

Carbon Emissions from Land-Use Change

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Why Model Land Use ?

 Carbon emissions from energy consumption are not the whole story.

- Carbon emissions from land-use change
- Carbon mitigation using biomass fuels
- CH₄ and N₂O emissions from agriculture

 Energy and agricultural systems are linked through biomass fuels.

Conclusions

-  A carbon policy for fossil fuel emissions provides incentives for production of commercial biomass.
-  Increased biomass production releases carbon from soils.
-  All modeling results are strongly affected by assumptions on crop productivity improvements.

MiniCAM Overview

- 👉 11 regions
- 👉 15-year time steps
(1990- 2095)
- 👉 Partial equilibrium
- 👉 Eight markets

Energy Markets

Oil
Natural Gas
Coal
Carbon

Biomass

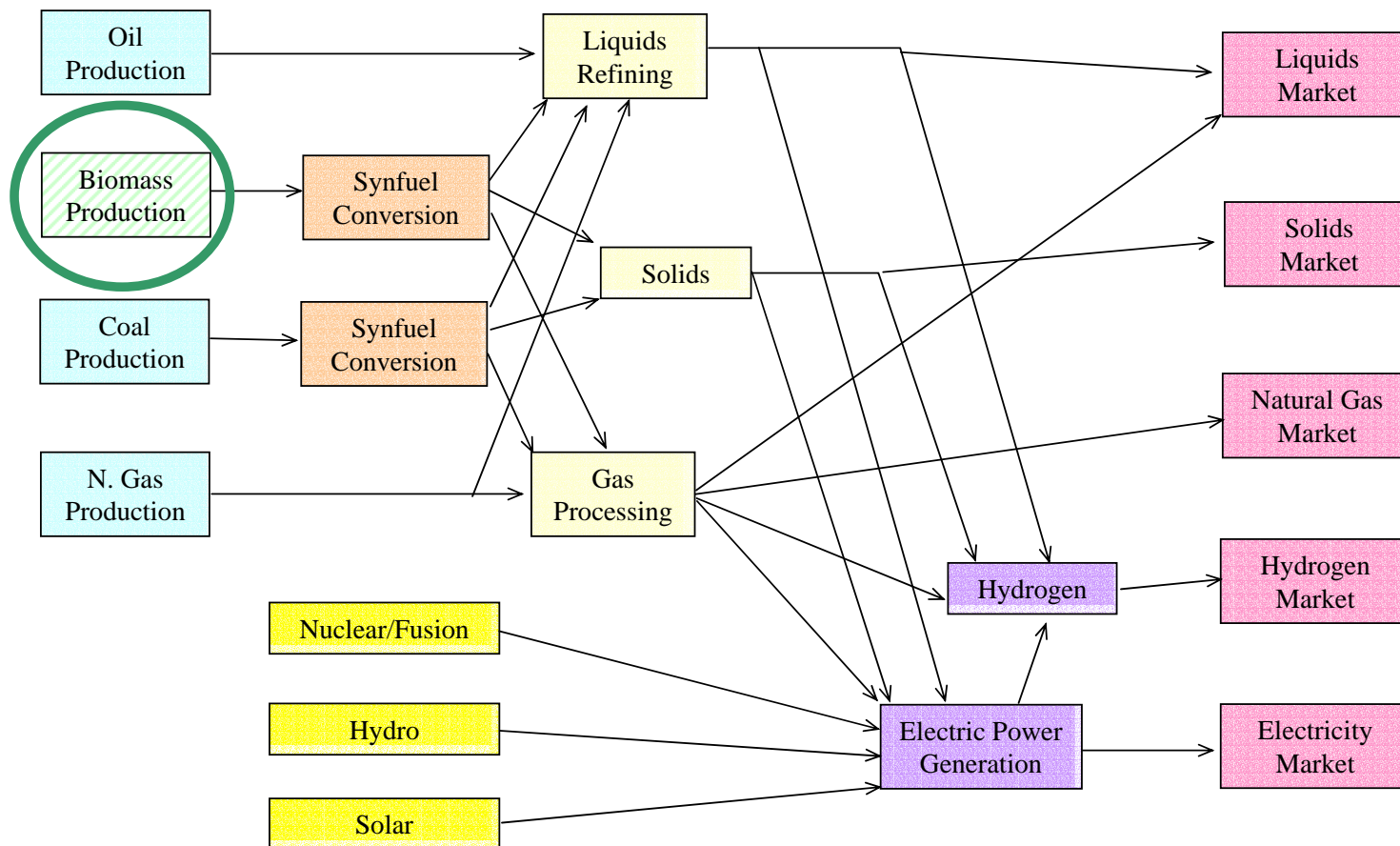
Grains and Oil Seeds
Animal Products
Forestry Products

