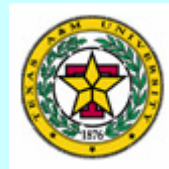


Is Bioenergy Development Good or Bad to Sustainable Forest Management?

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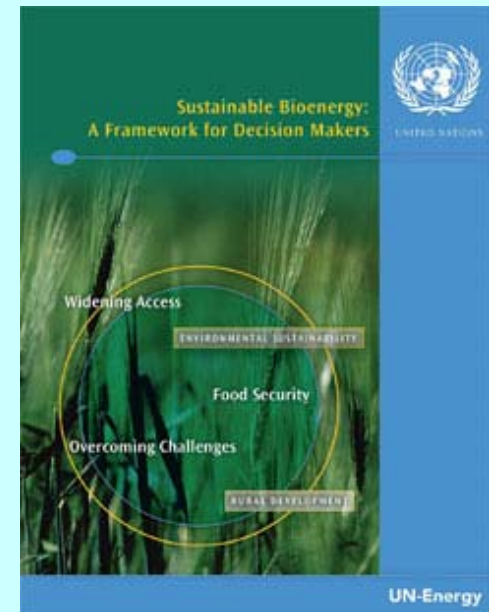
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Presentation outline

- **The issue**
- **Some definitions**
 - Forest biomass/bioenergy
 - Sustainable forest management
- **GOOD: Benefits to forest management**
- **BAD/UNCERTAIN: Potentially negative impacts**
- **Summary**

The issue/alert

“Bioenergy provides us with an **extraordinary opportunity** to address several challenges: climate change, energy security and development of rural areas. Investments, however, need to be planned and managed carefully to avoid generating **new environmental and social problems**, some of which could have **irreversible** consequences.”



Biomass (USDOE & USDA)

Any organic matter that is available on a renewable or recurring basis, including

- agricultural crops
- **trees**
- wood and wood wastes and residues,
- plants (including aquatic plants)
- grasses
- residue fibers
- animal wastes
- municipal wastes
- other waste materials

Sustainability concern stems from using trees that provide many products and services and require inputs to grow.

Sources of forest biomass

Conventional forests



Woody crops
(energy plantations)



