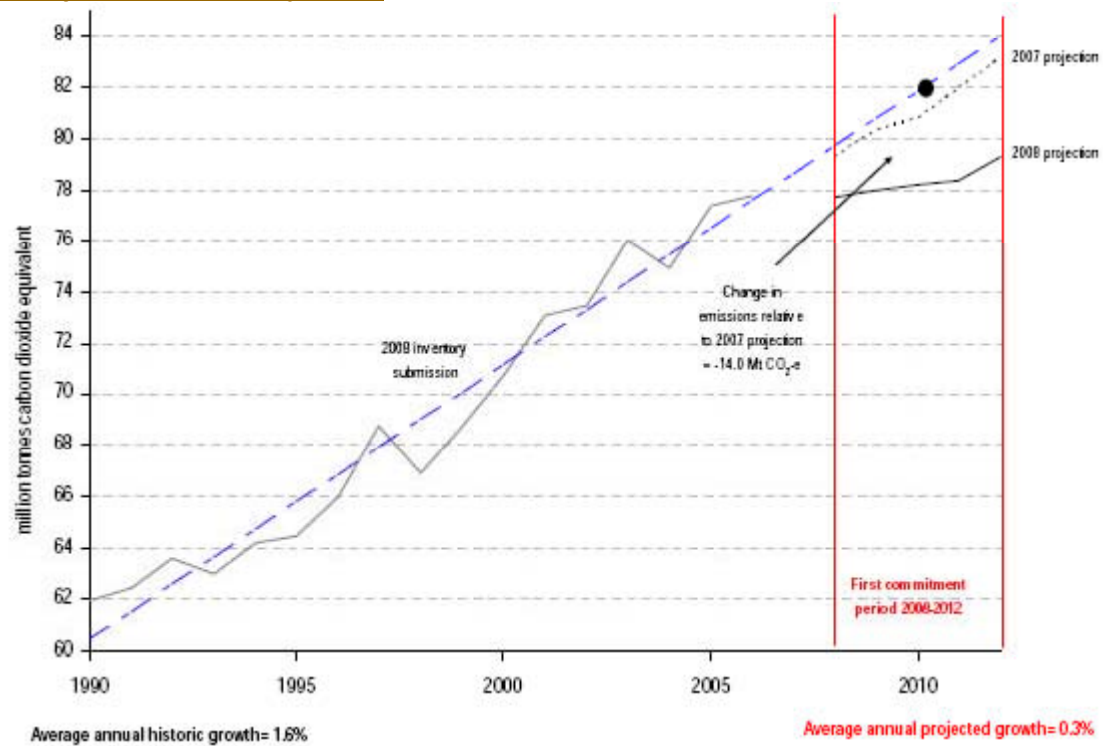
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Source: Ministry for the Environment (2008a)

**Figure 4: Historical emissions data and projected emissions 1990–2012**

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## New Zealand's net position report Forecast for CP1 (as at 2008)

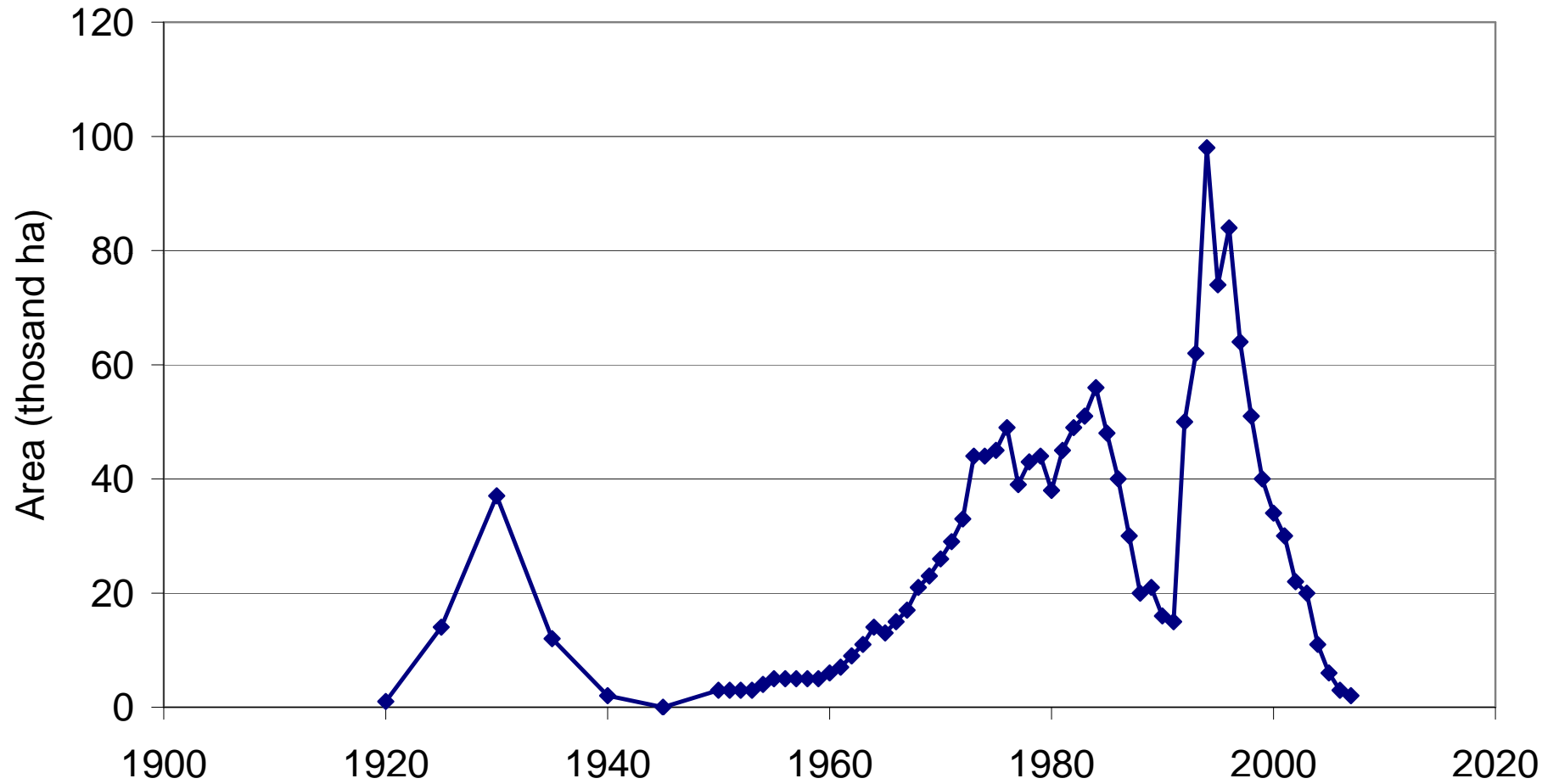
- Allowed to have net emissions of 309.6 million t CO<sub>2</sub> in total during CP1 (2008 – 2012)
  - Total emissions forecast to be 391.5 million t CO<sub>2</sub> in total during CP1
  - Gross deficit = 81.5 million t CO<sub>2</sub>
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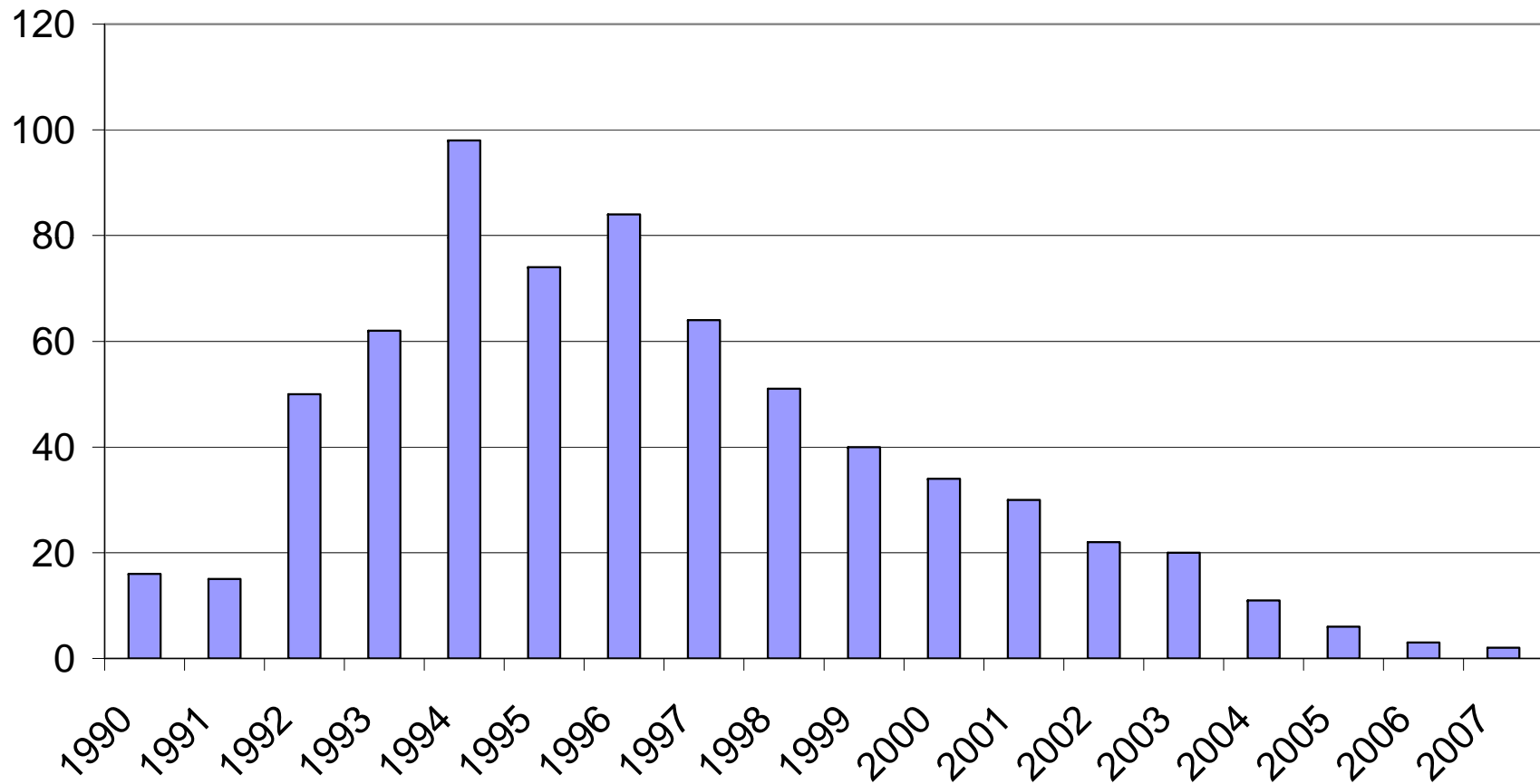
# Removals

