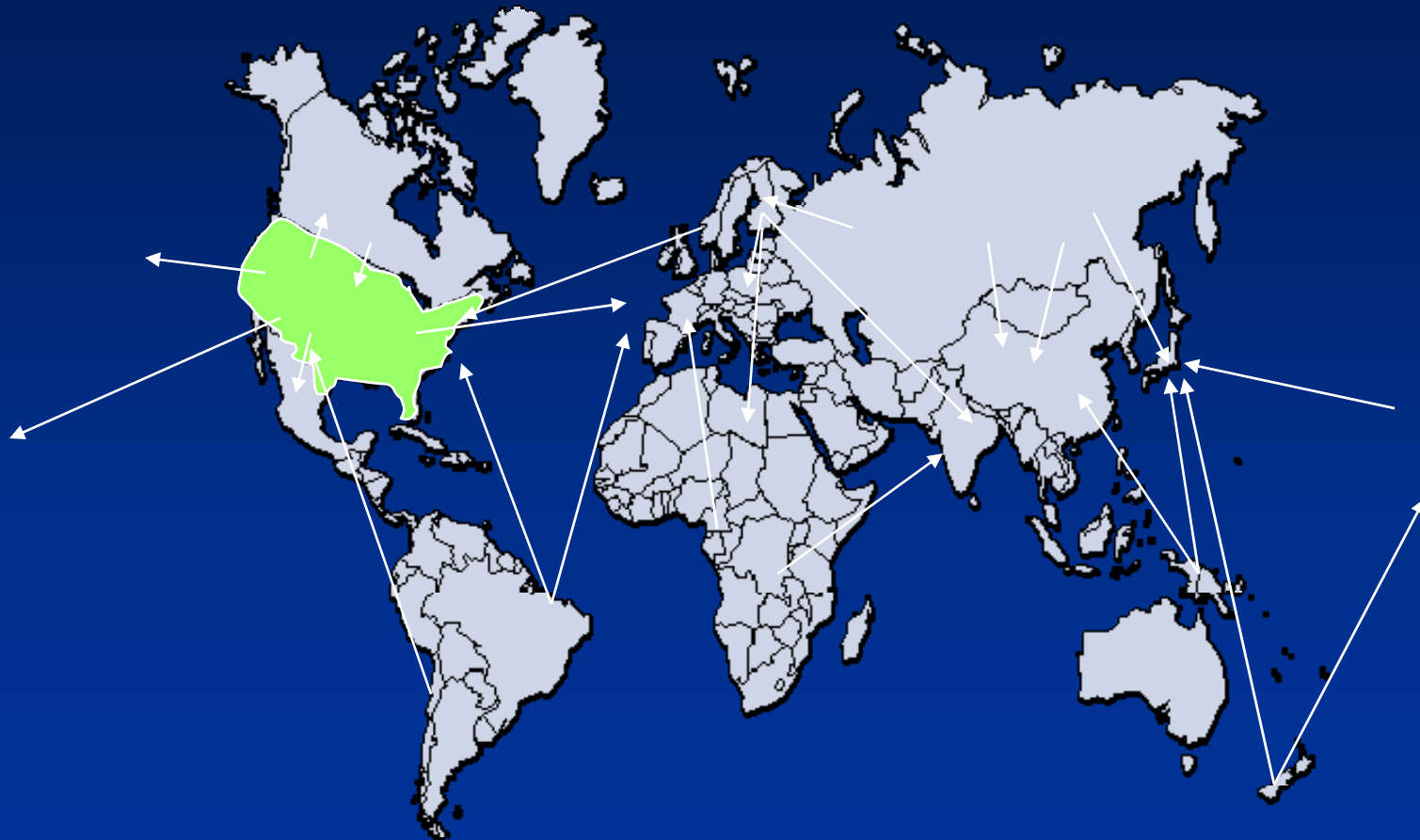


# Global Outlook for Forests and Forest Industries with Climate Change

R. Raunikar, J. Buongiorno, J.A.  
Turner, S. Zhu, J. Prestemon

# International Context for 2010 RPA Forest Assessment



# Objectives

- Long term effects of IPCC scenarios:
  - Production, imports, exports, prices, stock
  - Producer revenues
  - Consumer expenditures
  - Value added
- Global and by country

# GFPM

The image shows the cover of the book 'The Global Forest Products Model'. The background is a photograph of a dense forest with tall trees and sunlight filtering through the canopy. The title is written in a yellow, serif font. Below the title, the names of the authors are listed in white text on dark rectangular backgrounds.