Agricultural Markets

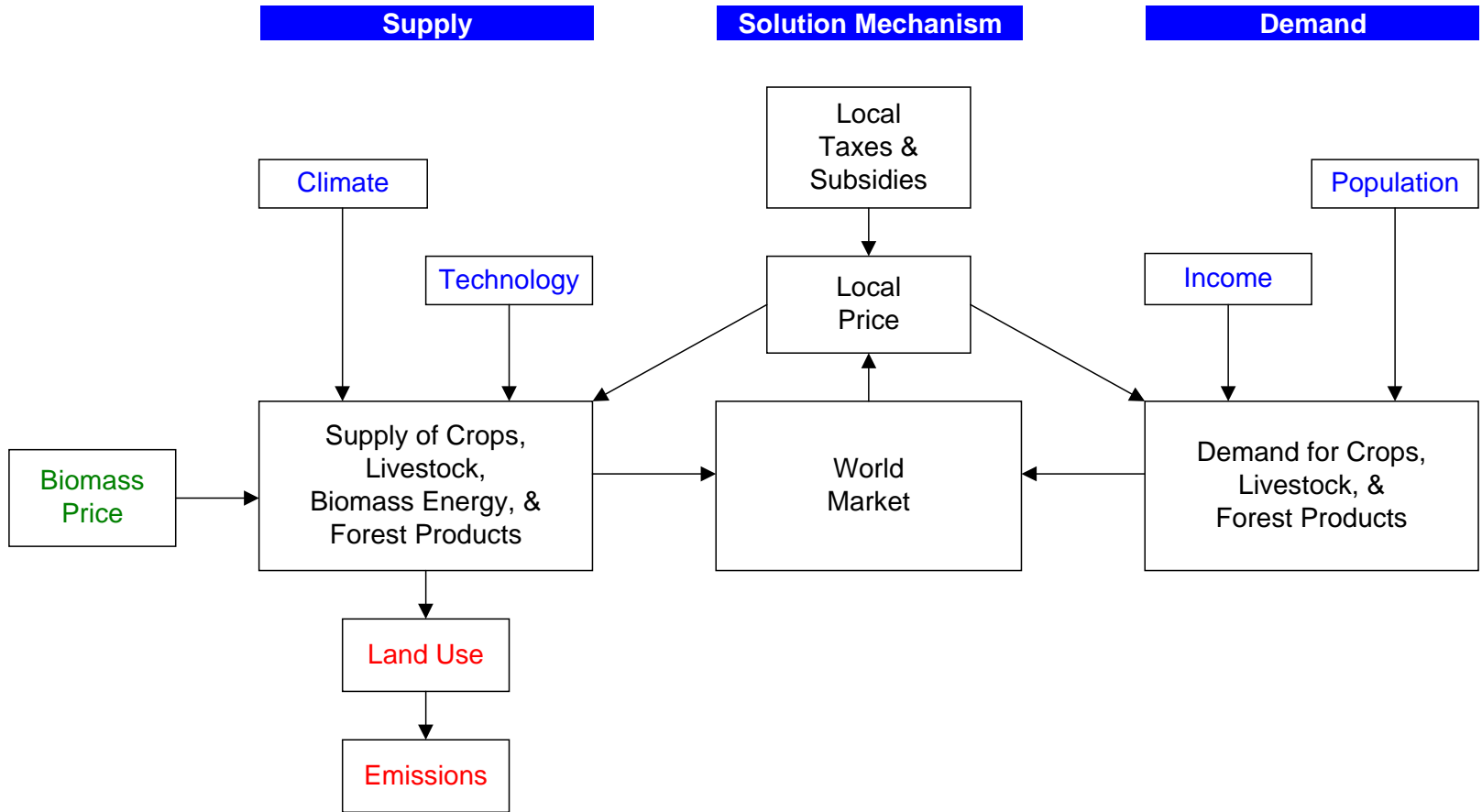
AgLU Regions

- 👉 North America
- 👉 Japan, Australia, New Zealand
- 👉 Western Europe
- 👉 Eastern Europe
- 👉 Former Soviet Union
- 👉 Latin America
- 👉 China and Centrally-Planned Asia
- 👉 South Asia
- 👉 Other Pacific Asia
- 👉 Africa
- 👉 Middle East

MiniCAM Energy Markets



AgLU Model Structure



Methodology Highlights

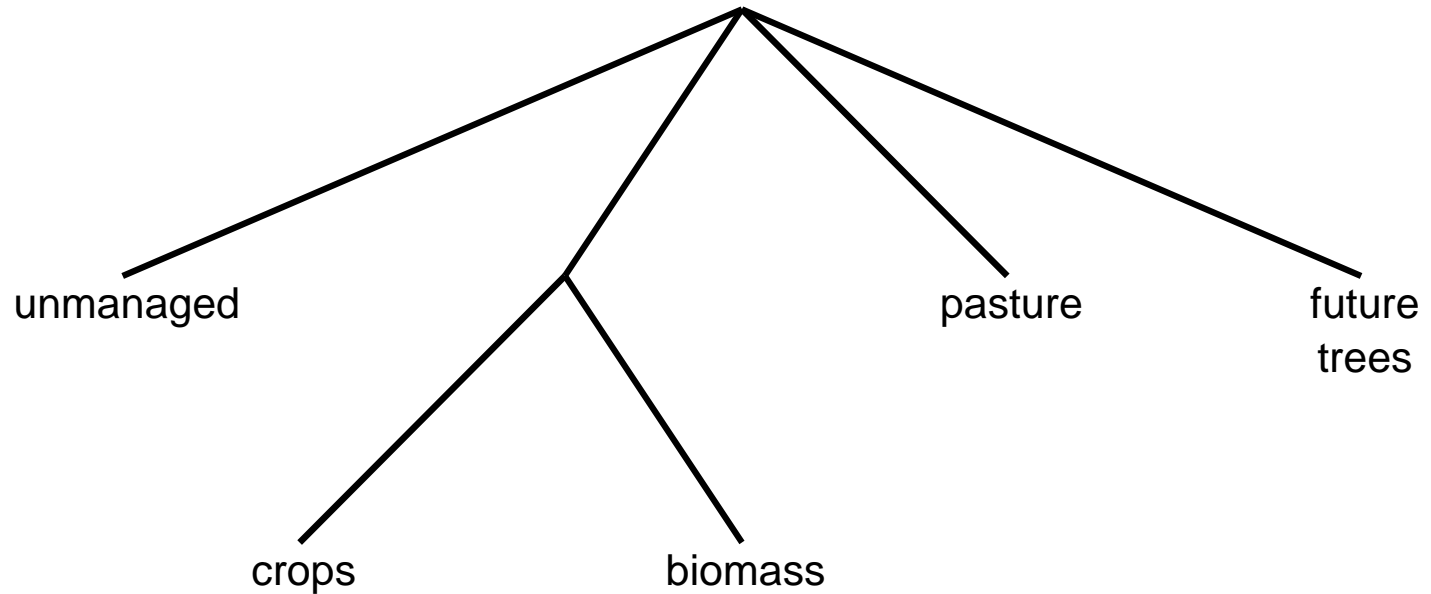
Forest Dynamics

- Trees in AgLU grow for 45 years
- Previous version of AgLU unstable
- Two forest markets (current and future) needed for model stability

Land Allocation

- Land owners compare economic returns across crops, biomass, pasture, and future trees
- Underlying probability distribution of yields per hectare