- Under article 3.3 of the Kyoto protocol (Land-use, land-use change & forestry) New Zealand is allowed to include CO<sub>2</sub> removals by plantation forests first planted since 1 January 1990
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## New planting in New Zealand



## New Zealand's Kyoto plantations

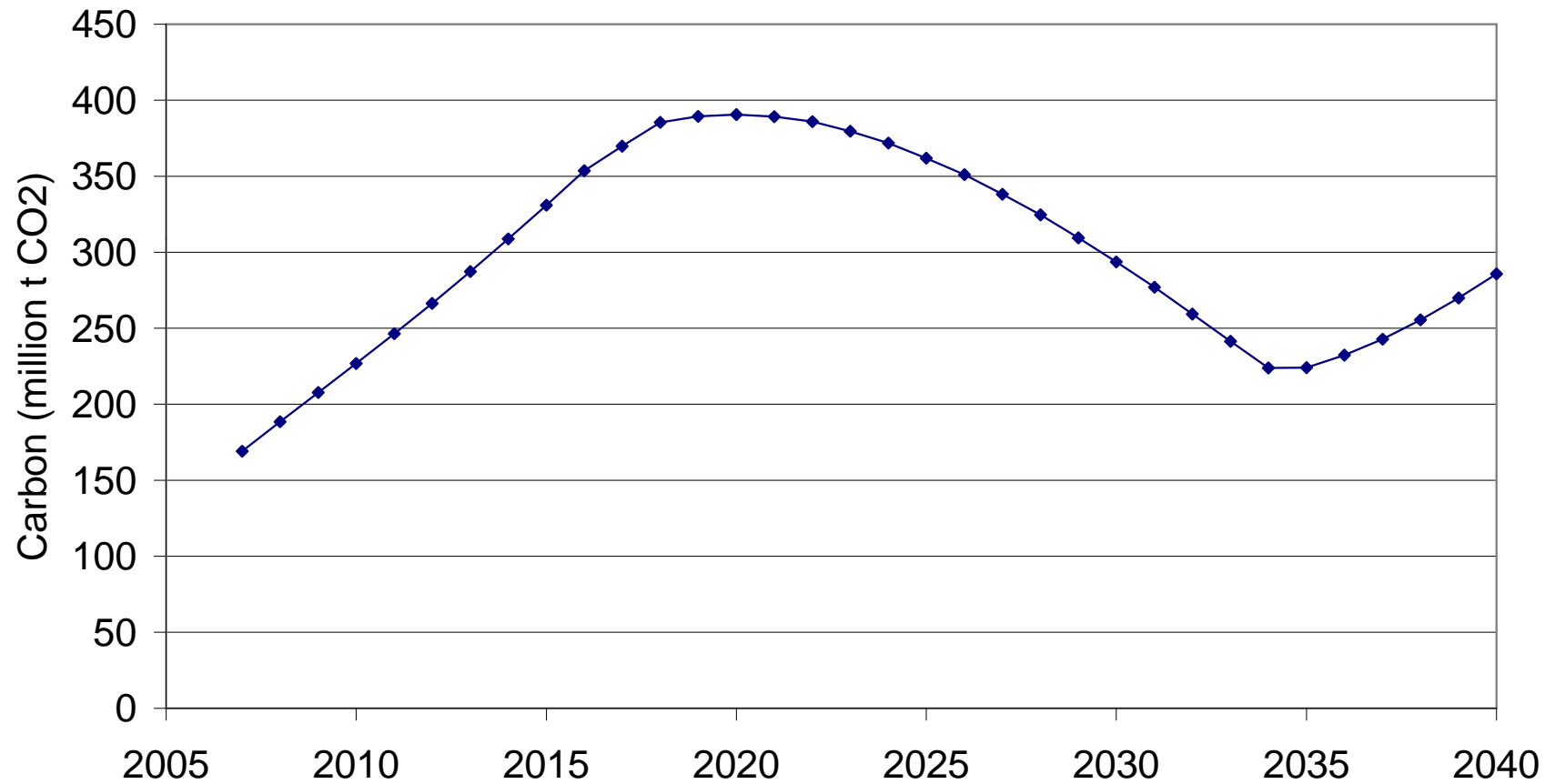


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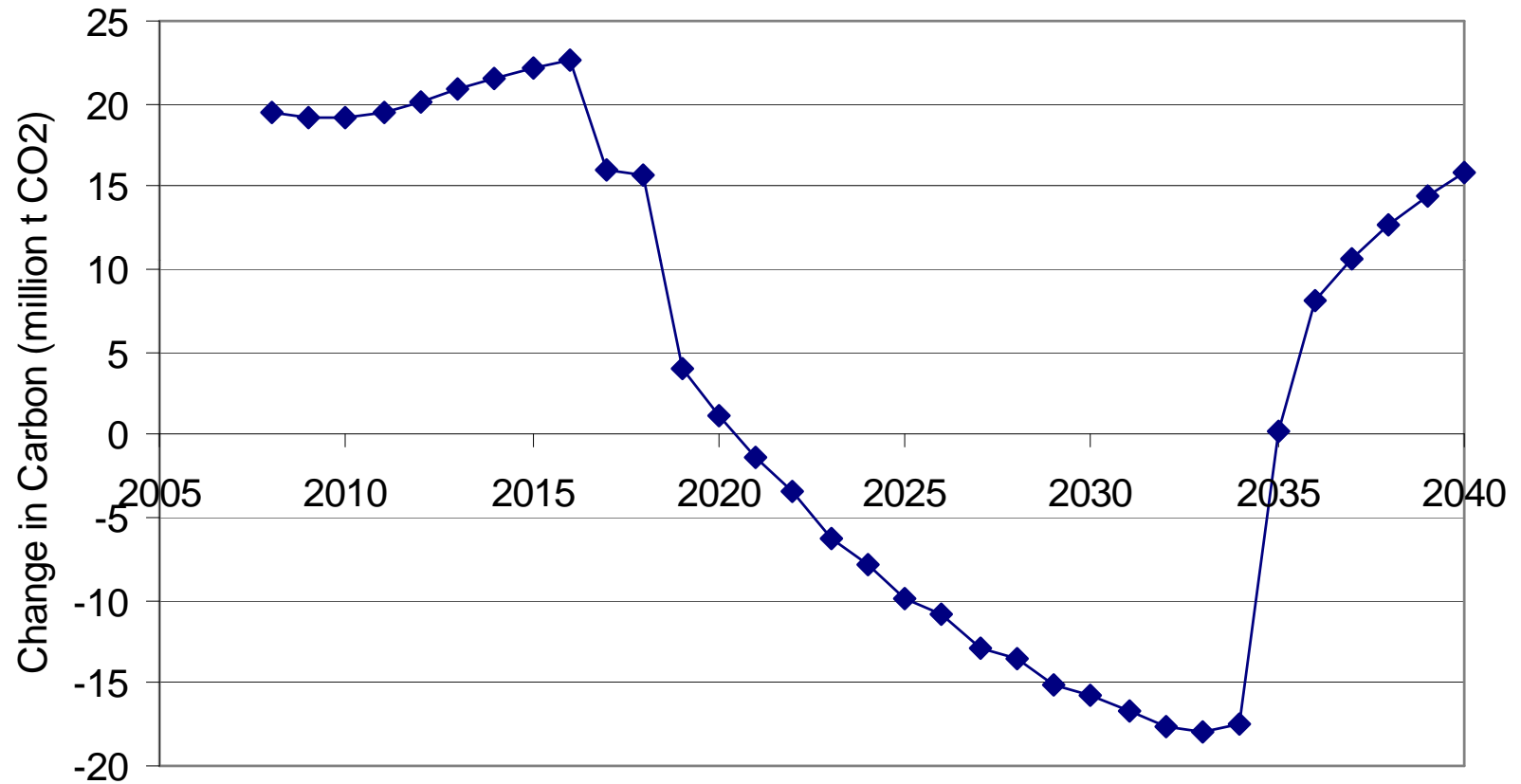
What are implications  
of these plantations  
for Kyoto?

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## Carbon stock in Kyoto plantations - Base case



## Change in carbon stocks - Base case



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## The good news

- NZ plantations are an important means for meeting Kyoto Plantation obligations
  - Gross deficit = 81.5 million t CO<sub>2</sub>
  - Removal via forests = 84.1
  - Deforestation emissions = 16.9
  - NZ CP1 net deficit = 14.7 million t CO<sub>2</sub>
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## The bad news

- New Zealand's Kyoto plantations become a carbon source after 2020.
  - A major liability for NZ Government