## The Global Forest Products Model

Joseph Buongiorno

Shushuai Zhu

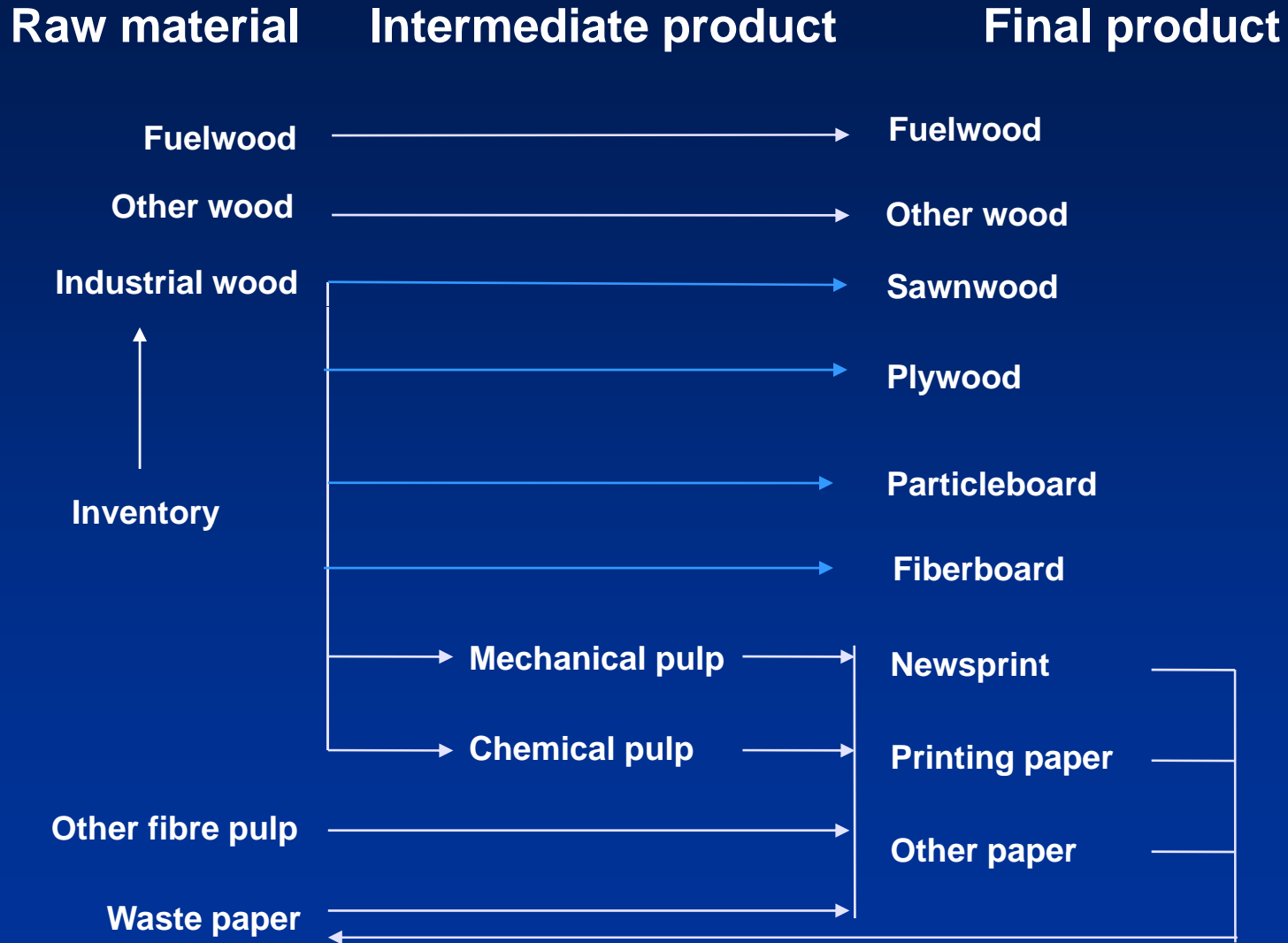
Dali Zhang

James Turner

David Tomberlin

- Dynamic Spatial Economic model
- 180 countries
  - 14 commodities
  - Production, imports, exports
  - Prices
  - Forest area & stock

