A photograph of a forest floor with ferns and tree trunks, overlaid with a light green text box with a brown border.

# **Does a decrease in forest harvesting cause substitution of higher global warming products: an empirical study**

Doug Hopwood, Adam Robertson, Caren Dymond

Presentation to Conference of Western Forest Economists  
September 2023

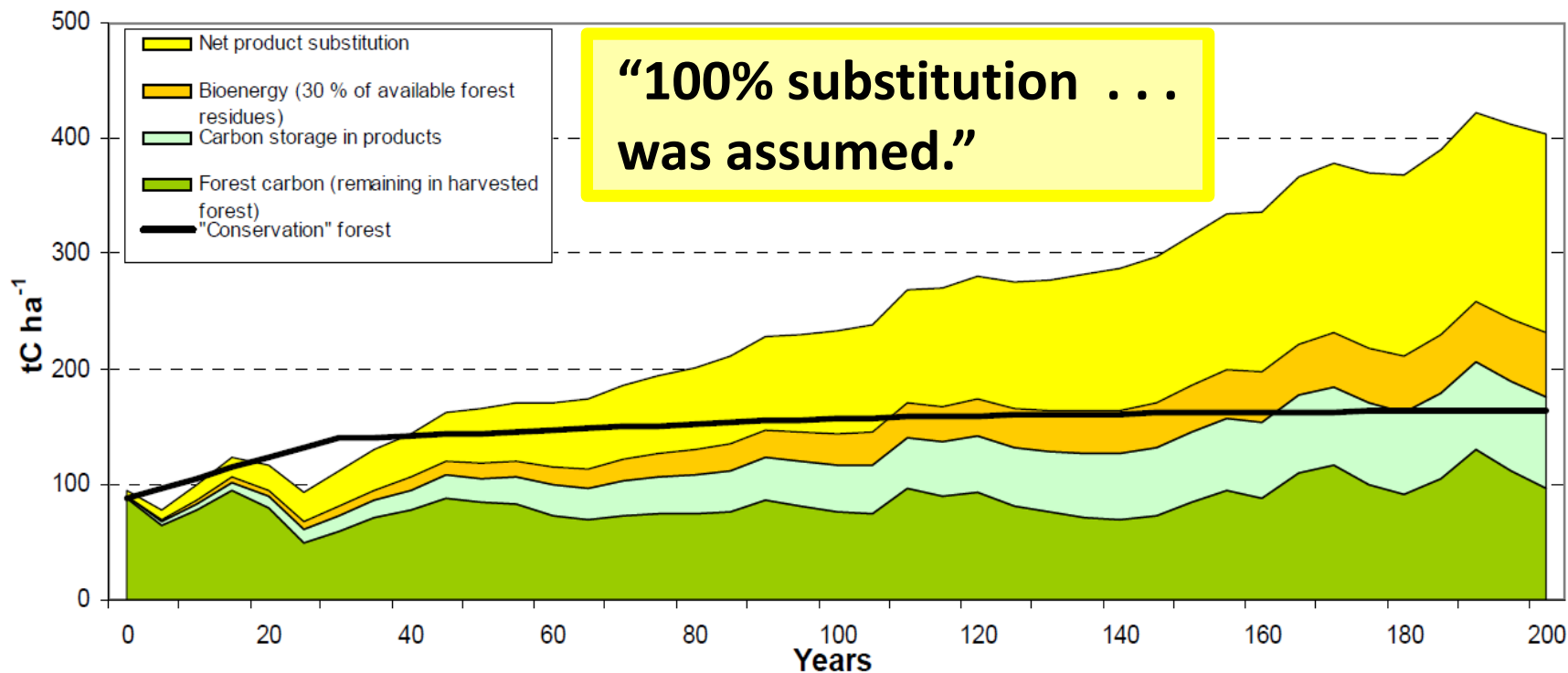
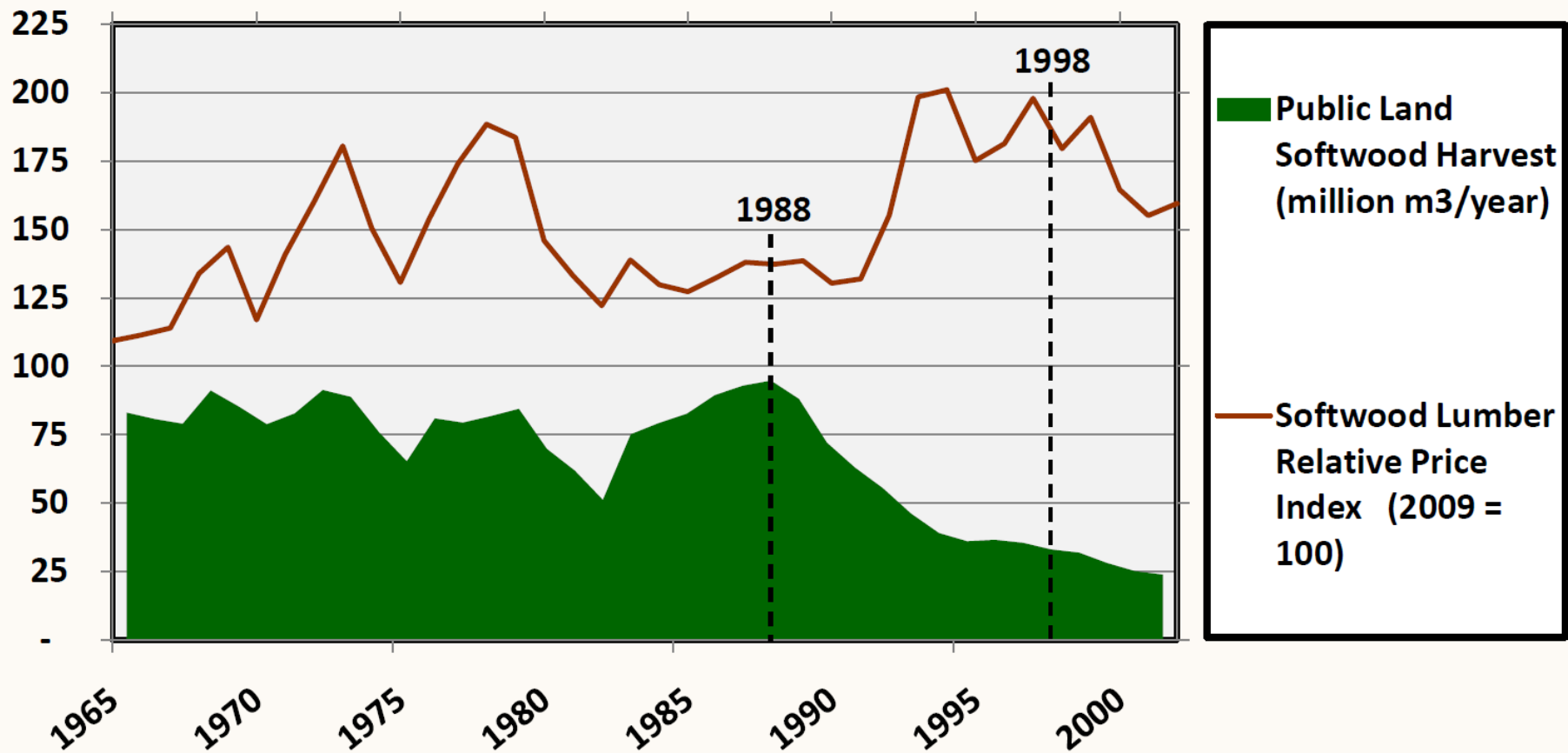