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In 2008 New Zealand Government passed legislation providing financial incentives for new planting

- Emission Trading Scheme
  - Afforestation Grant Scheme
  - Permanent Forest Sink Initiative
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# Emission Trading Scheme

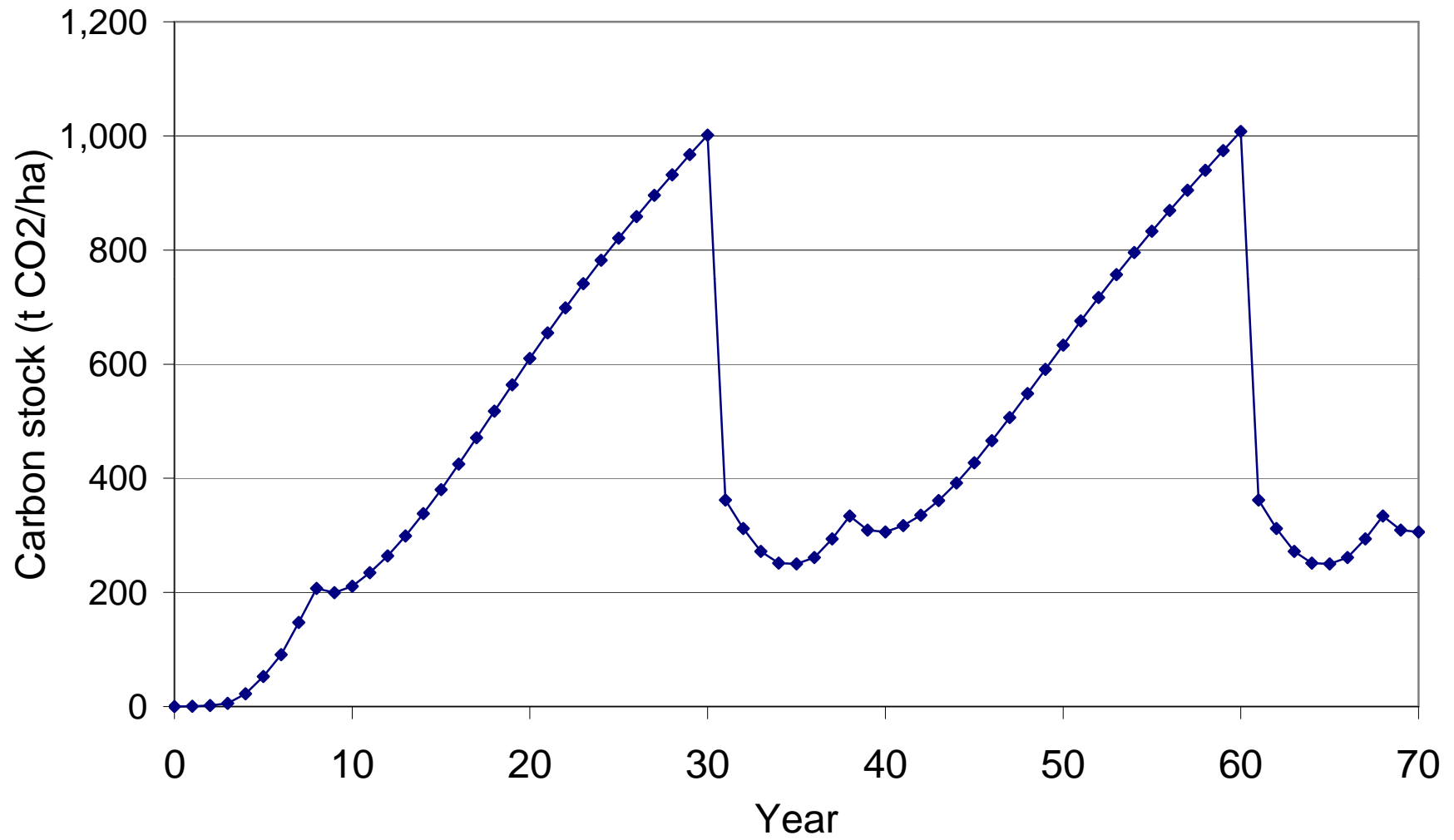
- Government will devolve carbon units to owners of Kyoto Plantations
  - Receive units when carbon stocks increase
  - Surrender units when carbon stocks decrease
  - Can trade units
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# Key issues

- What is the likely impact of carbon trading on
    - forest profitability
    - rotation length (& whether to harvest at all)
    - silviculture
    - choice of species
  - What is the associated risk?
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# Carbon stocks



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# Base clearwood regime

- Plant 800 stems/ha
  - Prune to 5.5 m in 2 lifts
  - Thin at height 12 m to 250 stems/ha
  
  - Plant in 2008
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# Financial criterion = LEV