# GFPM Product Flows



# GFPM objective function

$$\max Z = \sum_i \sum_k \int_0^{D_{ik}} P_{ik}(D_{ik}) dD_{ik}$$

$$- \sum_i \sum_k \int_0^{Y_{ik}} m_{ik}(Y_{ik}) dY_{ik}$$

$$- \sum_i \sum_j \sum_k c_{ijk} T_{ijk}$$

# GFPM constraints

$$\sum_j T_{jik} + Y_{ik}$$

=

$$\sum_n a_{ikn} Y_{in} + \sum_j T_{ijk} \quad \forall i, k$$

Dual Solution  $\Rightarrow P_{ik}$

# Dynamics

Demand shift

$$D = D_{-1}(1 + \alpha_y g_y)$$

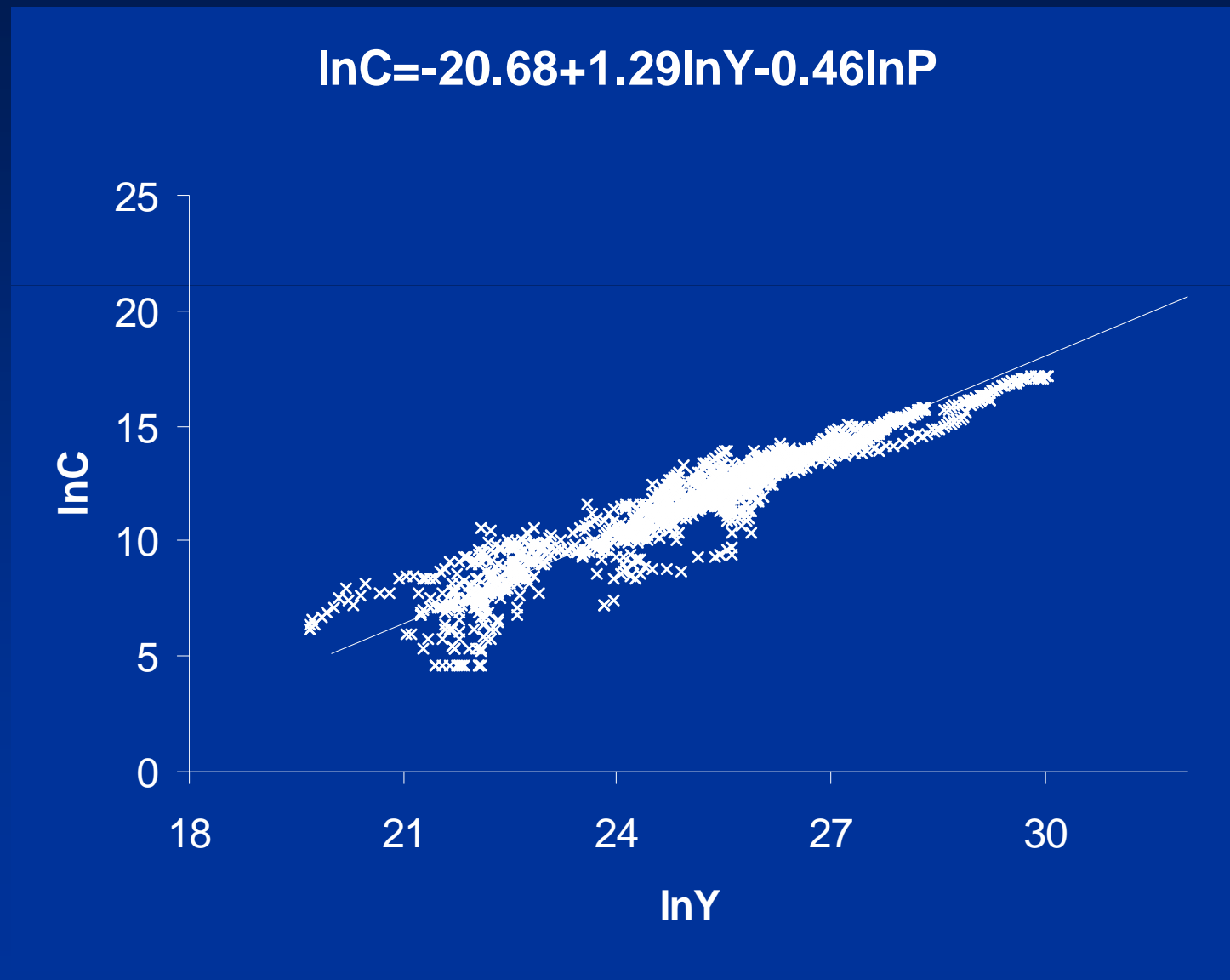
Forest area change

$$g_{aa} = \alpha_0 + \alpha_1 y' + \alpha_2 y'^2$$

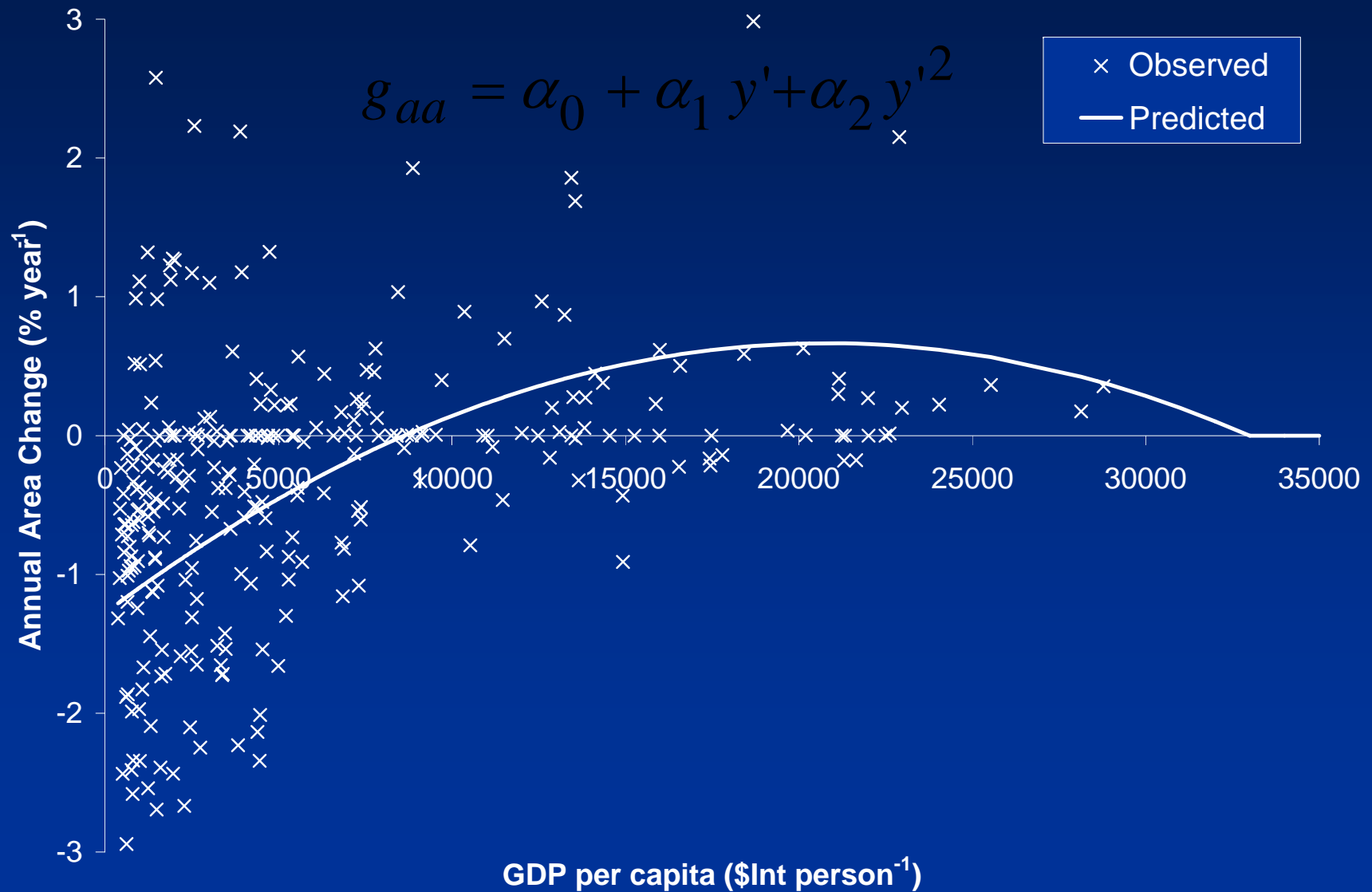
Inventory growth

$$g_{ua} = \gamma_0 \left( \frac{I}{A} \right)^\sigma$$

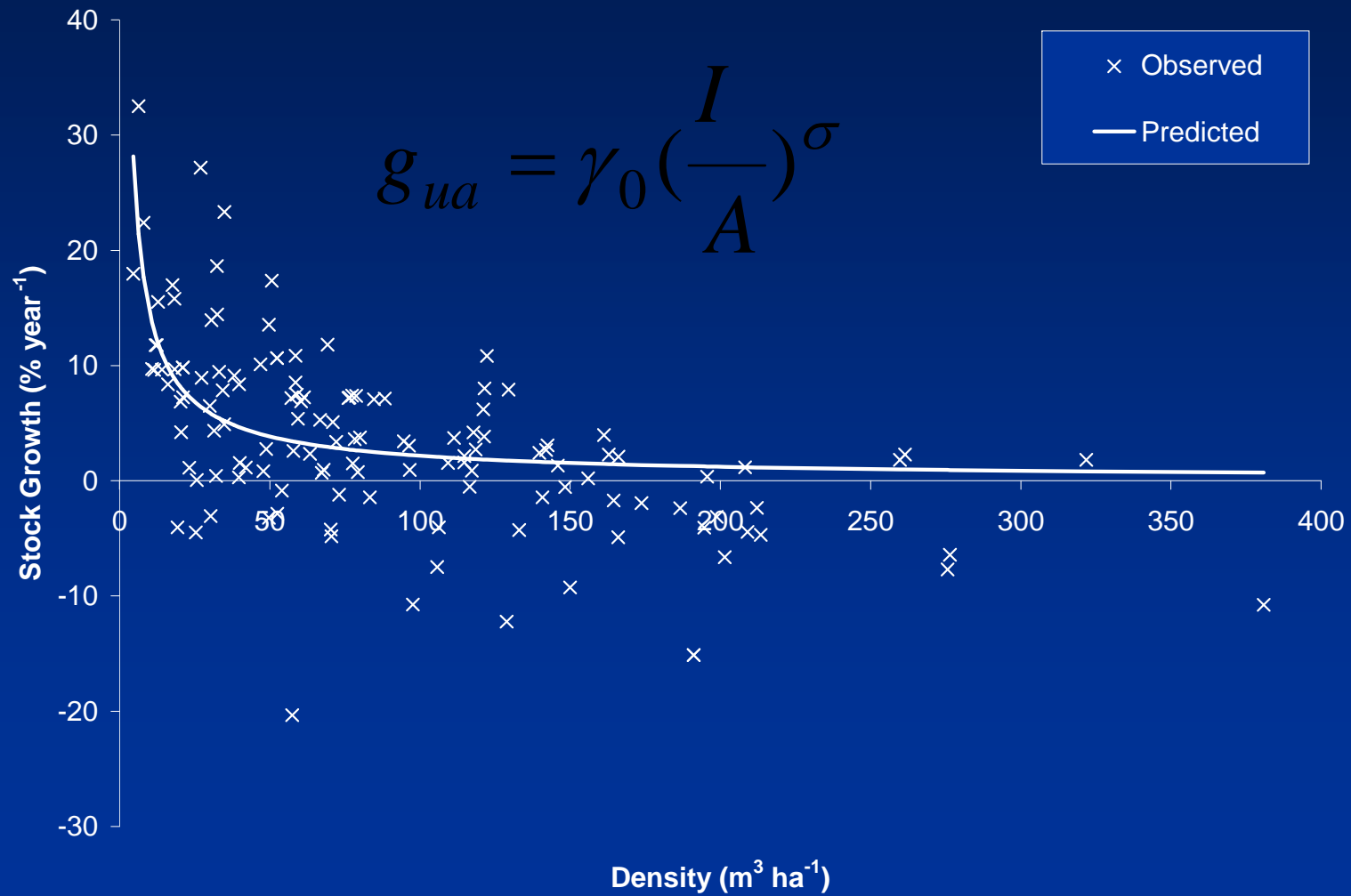
# Demand printing & writing paper



# Forest area change



# Inventory growth



# IPCC Scenarios

## A1-GLOBALIZATION

High income, low population