Figure 4.1 GHG implications of the 'conservation' and 'harvest' scenarios (t C ha<sup>-1</sup> sequestered or displaced) for North Coast forests modelled over a 200 year period.







## Case Study

- Softwood lumber products
- Production, consumption, imports and exports
- “Lower 48” states
- Before and after: 1988 and 1998
- Substitution and other adaptations

## LCA FOR ENERGY SYSTEMS AND FOOD PRODUCTS

# **The implications of empirical and 1:1 substitution ratios for consequential LCA: using a 1 % tax on whole milk as an illustrative example**

Neil George Chalmers<sup>1</sup> • Matthew Brander<sup>2</sup> • Cesar Revoredo-Giha<sup>3</sup>

“There is an apparent convention within . . . life cycle assessment to assume a 1:1 substitution ratio between functionally equivalent product systems.

“However, this convention may not be compatible with the purpose of consequential LCA, which is to model the actual consequences of the decision at hand. “

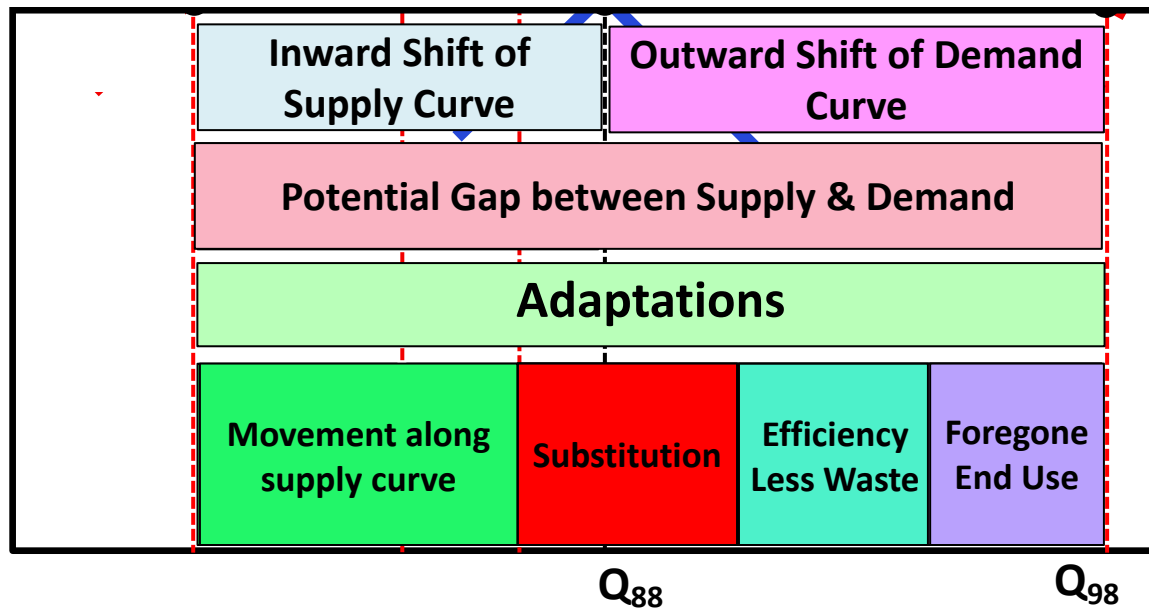
# What is the Substitution Ratio?

## Numerator

*The annual consumption of softwood  
lumber displaced by a shift in market  
share to an alternative product*

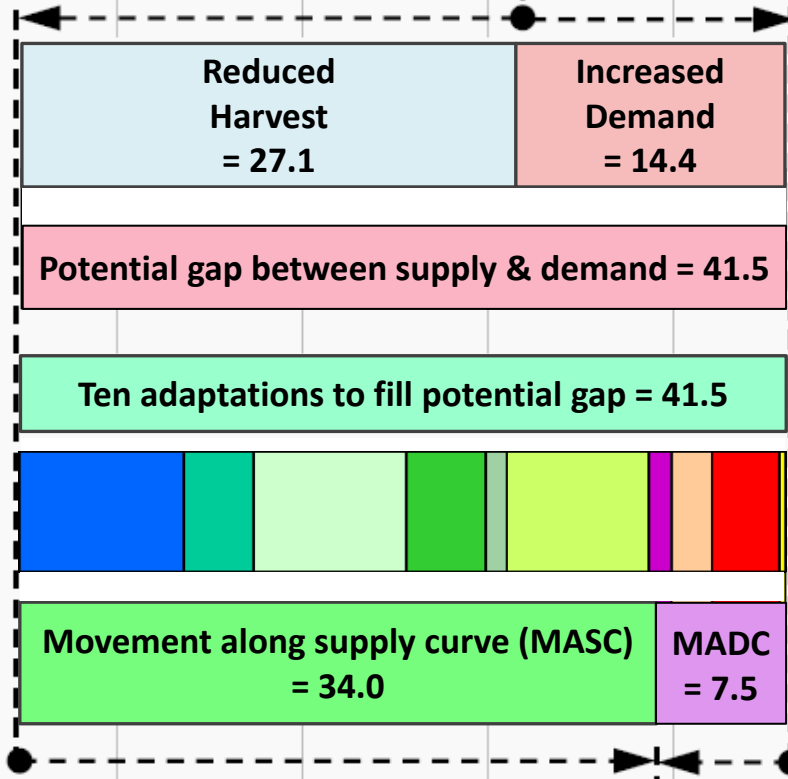
## Denominator

*The potential gap between the supply of  
softwood lumber and the demand for  
softwood lumber or an equivalent  
alternative product*