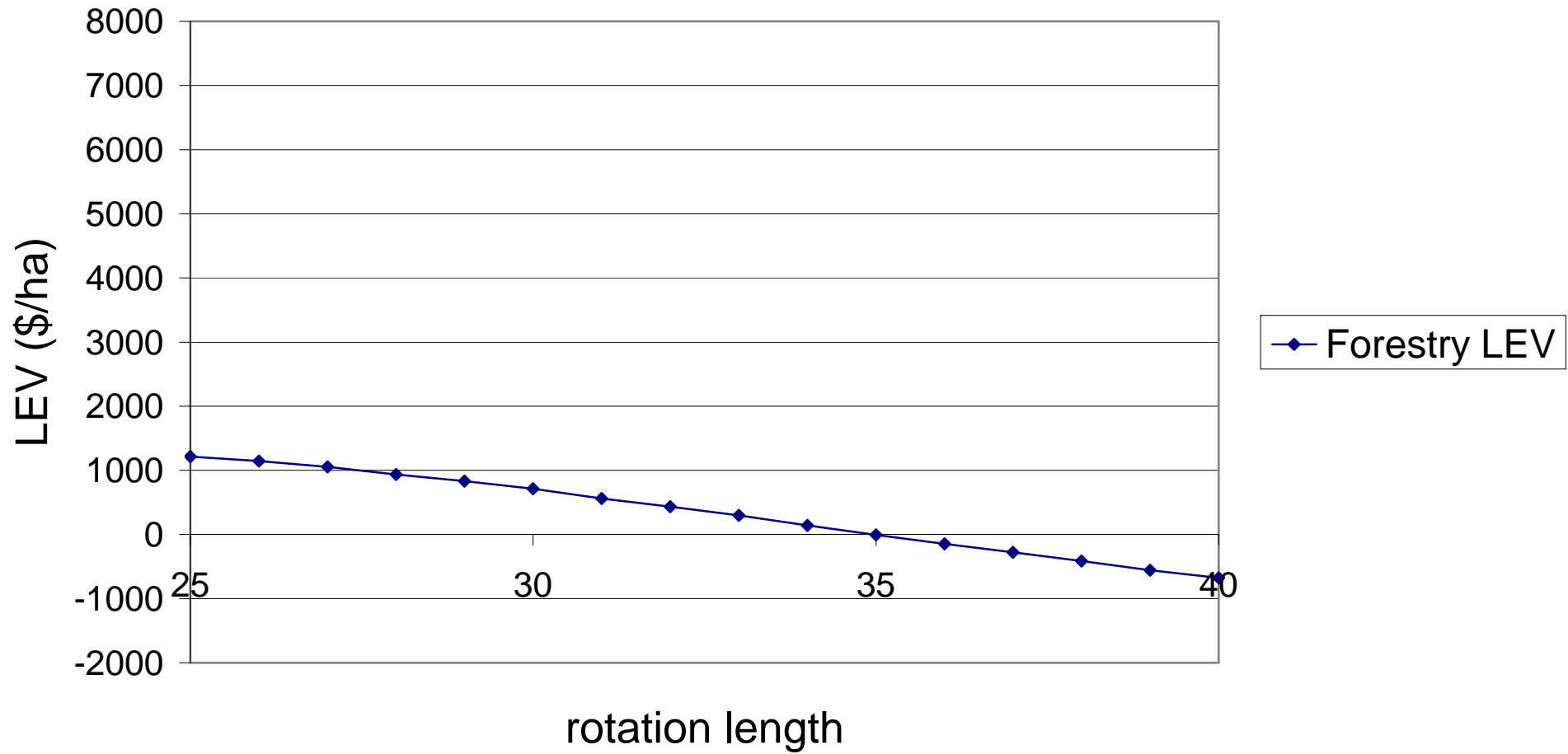
- Land Expectation Value (\$/ha)
  - The maximum that can be paid for land to achieve a given rate of return from forestry.
  - 8% discount rate
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What if we consider  
growing for logs only ?

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Radiata pine clearwood regime  
(2008 planting)