Urban forests



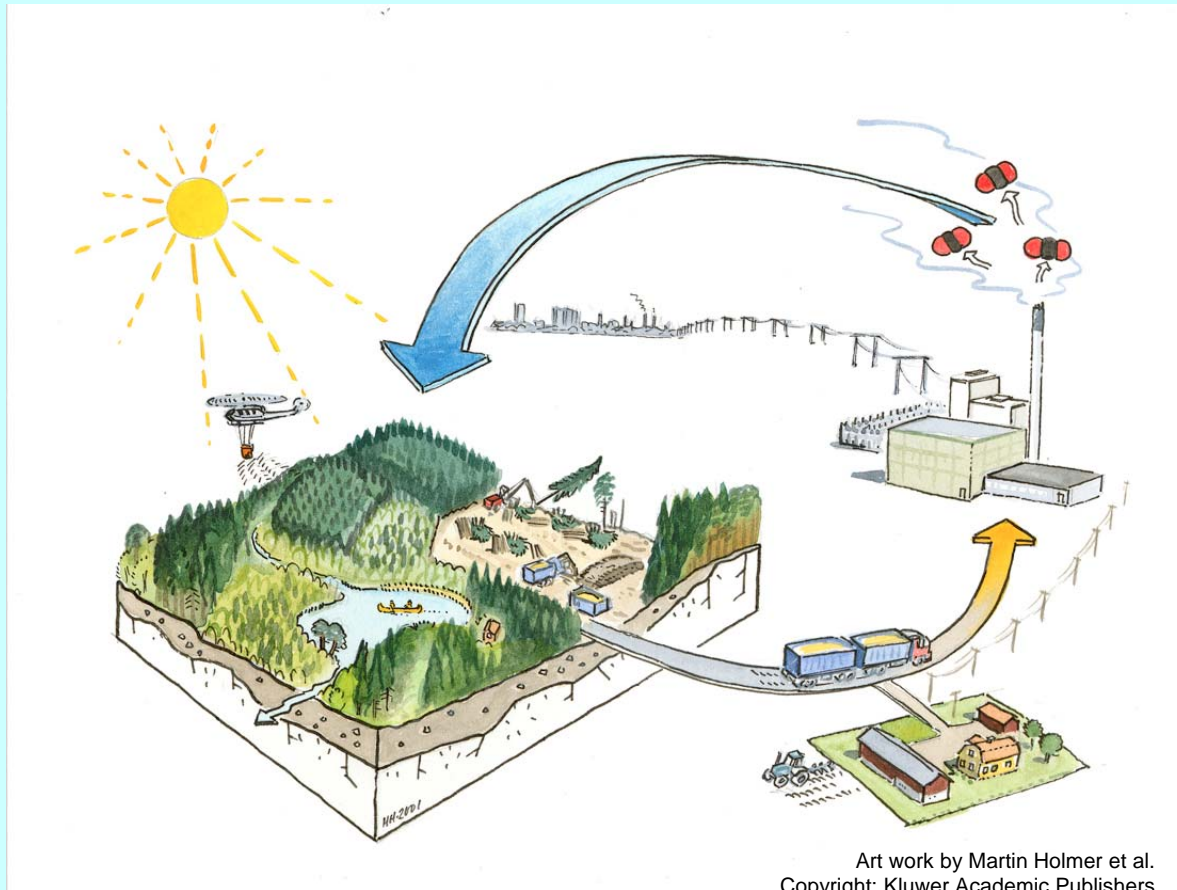
Sustainable forest management

The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.

Balance between society's increasing demands for forest products and benefits, and the preservation of forest health and diversity.

Developed by the Ministerial Conference on the Protection of Forests in Europe (MCPFE) and adopted by FAO.

Forest bioenergy supply chain



GOOD: Benefits to forest management

Reduce
fire hazard



GOOD: Benefits (cont'd)

Reduce site preparation costs (logging residues)

- Cost savings: US\$200-250/ha in the US South



GOOD: Benefits (cont'd)

Help with restoring disturbance-damaged forests



GOOD: Benefits (cont'd)

Opportunity for stand improvement

Low stocking,
low value,
and undesirable or
nonmerchantable species

Stands left behind after high-
grading, diameter-limited
harvesting



Photo source: Darwin Foster

GOOD: Benefits (cont'd)

Opportunity for utilizing small-diameter trees



GOOD: Benefits (cont'd)

Additional income to landowners

- Revenue from biomass sales
- Revenue from carbon credits/values



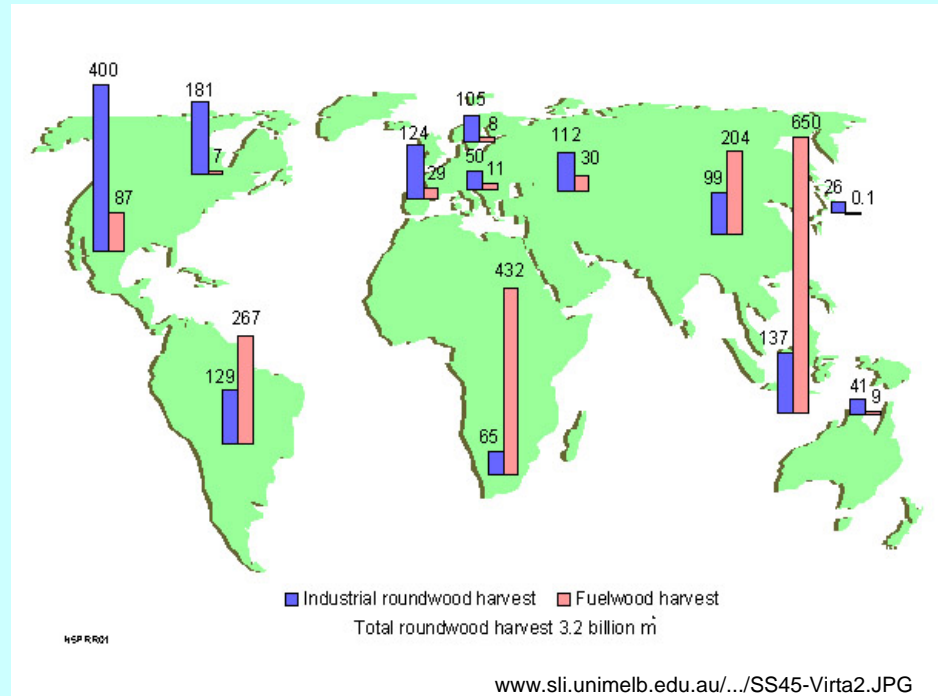
Photo source: Darwin Foster



Chicago Climate Exchange (CCX)

BAD/UNCERTAIN: Potentially negative impacts

Demand for fuel wood, the main energy source for 40% of the world's population, has been argued as a major reason for tropical deforestation.



Could the same thing happen in the developed world?

BAD/UNCERTAIN (cont'd)

Soil productivity

- Crown removal could reduce site productivity, depending on site conditions and the level and composition of biomass removed (Burger 2002, Hakkila 2002)
- Whole tree harvesting could reduce the early growth (age 7-10 yrs) of loblolly pines by 18% in the southeast U.S. (Scot and Dean 2006)

How about long-term impacts?

Could ash recycling or fertilization be a solution?

What is the optimal level of biomass removal?