Land Allocation

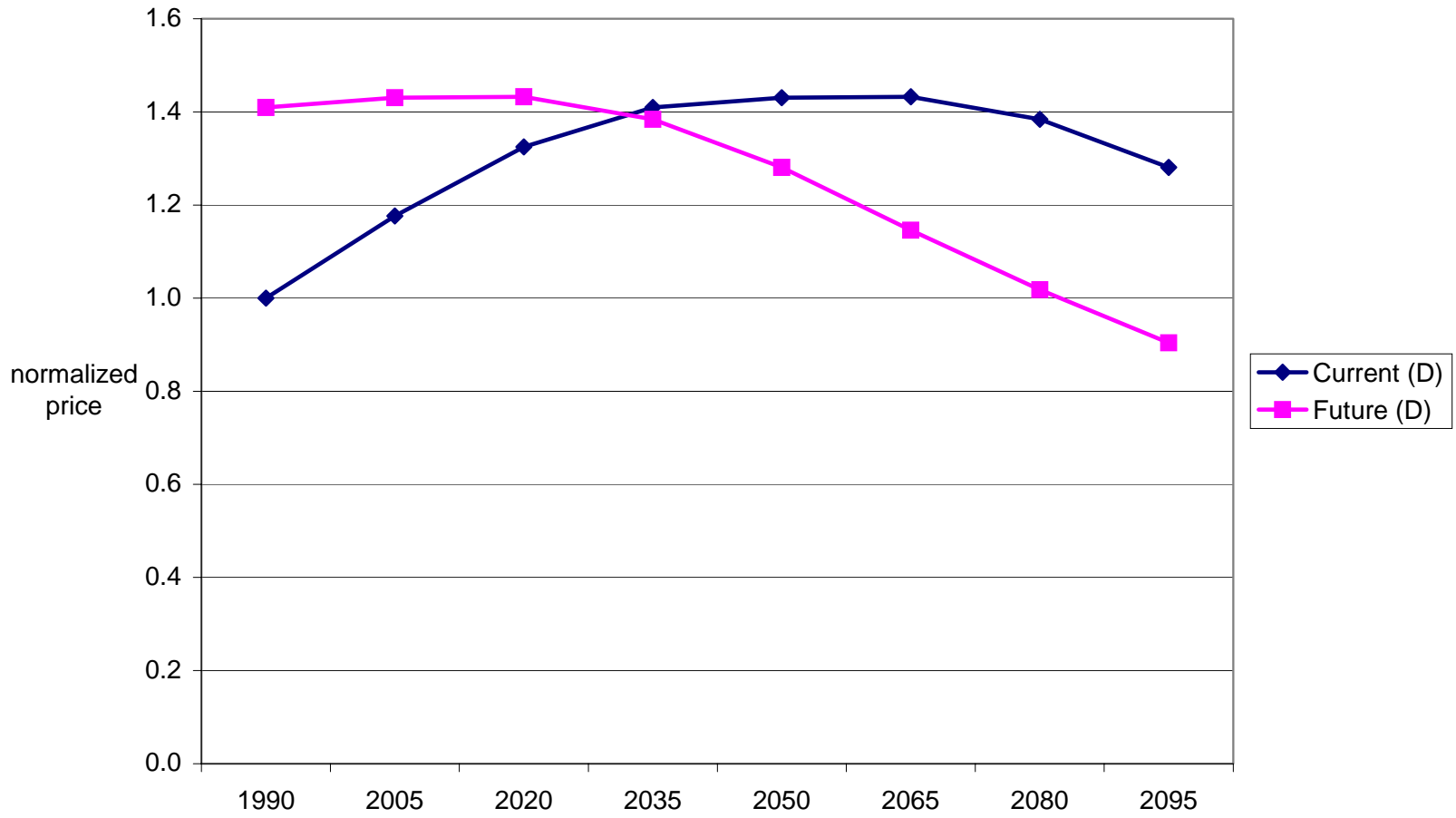


AgLU Scenarios

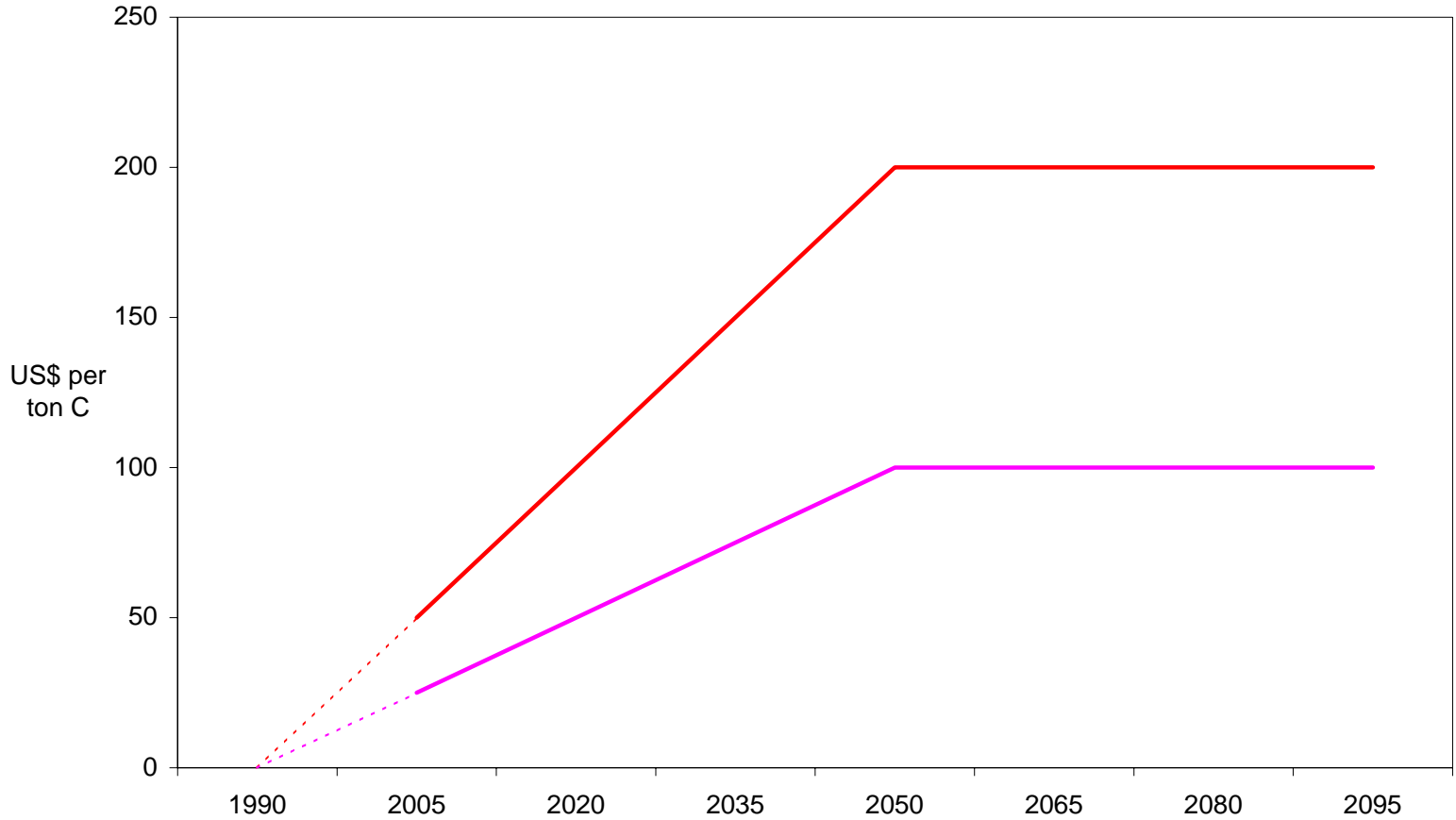
0.3% Tech. Change
0.5% Tech. Change
0.7% Tech. Change