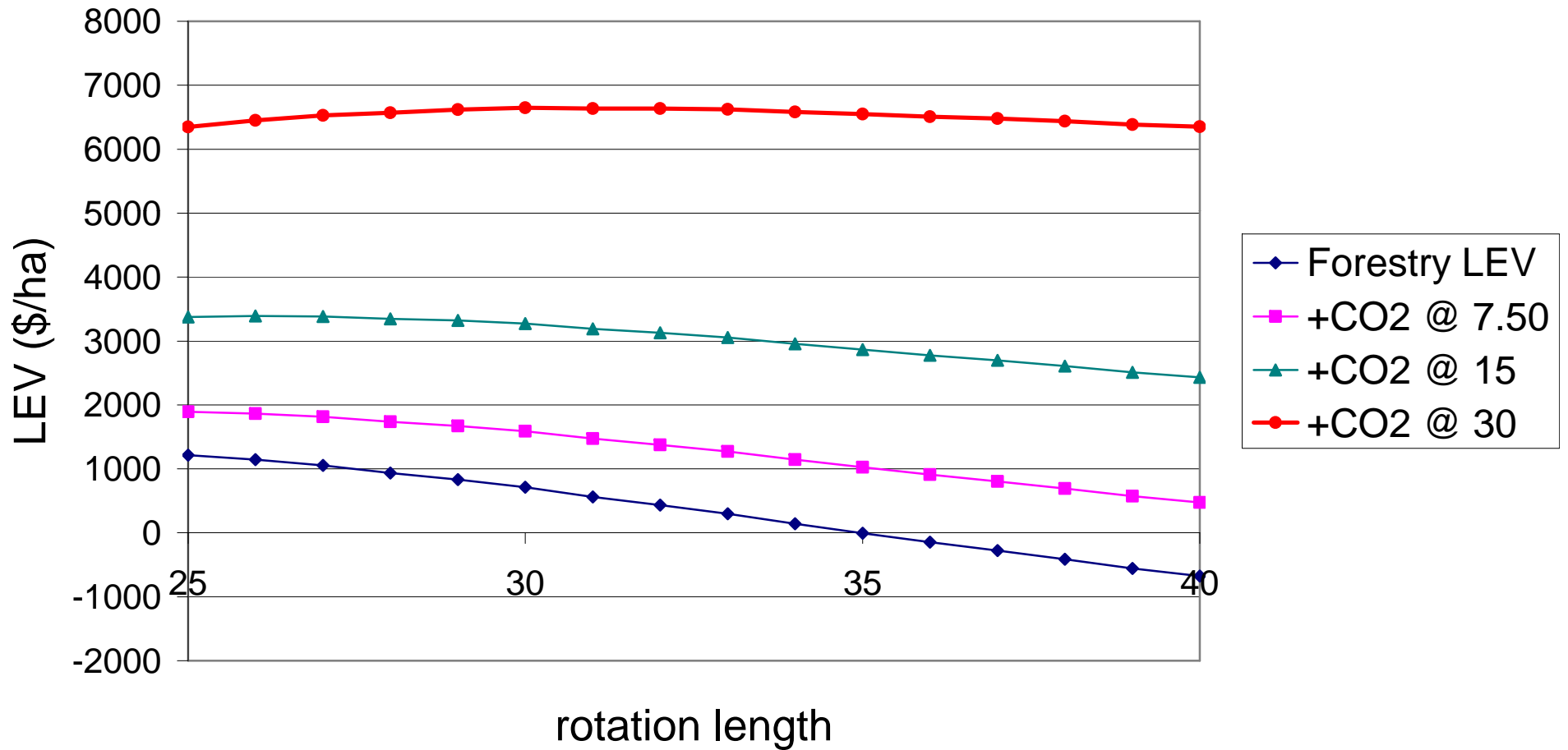


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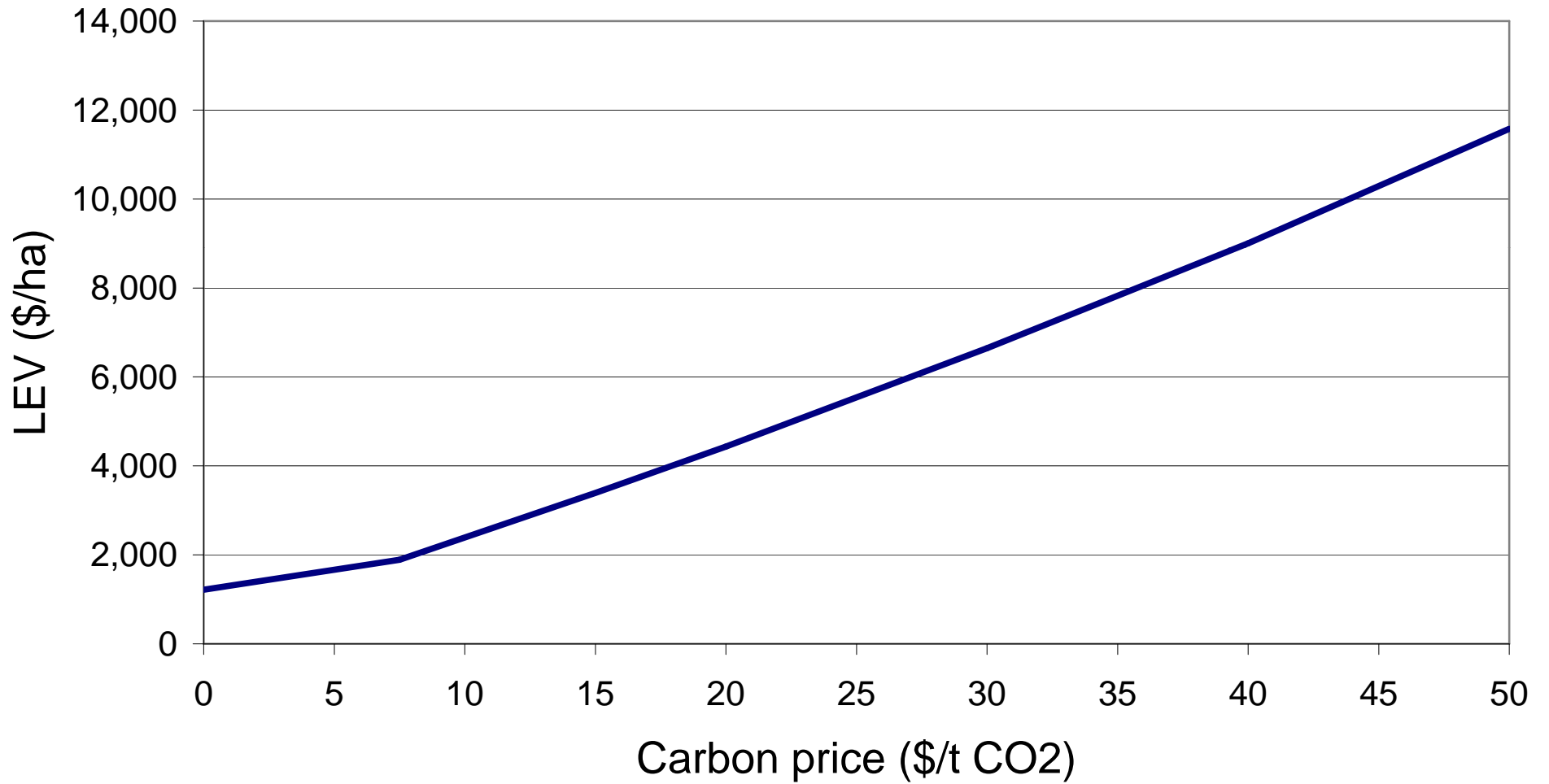
What if we consider  
growing for logs  
and carbon ?

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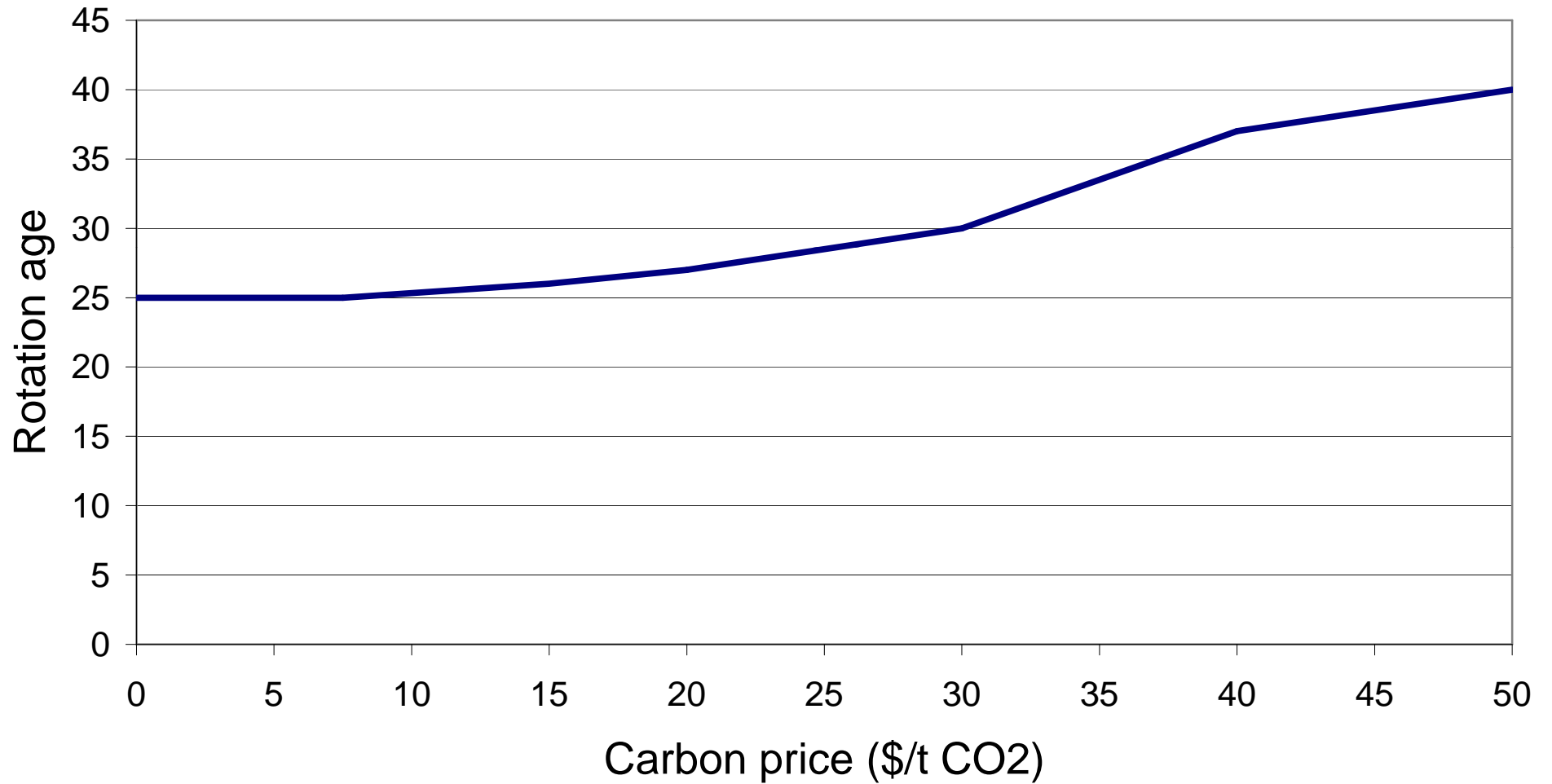
## Radiata pine clearwood regime (2008 planting)



## Effect of carbon price on LEV



## Effect of carbon price on rotation age



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What is the impact  
on silviculture?

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# Looked at varying regime

- Increasing carbon prices favoured
    - Later thinning
    - Higher final crop stockings
    - Unpruned regimes
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What are the implications  
for New Zealand's  
Kyoto obligations?