Biofuels: 2060/2006=6x      2100/2006=9x

## A2-REGIONALIZATION

Lower income, higher population

Biofuels: 2060/2006=3x      2100/2006=4x

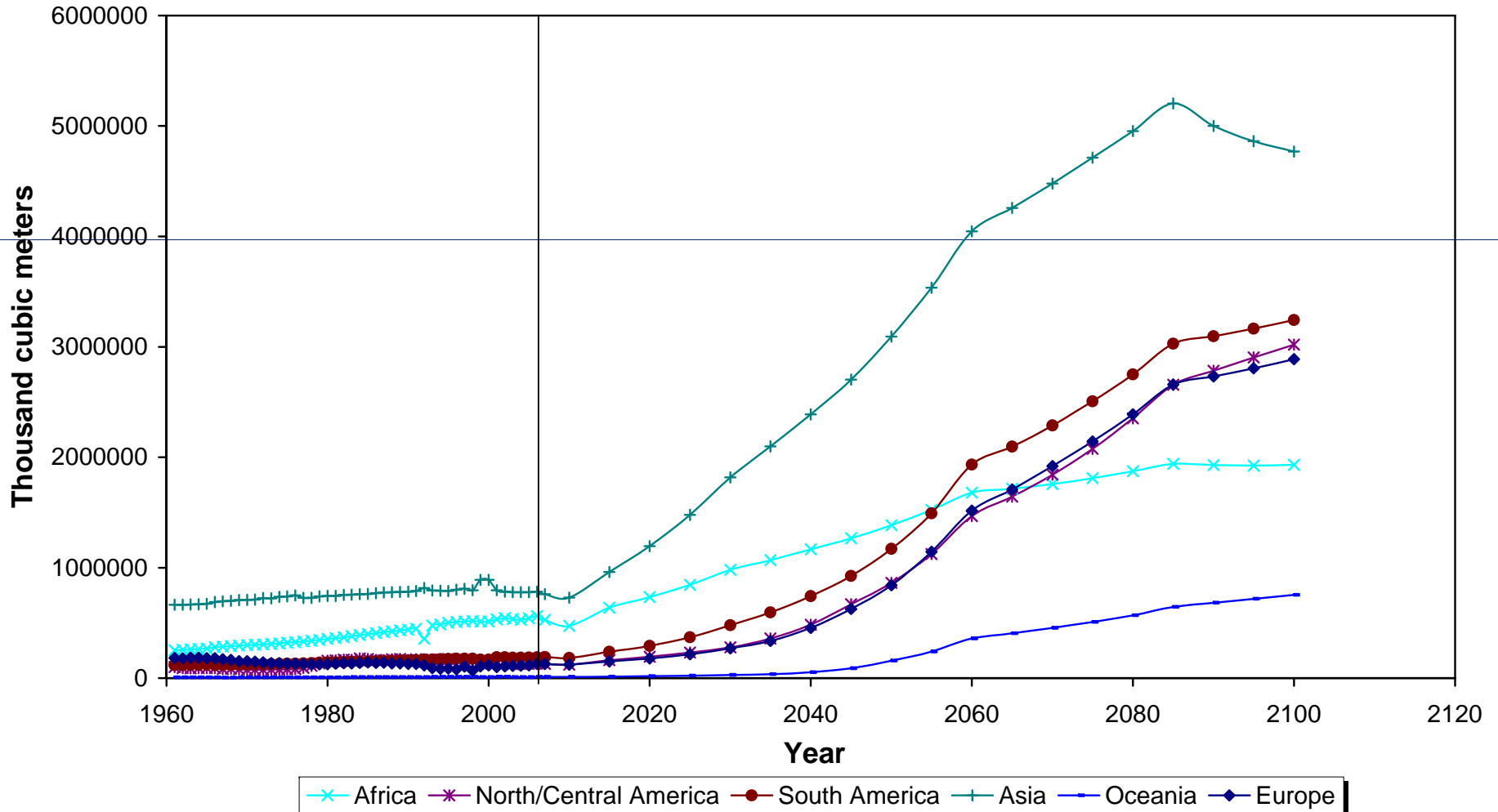
## B2-SUSTAINABLE REGIONALIZATION

Intermediate income, population

Biofuels: 2060/2006=3x      2100/2006=7x

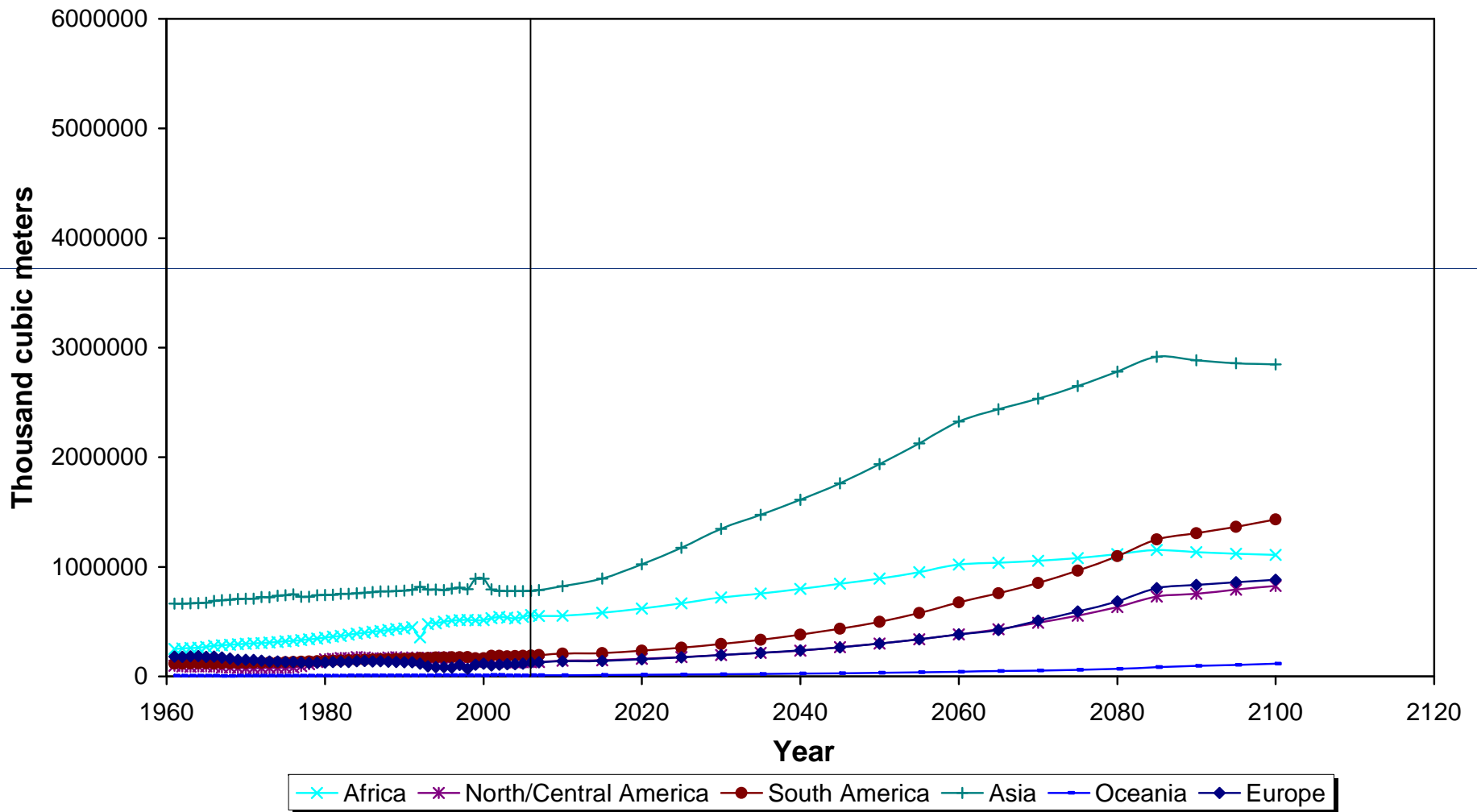
# Scenario A1

Production of Fuelwood