Scenario Carbon Prices		
Zero	Moderate	High
A	B	C
D	E	F
G	H	I

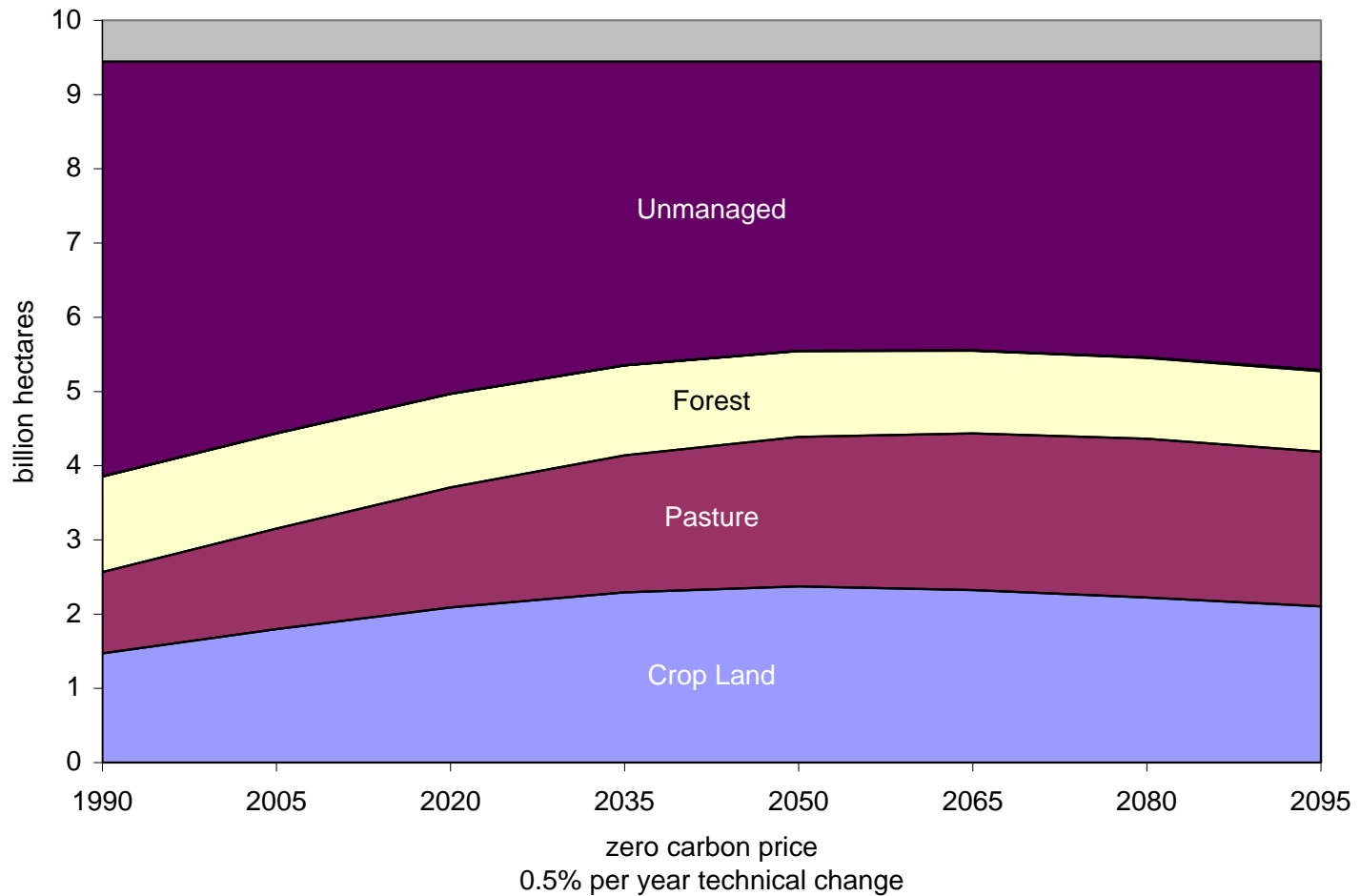
Price of Forest Products