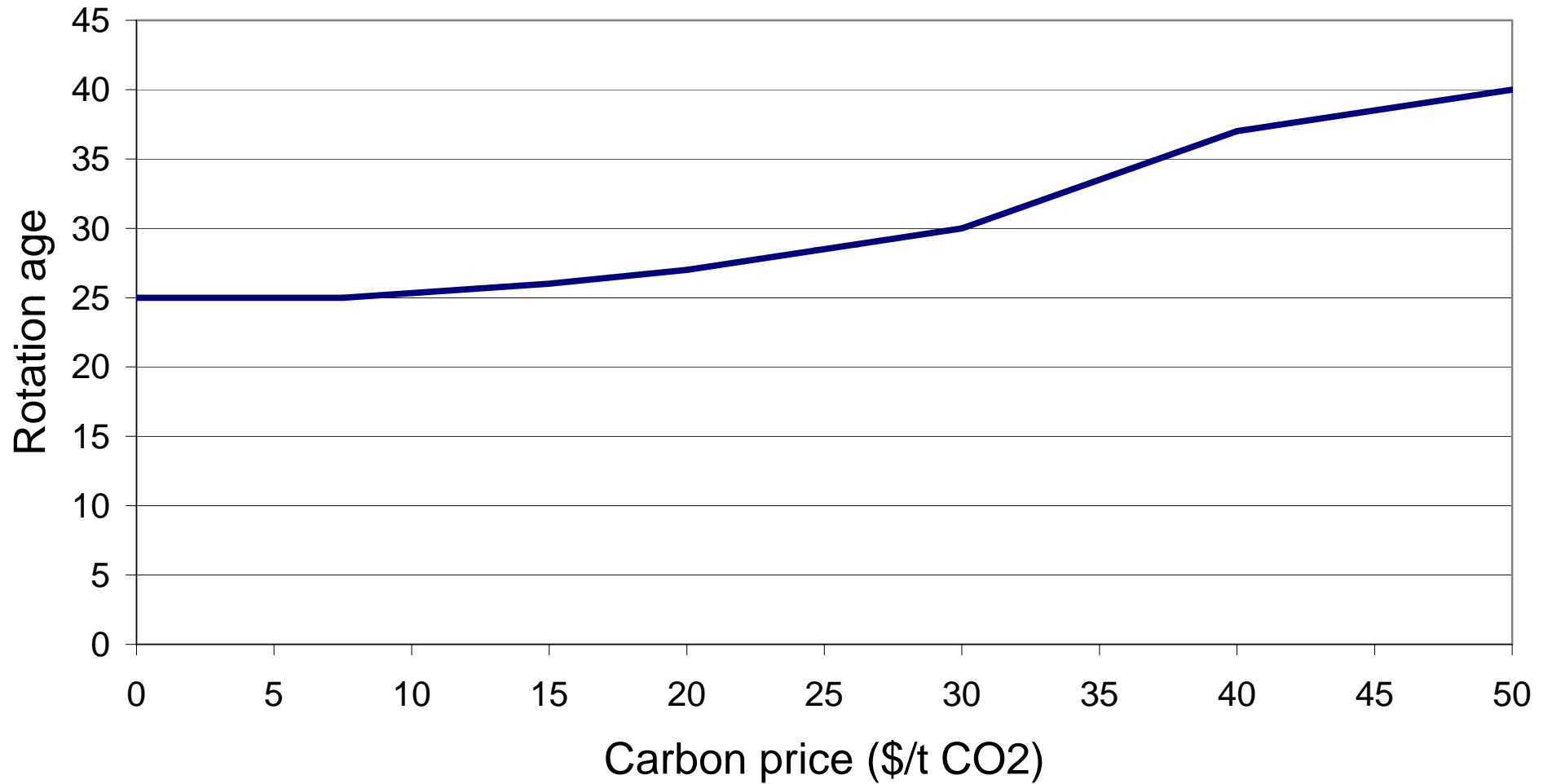
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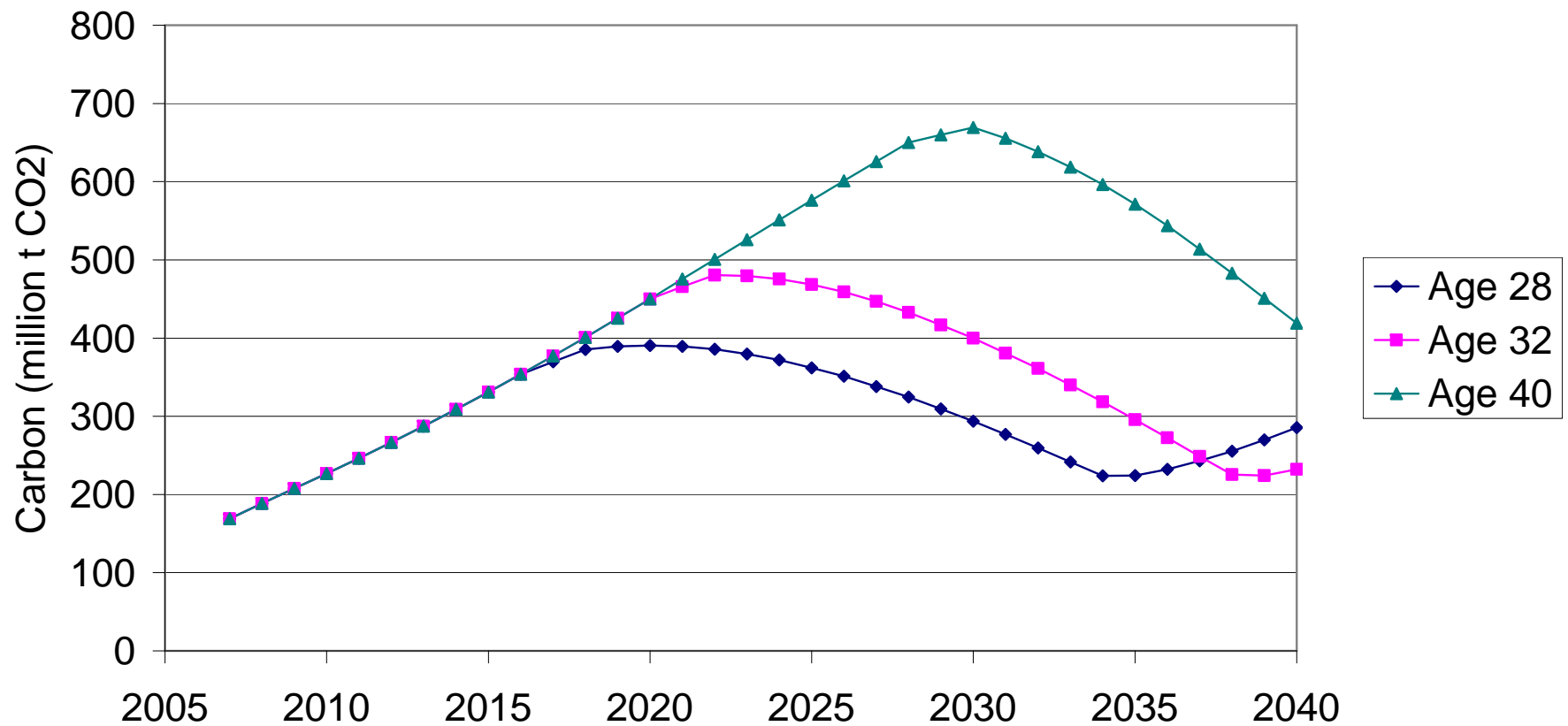
1. What is the impact  
of increasing rotation age

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## Effect of carbon price on rotation age