# Scenario A2

Production of Fuelwood

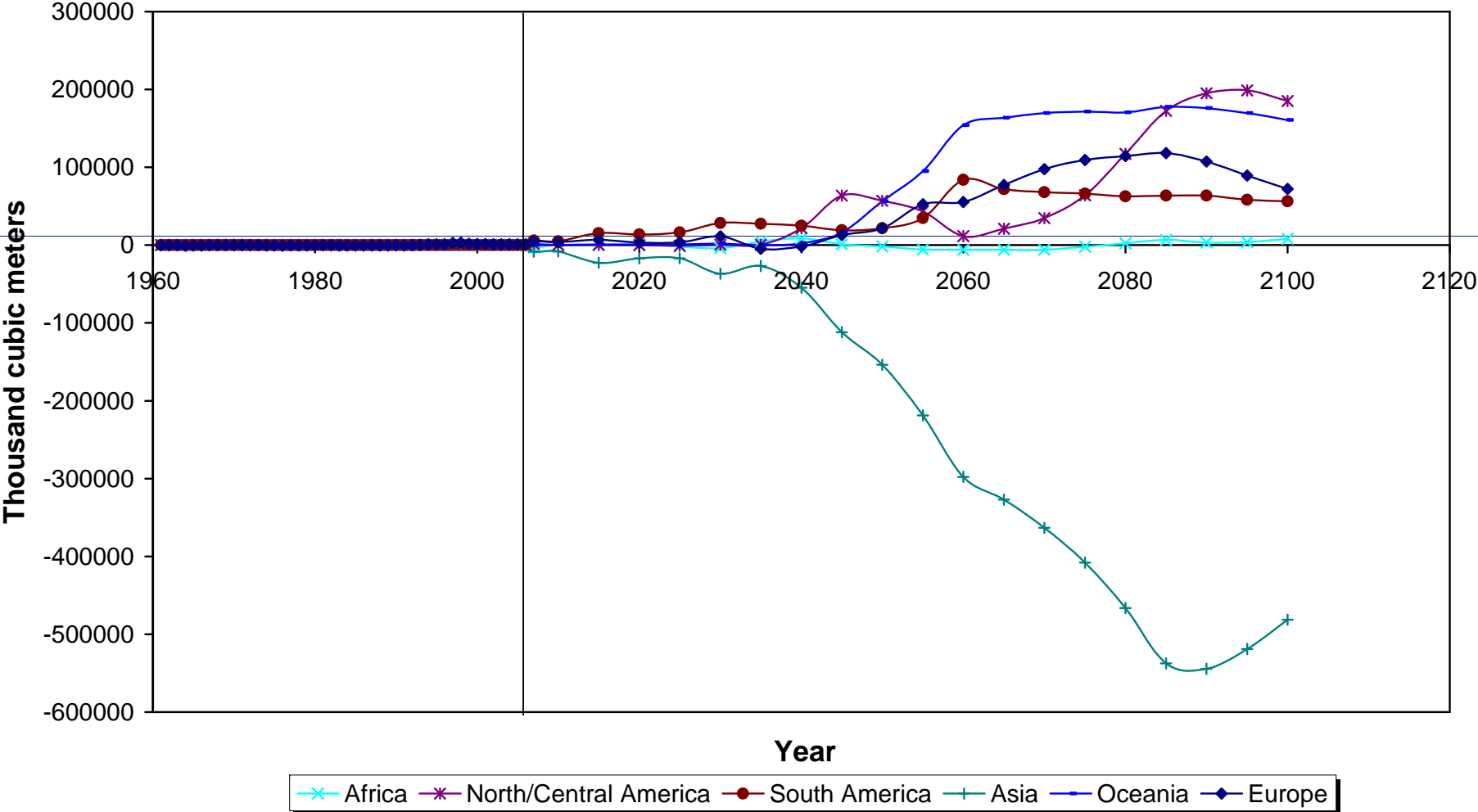


## Annual growth of fuelwood production (%)

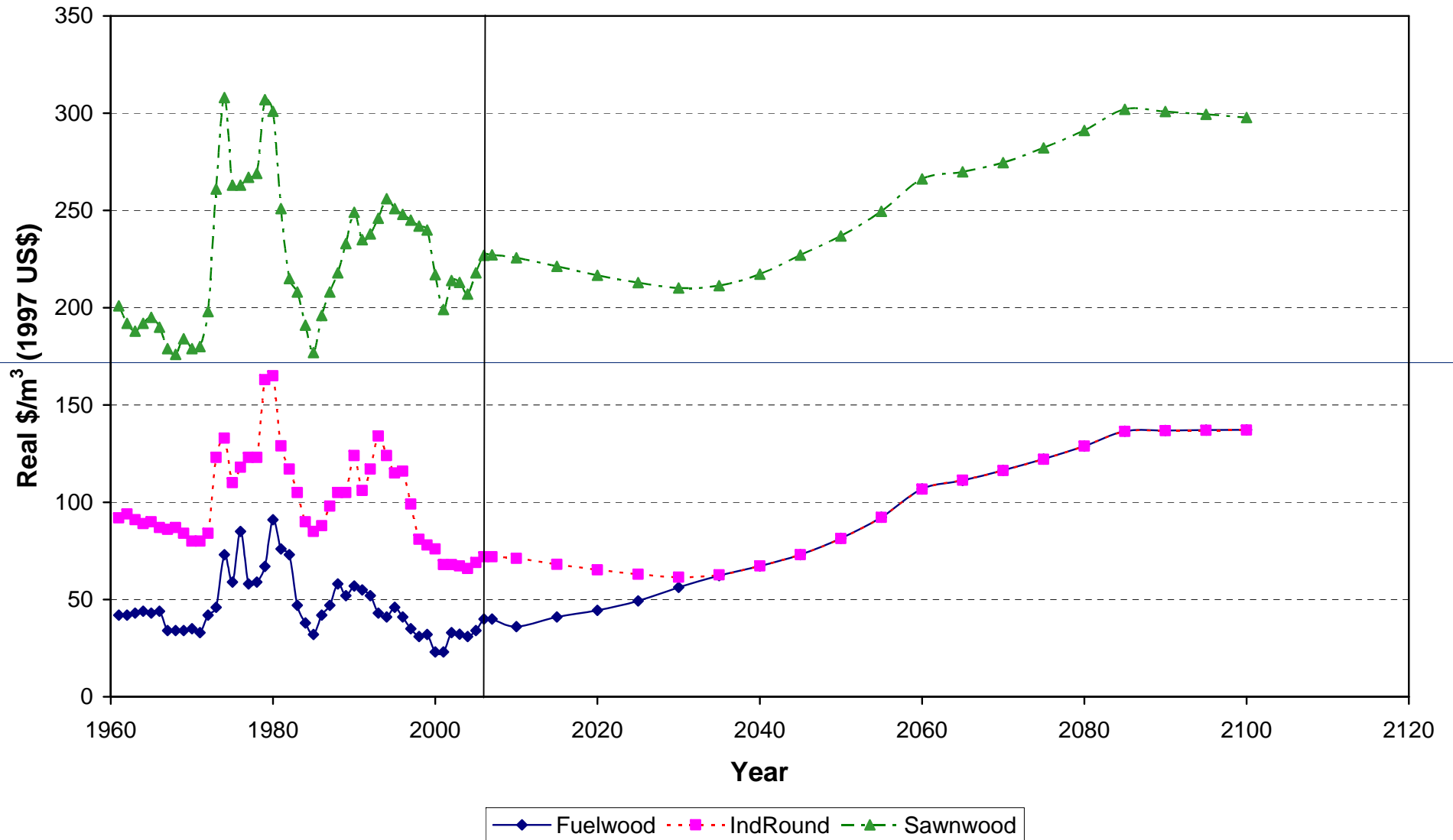
		<u>2006-2060</u>	
	<u>1992-06</u>	<u>A1</u>	<u>A2</u>
Canada	-5.6	4.0	1.1
USA	-5.0	6.0	2.4
Brazil	0.8	3.3	1.1
Indonesia	-3.2	3.1	1.4
Japan	-2.7	10.3	2.4
Finland	3.7	5.1	2.0
Russian Fed.	-2.2	4.3	1.2
Sweden	3.6	4.0	1.5
DEVELOPED	-1.3	5.3	2.3
DEVELOPING	1.0	3.0	1.8