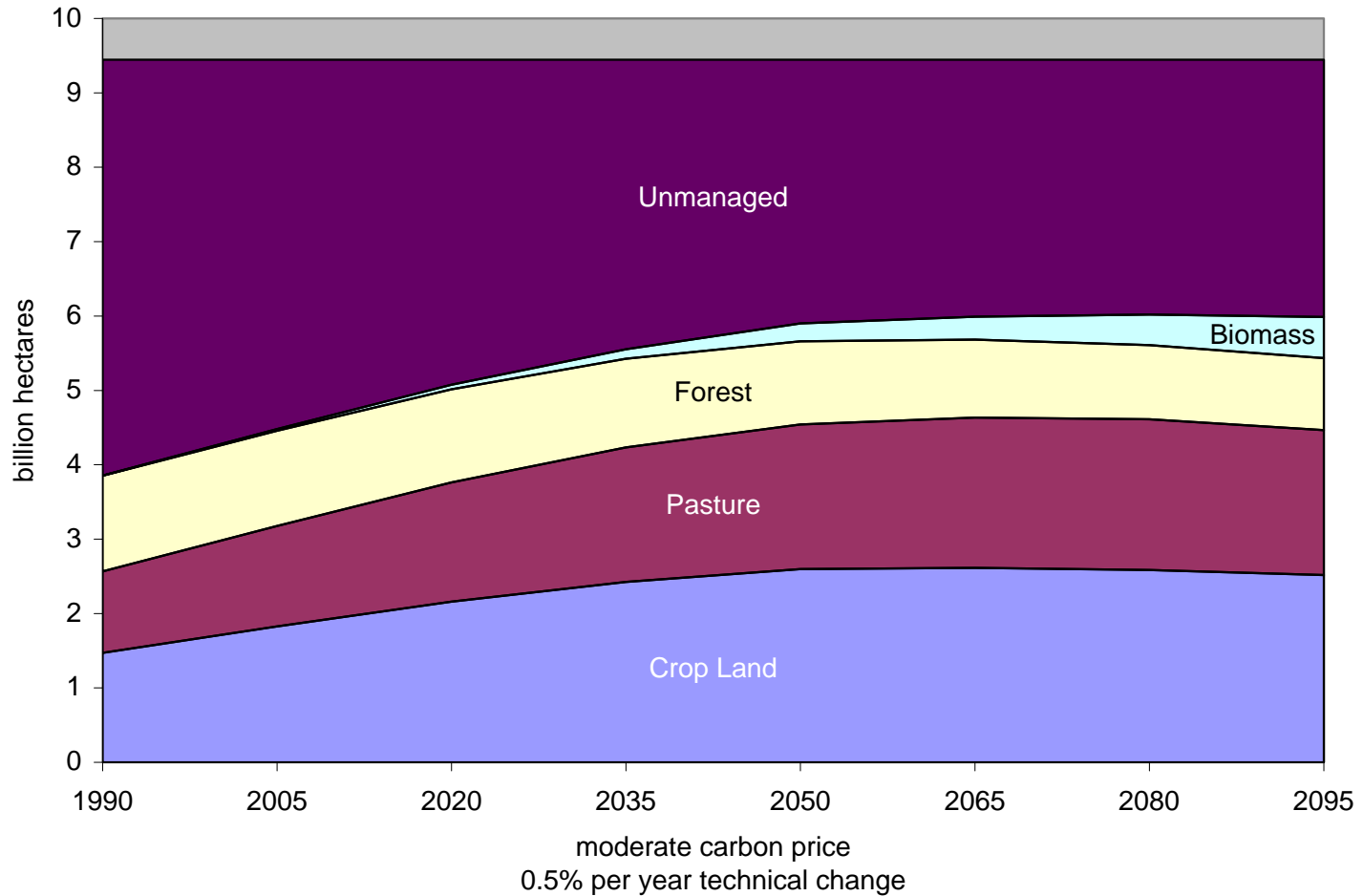
Scenario Carbon Prices



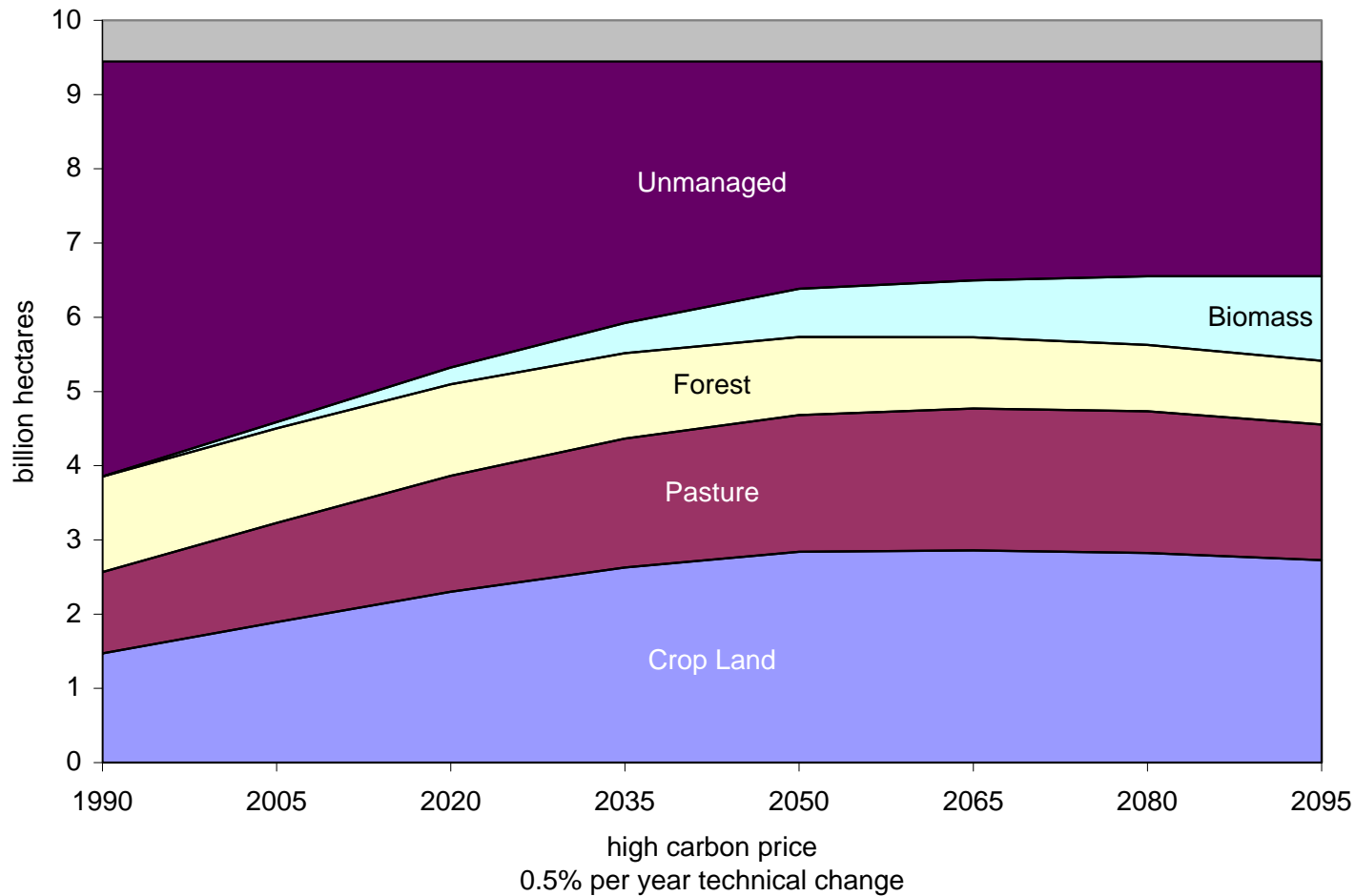
Global Land Use (D)