## Carbon stock in Kyoto plantations Effect of increasing rotation age

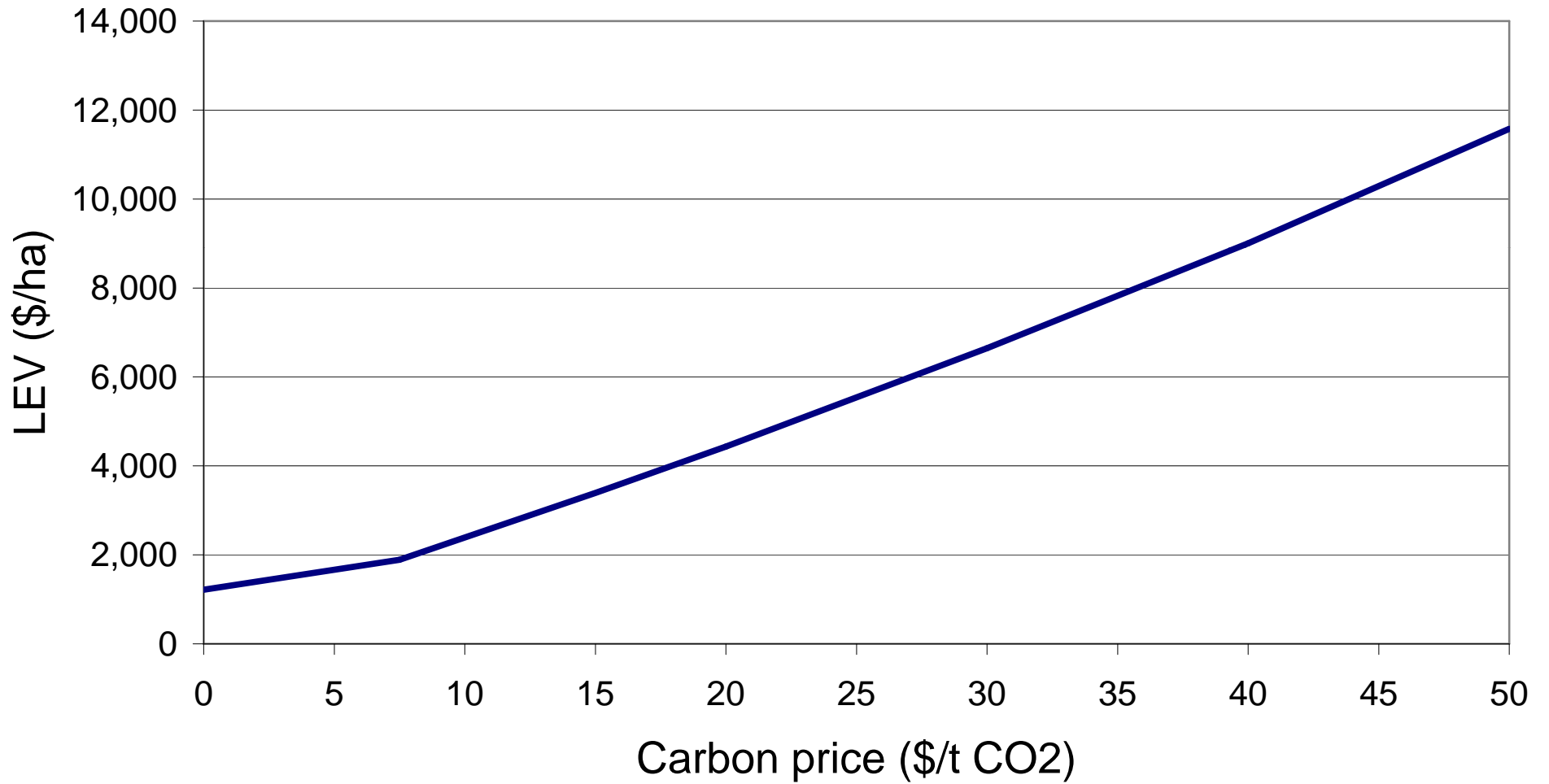


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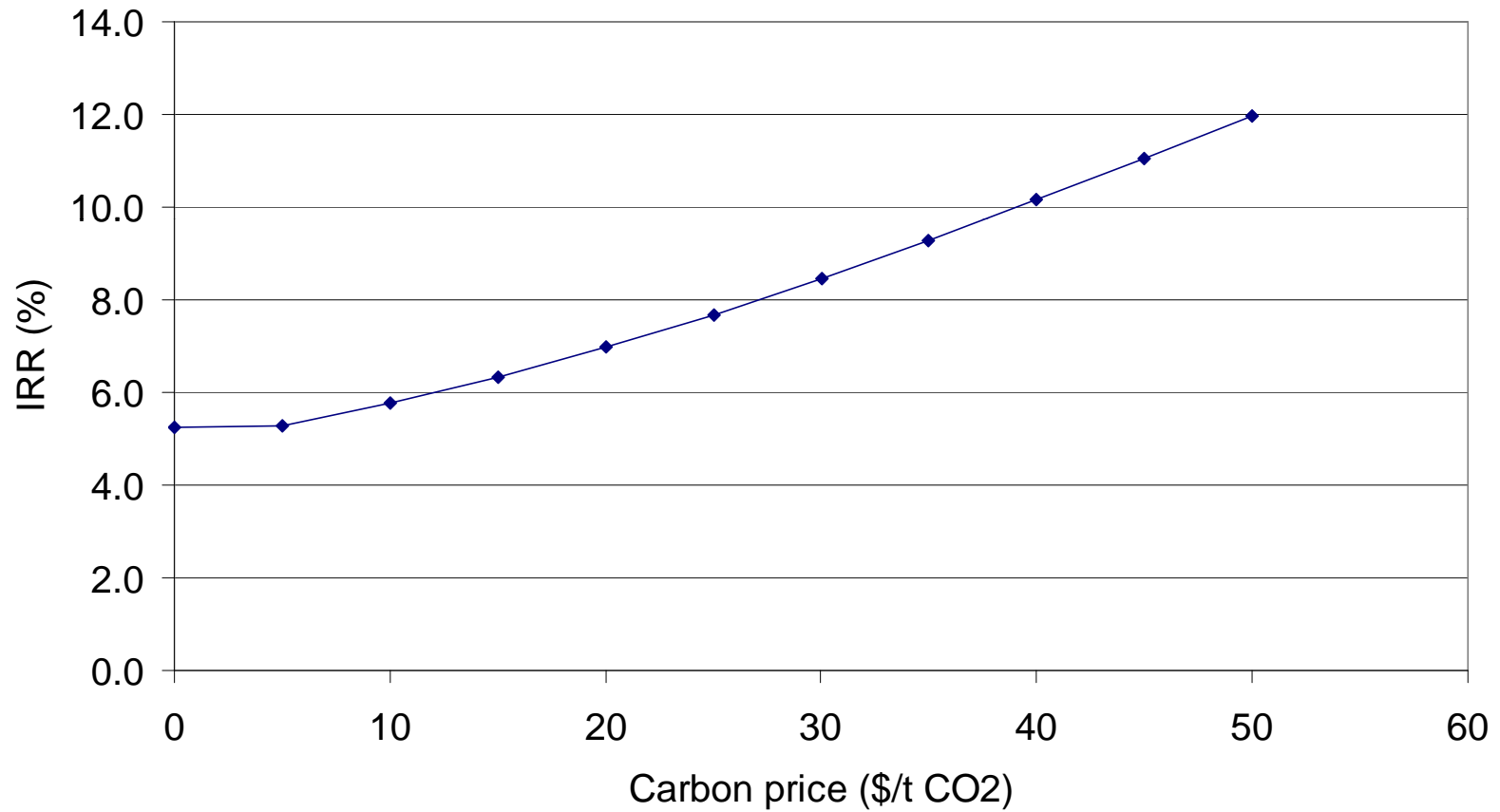
2. What is the impact  
of increasing afforestation

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## Effect of carbon price on LEV



Effect of carbon price on IRR  
(land cost = \$6000/ha)