1988 SWL consumption = 81.6

Changes from  
1988 to 1998



1998 SWL Consumption = 88.7

10

20

30

40

50

60

70

80

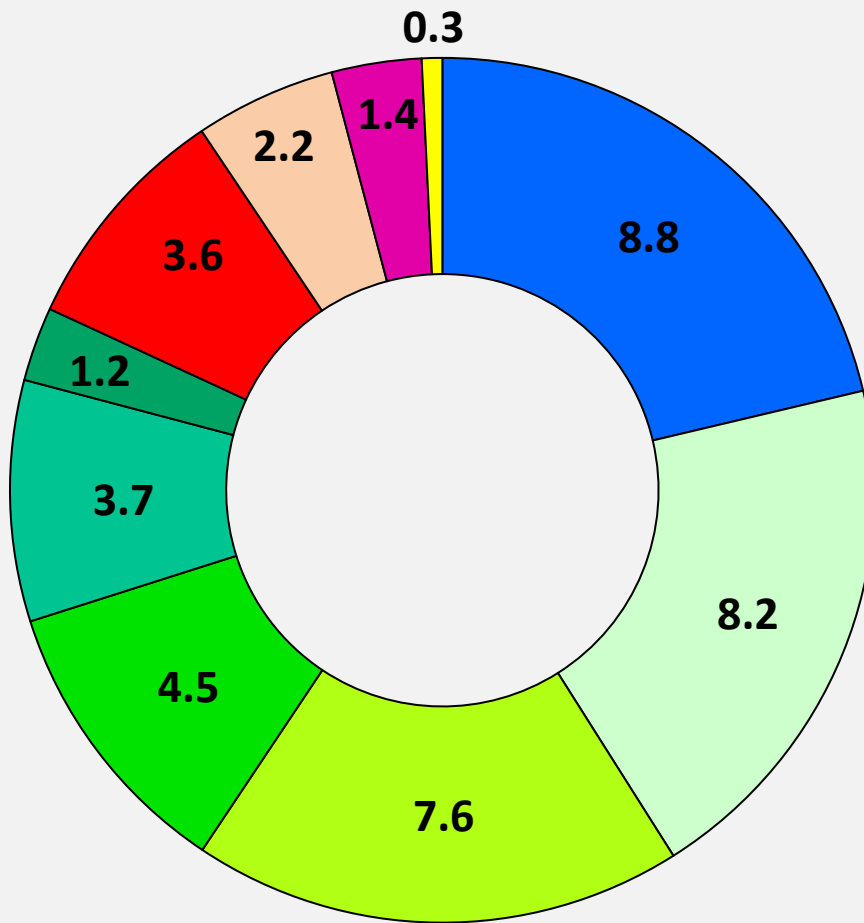
90

100

Consumption of softwood lumber or alternatives (million m<sup>3</sup>/year, lumber equivalent)



**Ten adaptations to fill potential gap  
between supply and demand**



**Total of adaptations = 41.5 million  
m<sup>3</sup>/year SWL or equivalent**

- Increased lumber import
- Decreased sawlog export
- Increased lumber recovery
- Increased US harvests
- Decreased lumber export
- Increased sawlog sort factors
- Substitution: Non-wood products
- Substitution: Other wood products
- Increased lumber use efficiency
- Foregone residential construction

# Substitution ratios of non-wood products

*Two ways to calculate substitution ratio*

Non-wood product substitution  
Inward shift of supply curve + outward shift of demand curve

$$= 3.6 / 41.5 = 8.7\%$$

Non-wood product substitution  
Inward shift of supply curve

$$= 3.6 / 27.1 = 13.4\%$$

# Conclusions & Discussion

- **1:1 Substitution ratio not supported**
- **Researchers should use realistic assumptions**
- **Good news for climate change mitigation?**
- **What about offset projects?**
- **Adaptations may be influenced by policy choices**
- **Beyond equilibrium economics?**



***Thank  
you***