# Scenario A1

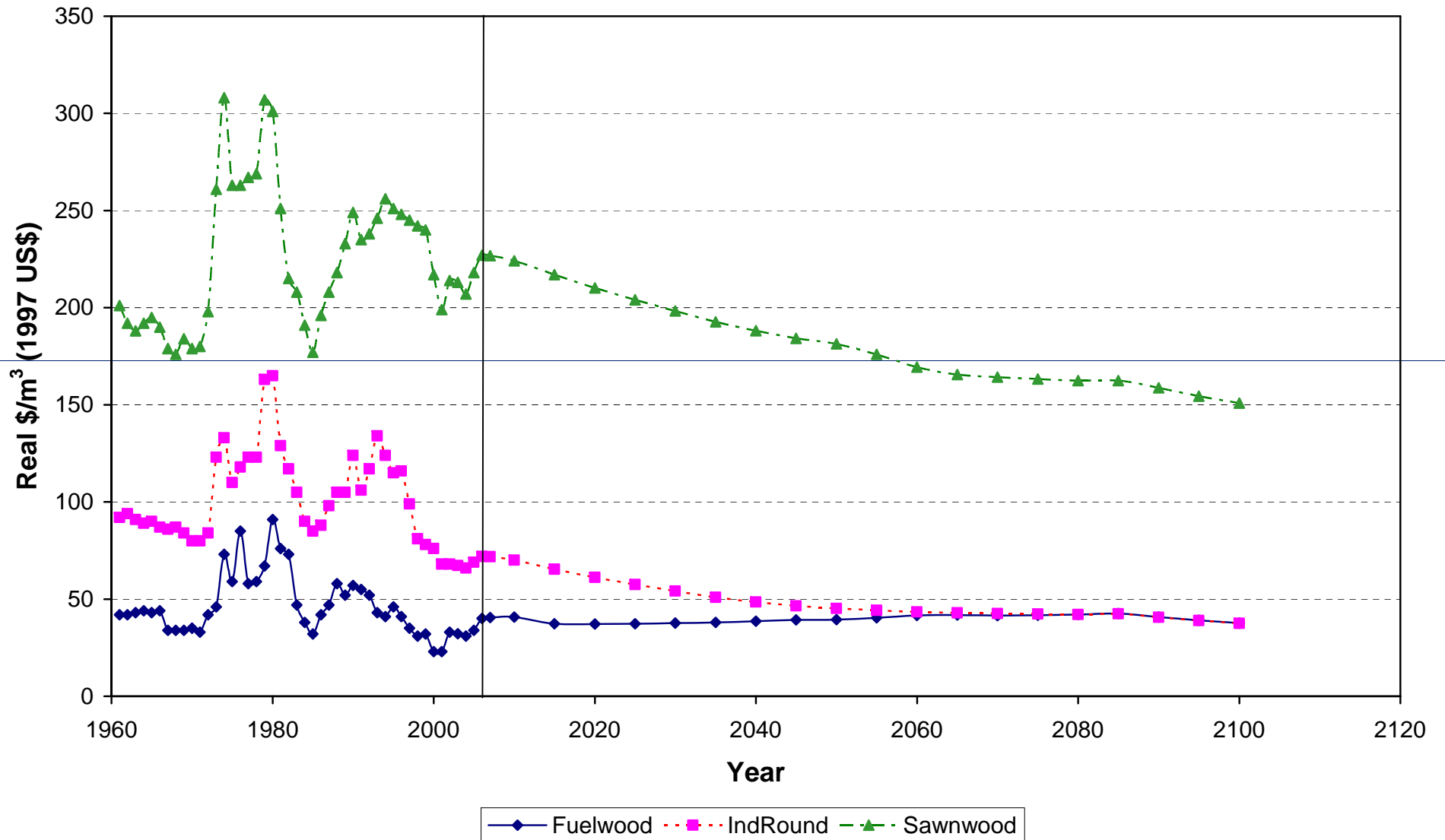
Net Trade of Fuelwood



# Solid wood prices, Scenario A1

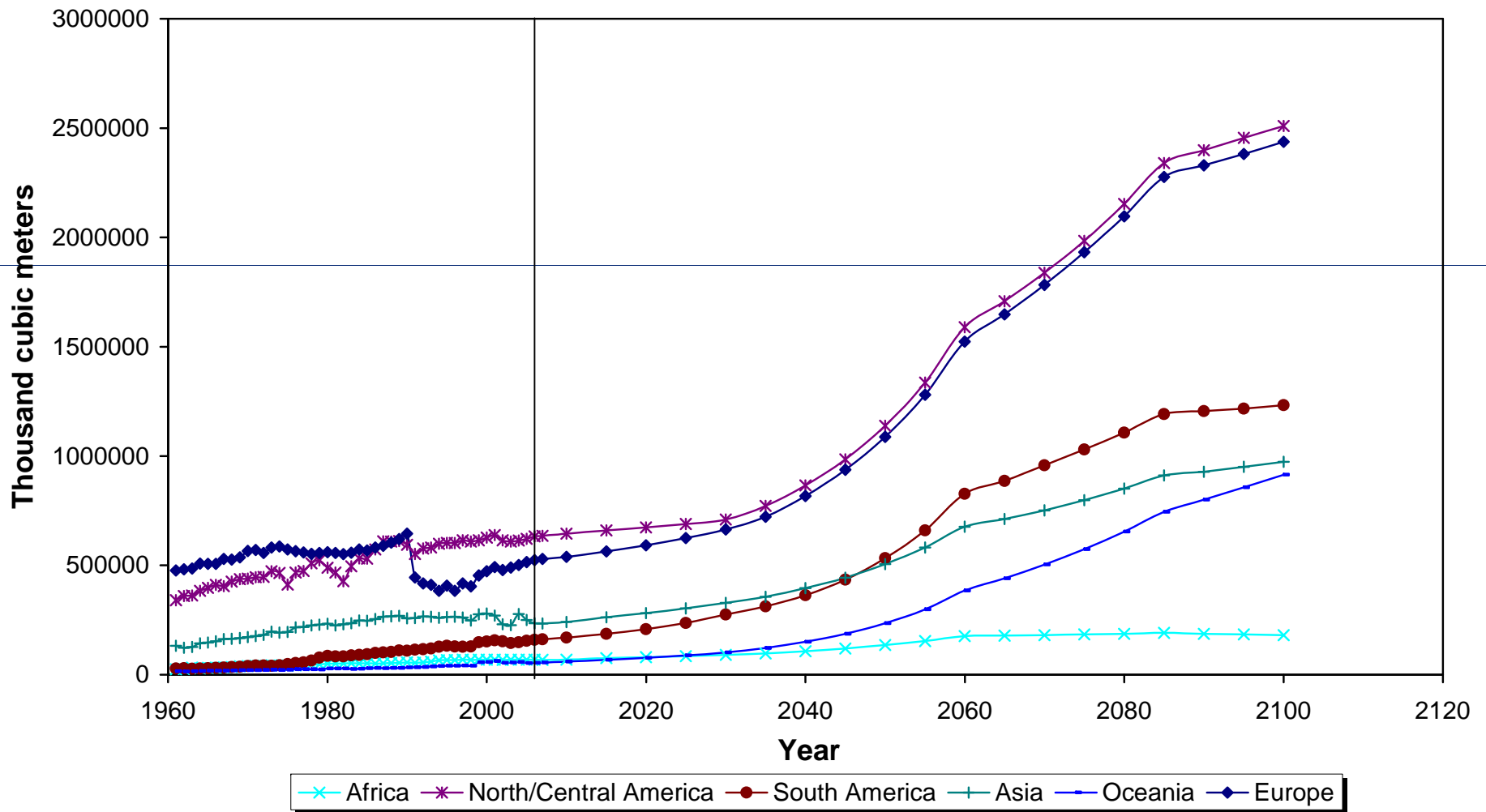


# Solid wood prices, Scenario A2



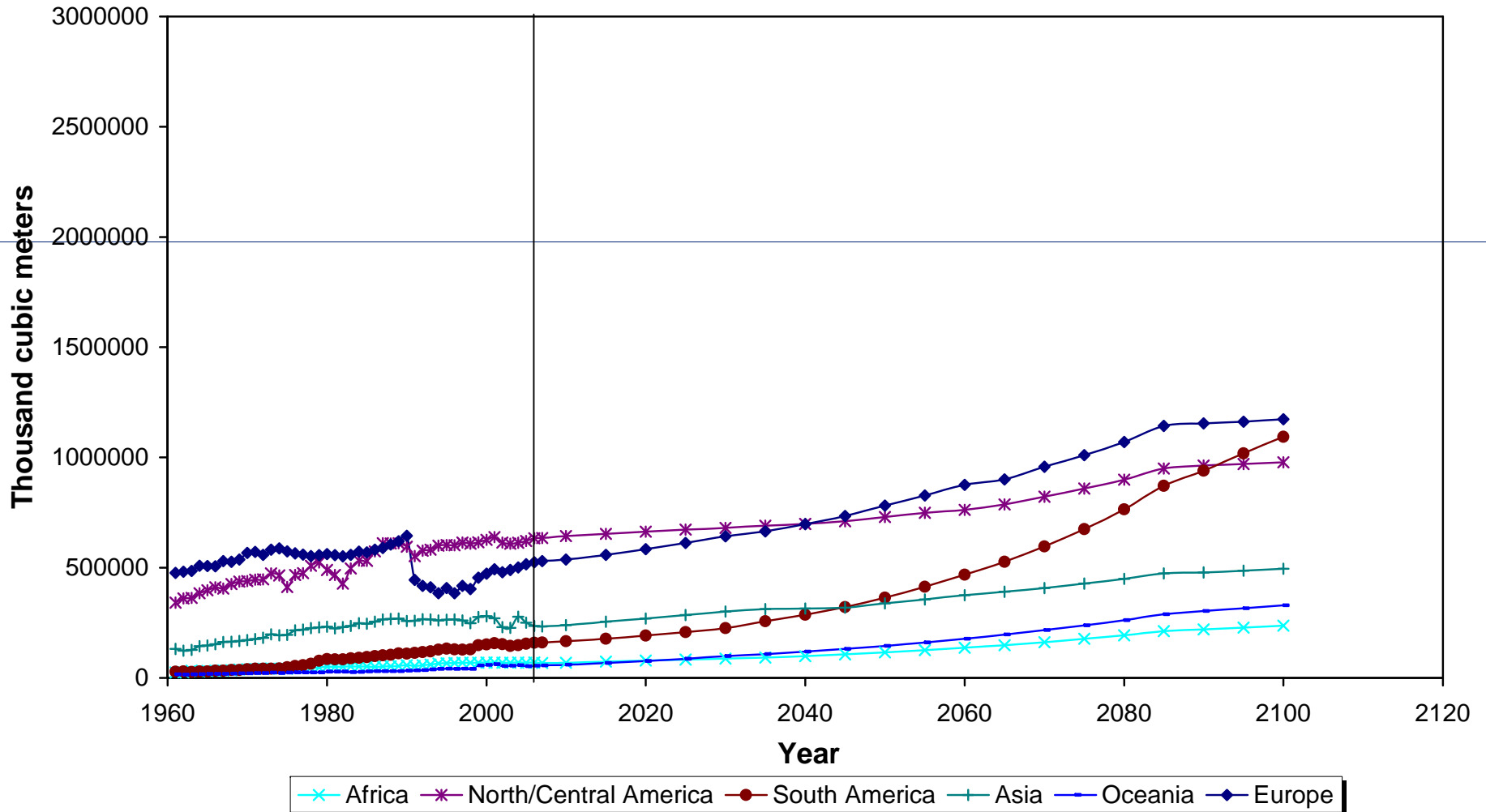
# Scenario A1

## Production of Industrial Roundwood



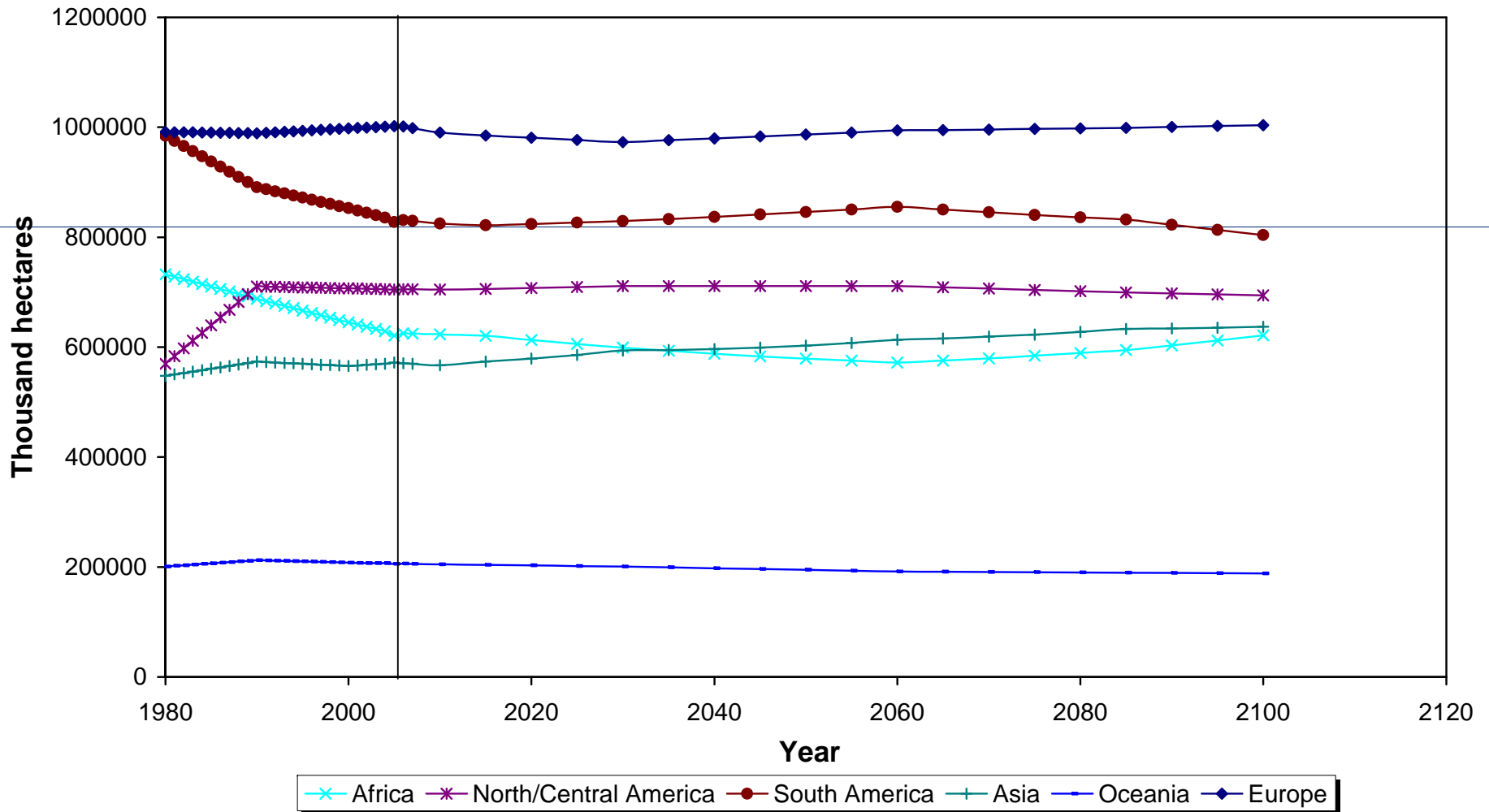
# Scenario A2

## Production of Industrial Roundwood



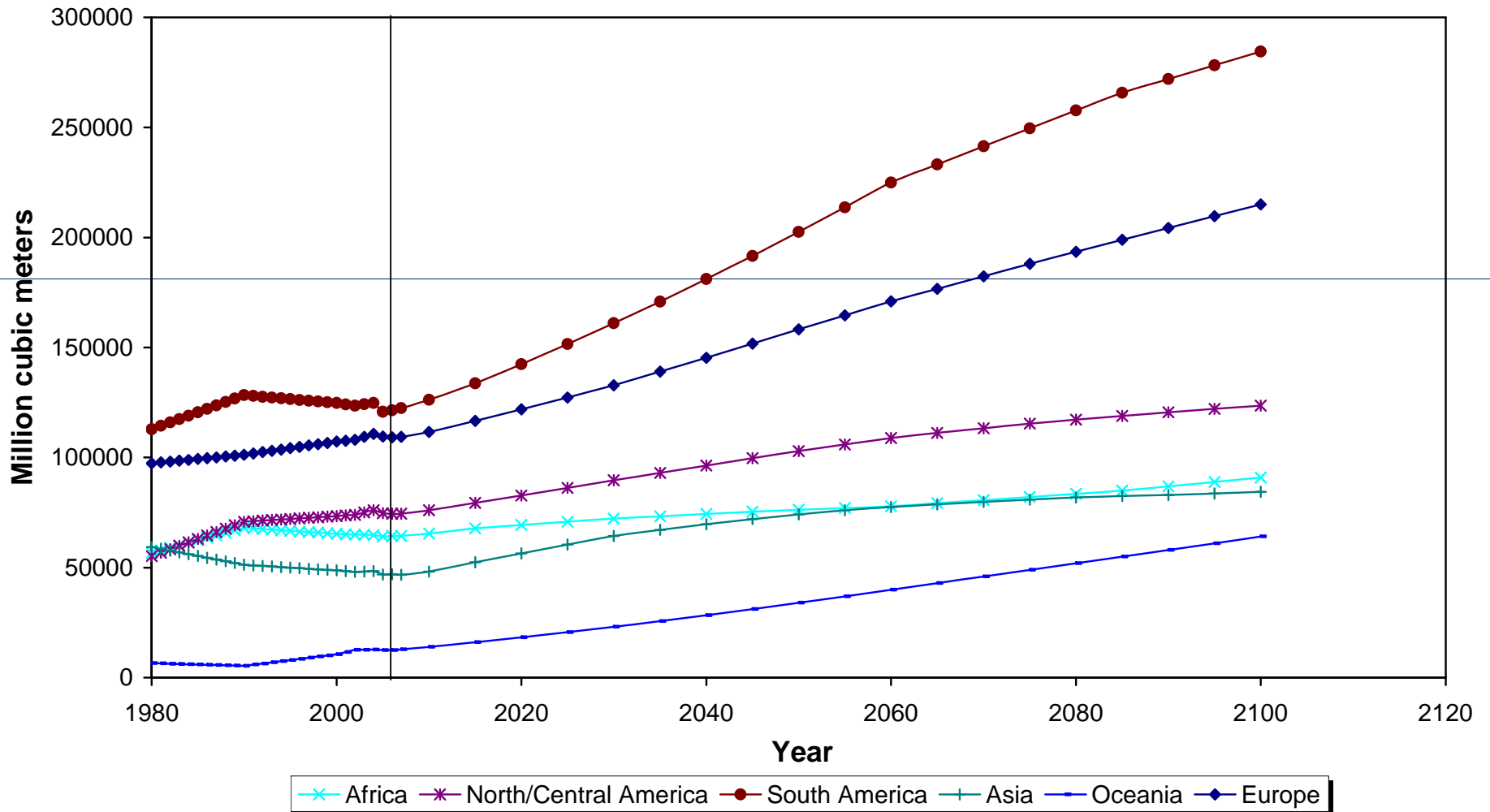
# Scenario A1

## Forest Area



# Scenario A1

Forest Stock



## Annual rate of growth of stock (%)

	1992-06	2006-2060	
		A1	A2
Nigeria	-2.2	-1.1	-0.7
Canada	0.0	0.6	0.7
USA	0.5	0.8	0.9
Brazil	-0.5	0.8	0.7
Chile	1.1	2.5	3.0
China	1.3	1.2	1.2
Indonesia	-5.2	0.7	0.8
Finland	0.7	1.2	1.3
Russian Fed.	0.0	0.8	0.8
<b>DEVELOPED</b>	<b>0.8</b>	<b>0.9</b>	<b>1.0</b>
<b>DEVELOPING</b>	<b>0.4</b>	<b>0.9</b>	<b>1.0</b>

# Conclusion

- Impact of high demand for biofuels
  - Prices of fuelwood & industrial roundwood converge
  - Supply of industrial wood rises
  - Limited impact on growing stock
- Partial effect of global warming?
- Hard and soft data



Thank you!