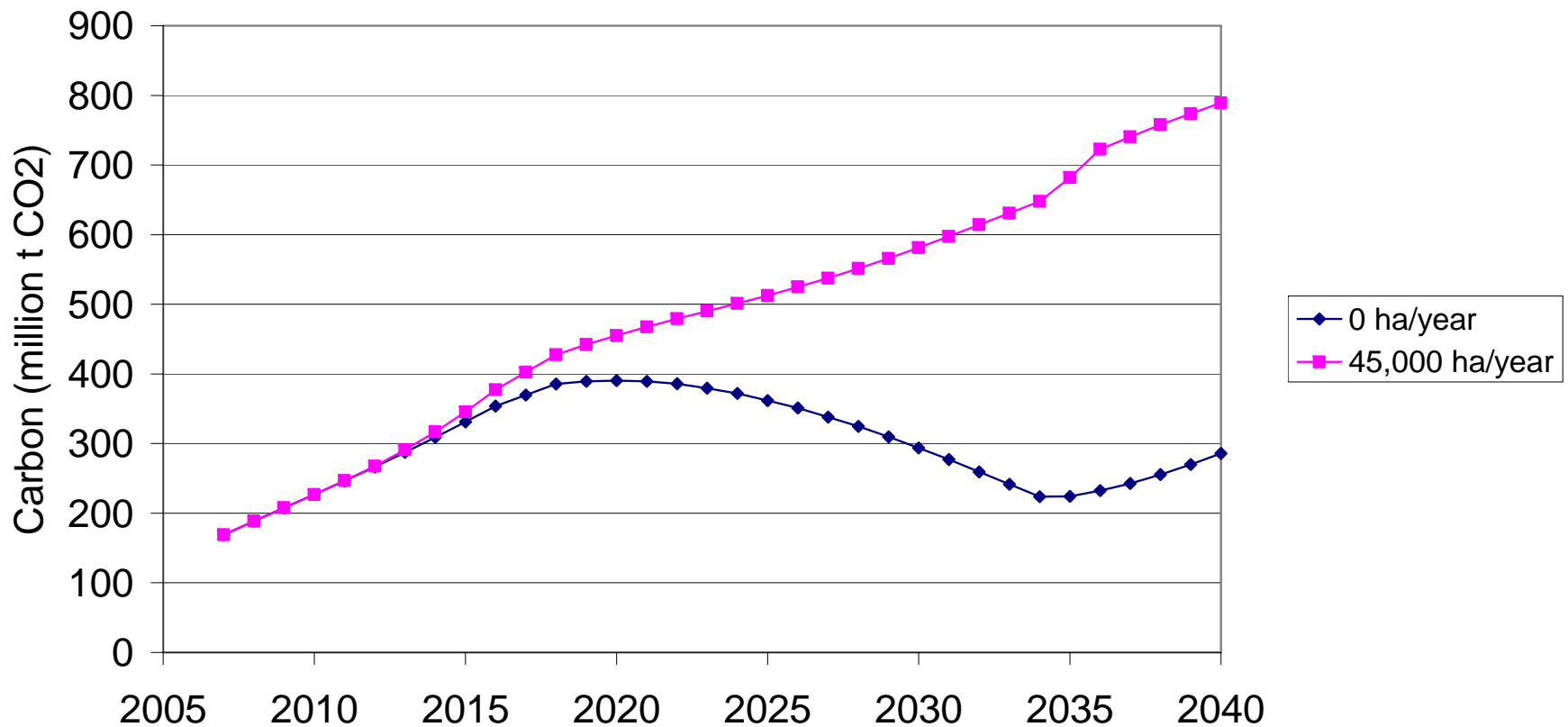


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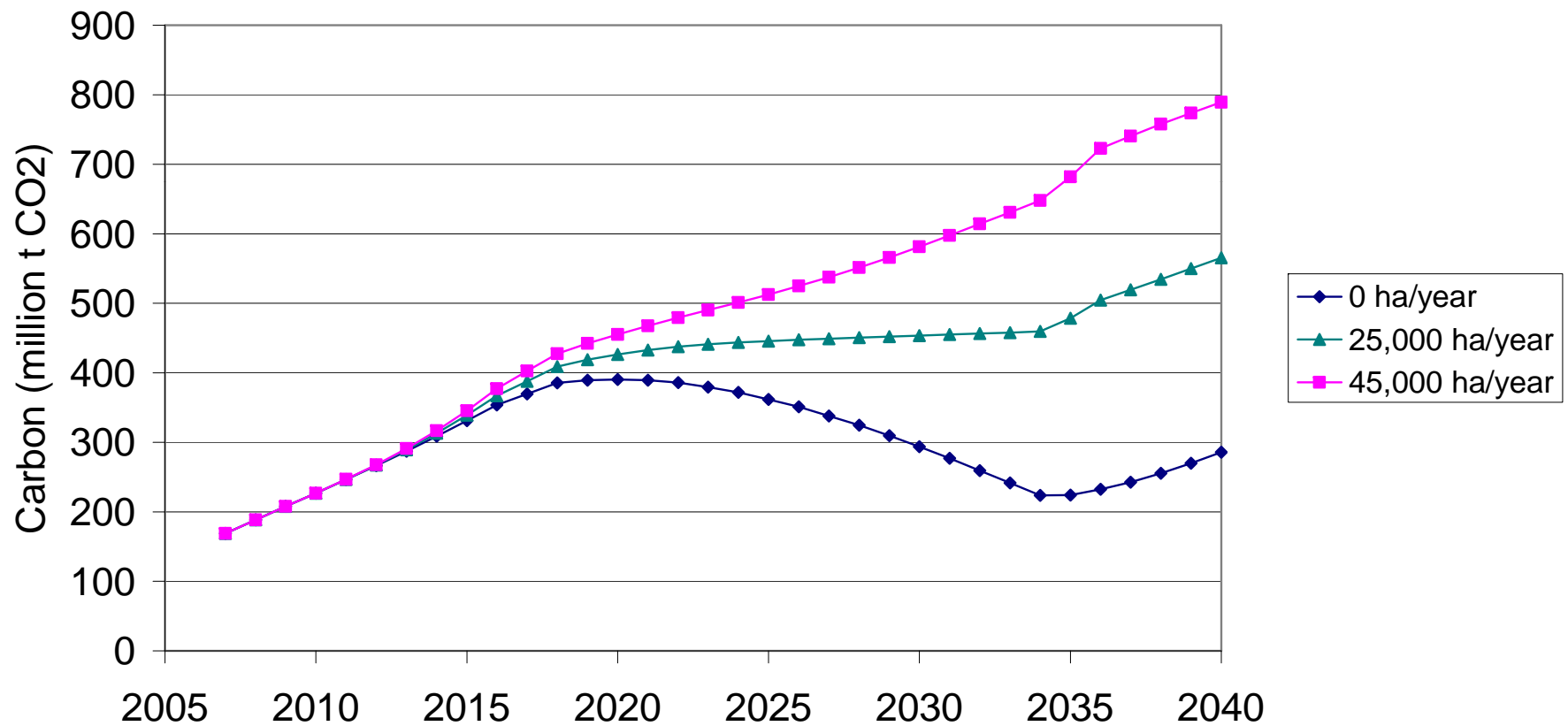
# Potential impact on afforestation

- Carbon at \$30/t CO<sub>2</sub>
  - IRR increases from 5.2% to 8.4%
  - Estimated afforestation increases from 0 to 45,000 ha/year
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## Carbon stock in Kyoto plantations Effect of afforestation



## Carbon stock in Kyoto plantations Effect of afforestation



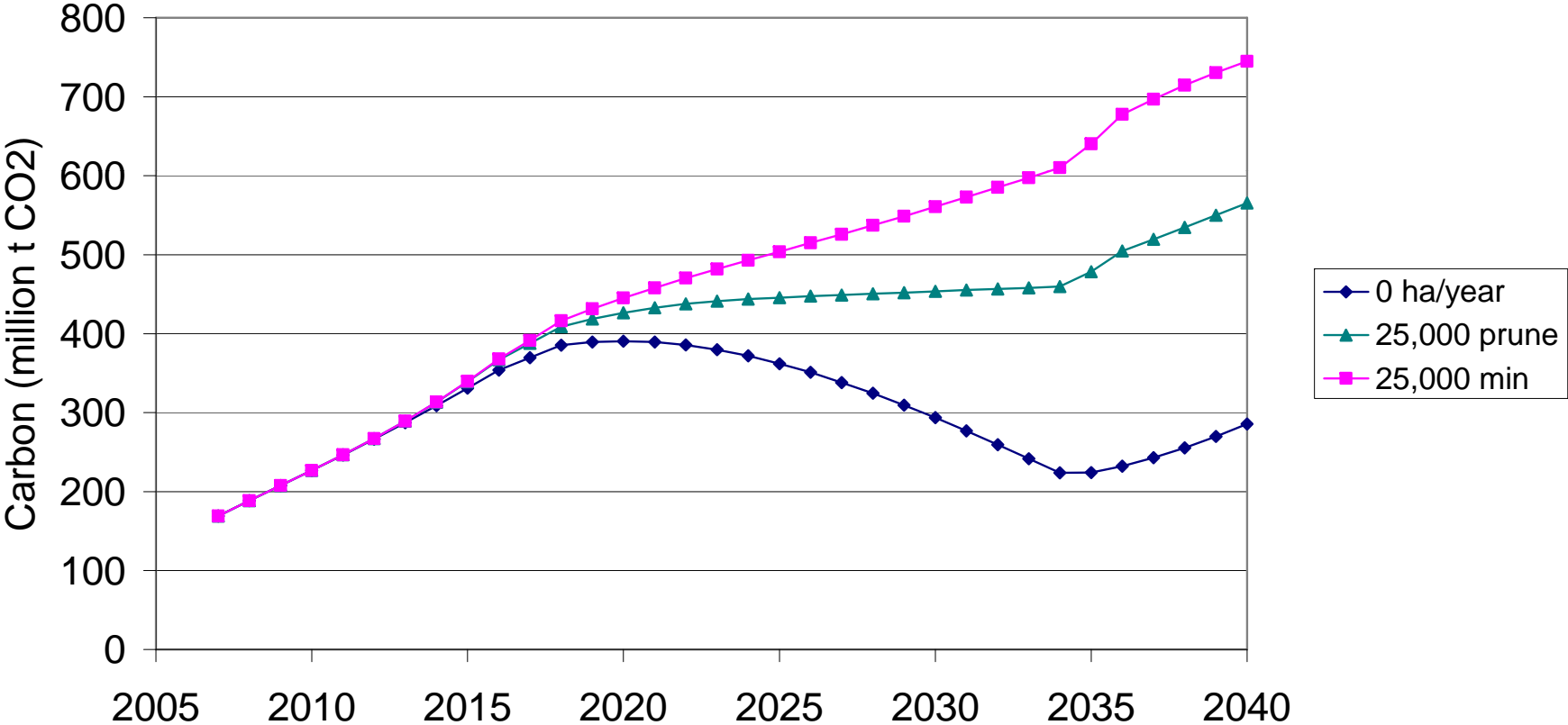
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3. What is the impact of changing silviculture (higher stocking & no thinning)

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# Carbon stock in Kyoto plantations

## Effect of afforestation



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# Summary

- Plantations are important for meeting New Zealand's Kyoto obligations
  - Create a liability after 2020
  - New Zealand Government wants additional planting
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# Summary

- Devolving carbon units via Emission Trading Scheme has potential to meet Government afforestation target of 250,000 ha by 2020.
  - ETS also has potential to help meet NZ Kyoto obligations via
    - Longer rotation ages
    - Changes in silviculture
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# Postscript

- New Zealand had a general election on 8 November 2008
  - Elected a new Government which
    - Generally supports an Emission Trading Scheme
    - Wants to review details
    - Has postponed implementation for 1 year
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