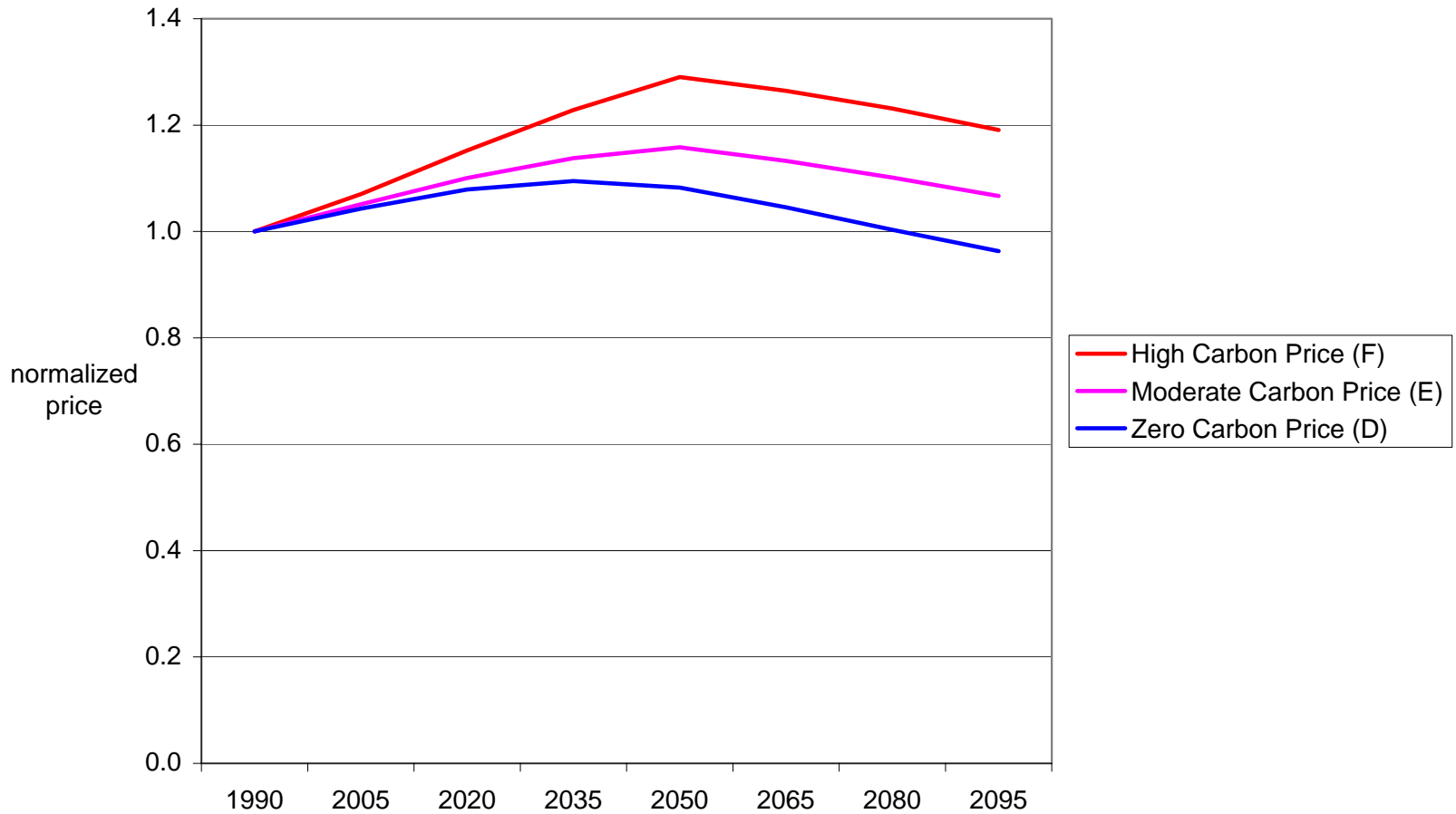
Global Land Use (E)



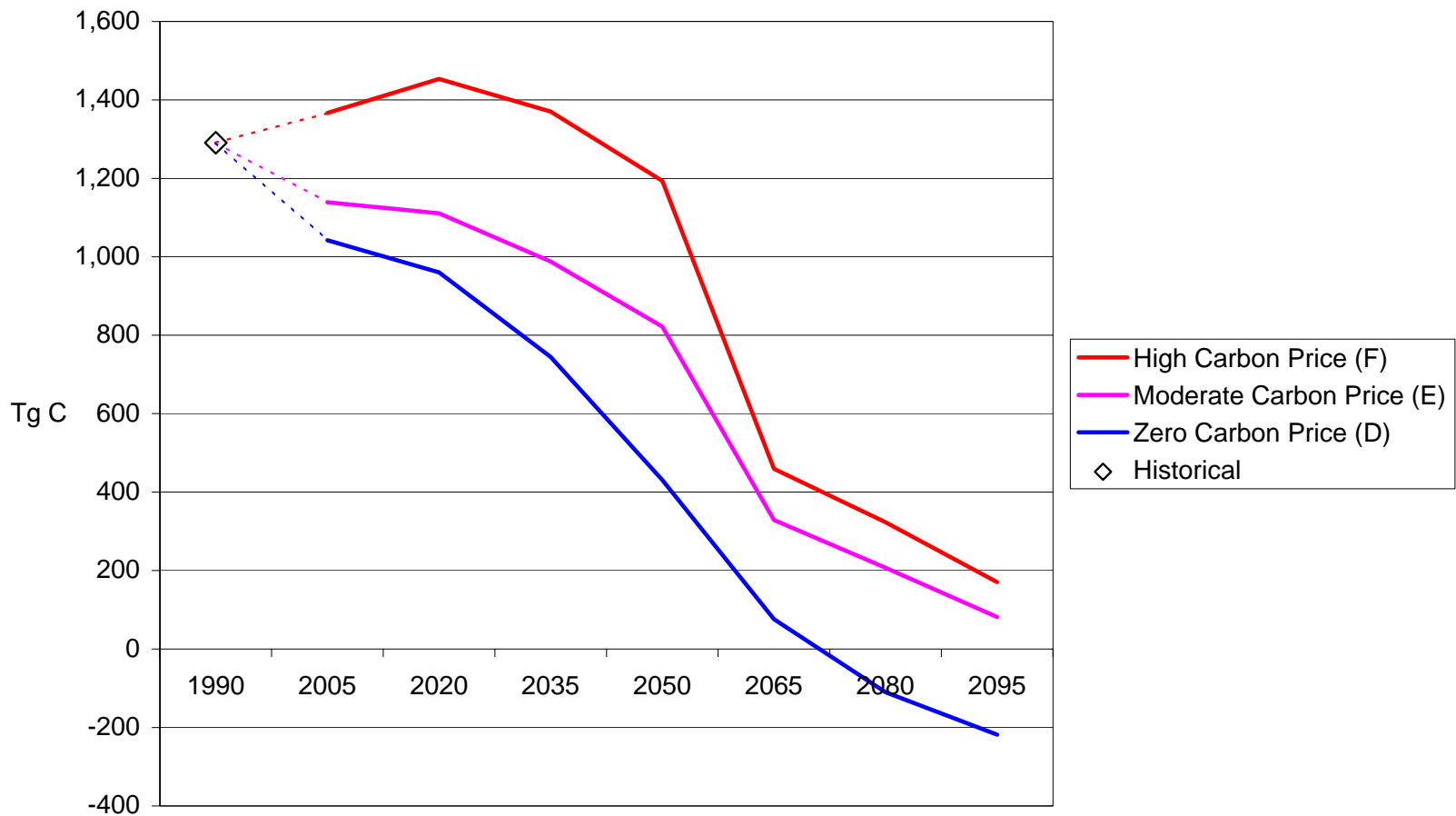
Global Land Use (F)



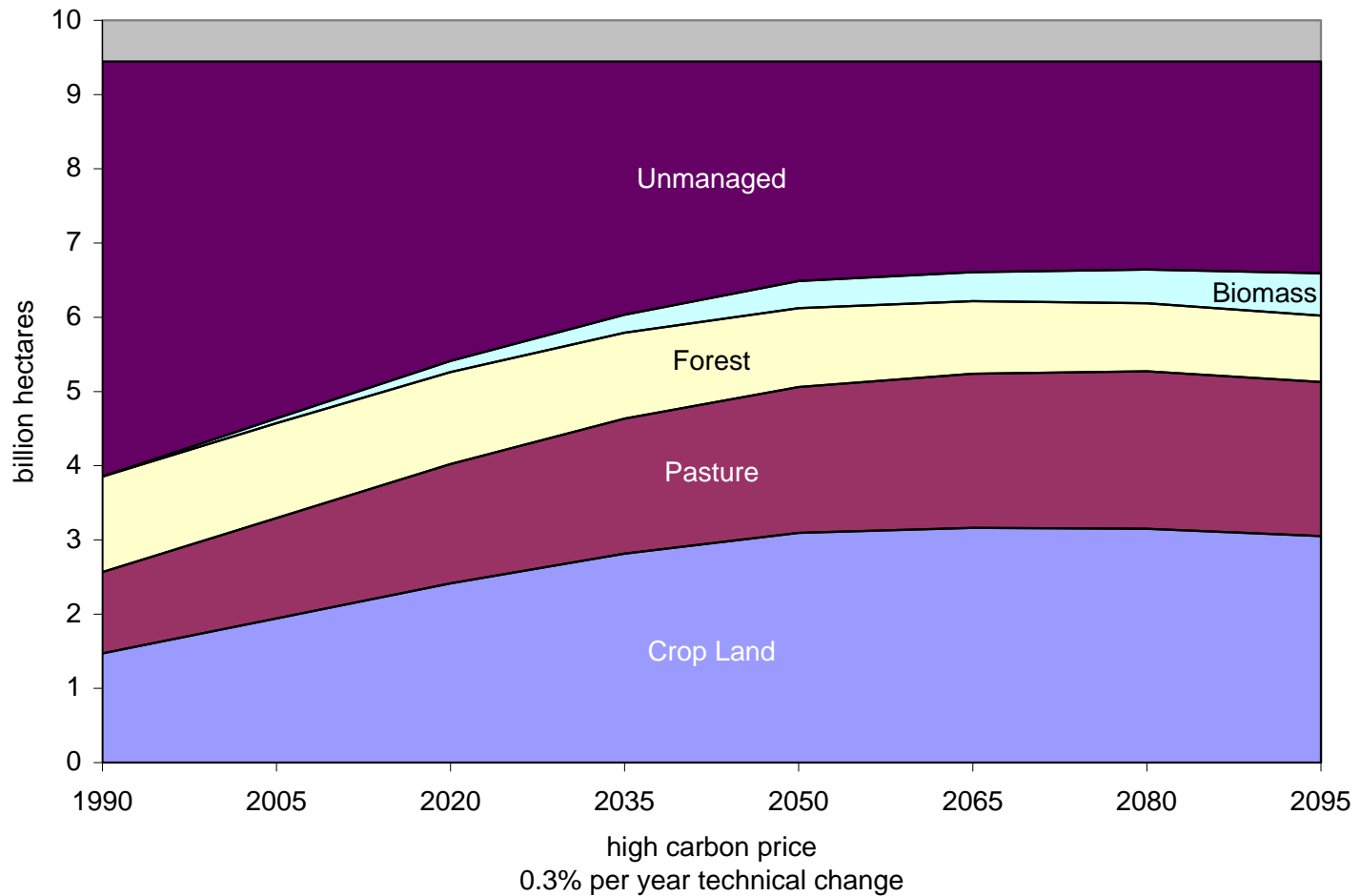
Price of Composite Crop



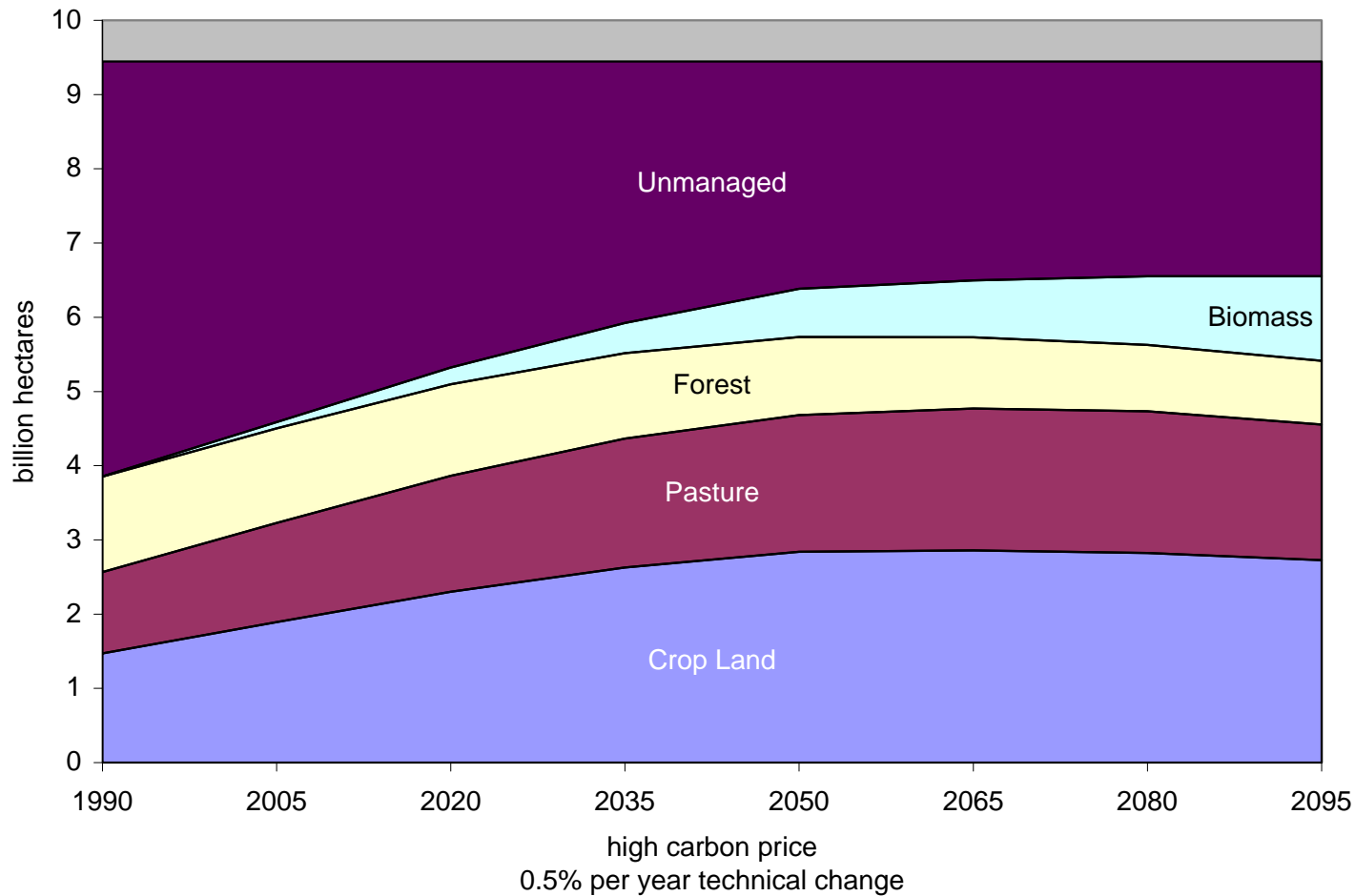
Carbon Emissions from Land Use Change



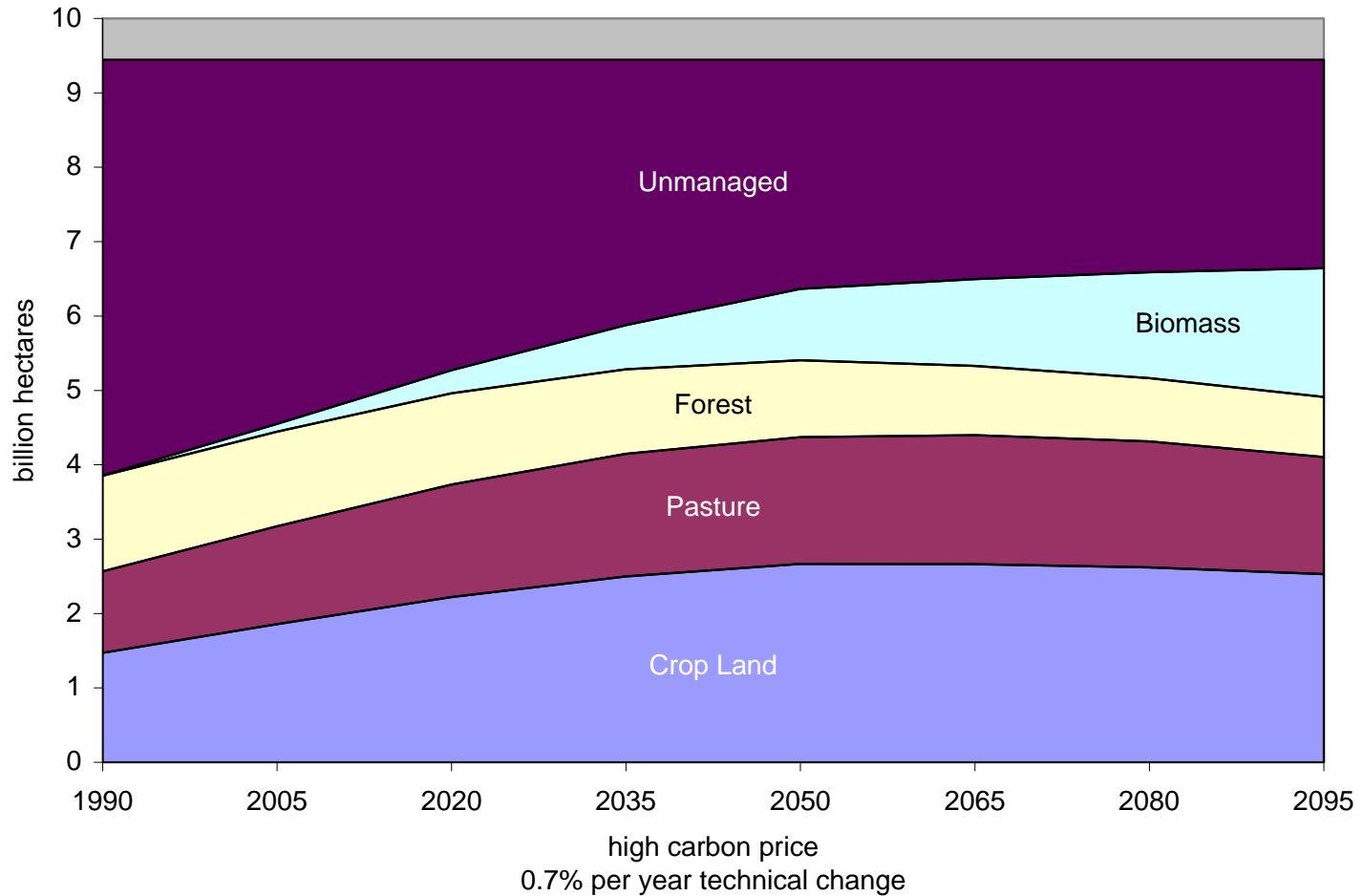
Global Land Use (C)



Global Land Use (F)






Global Land Use (I)



Model Development

- 👉 Demand and supply of agricultural products from FAO food balance tables
- 👉 Dynamics of carbon emissions from land-use change
- 👉 CH₄ and N₂O emissions from agriculture
- 👉 Water supply and demand

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