BAD/UNCERTAIN (cont'd)

- Soil compaction
 - Soil bulk density will increase with more trafficking during harvesting (Burger 2002, Carter et al. 2006)
- Water quality
 - Water temperature
 - Sediment
 - Water pollution

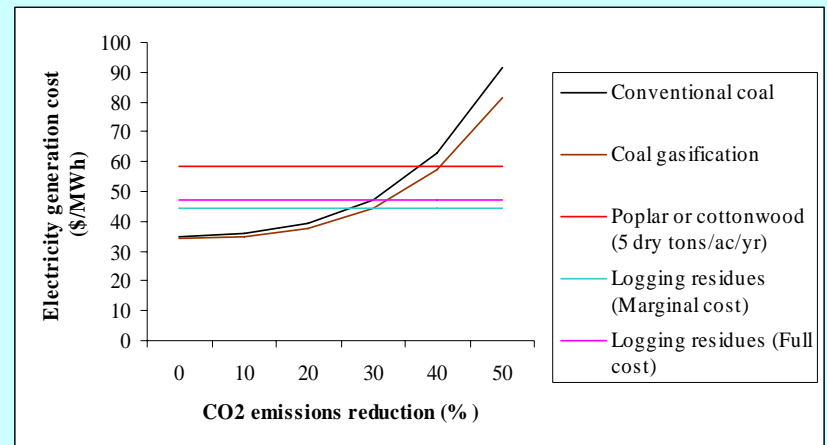
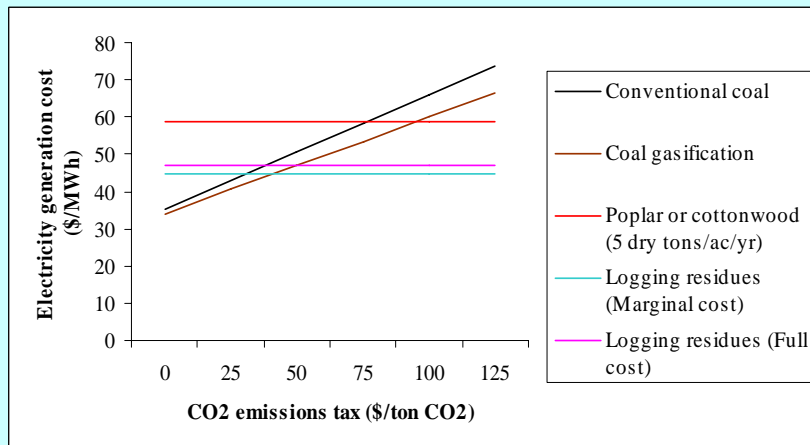
Is BMP a mitigation option?



The cost factor

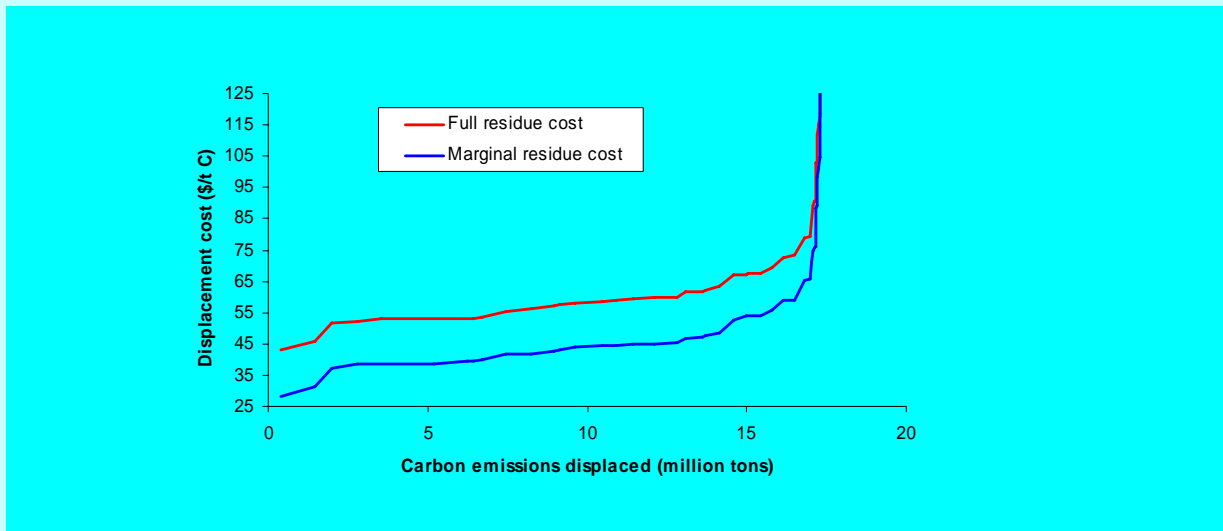
Alleviating these negative impacts is likely to increase the production cost of forest biomass/bioenergy.

Cost disadvantage of forest bioenergy (compared with fossil fuels):



The cost factor (cont'd)

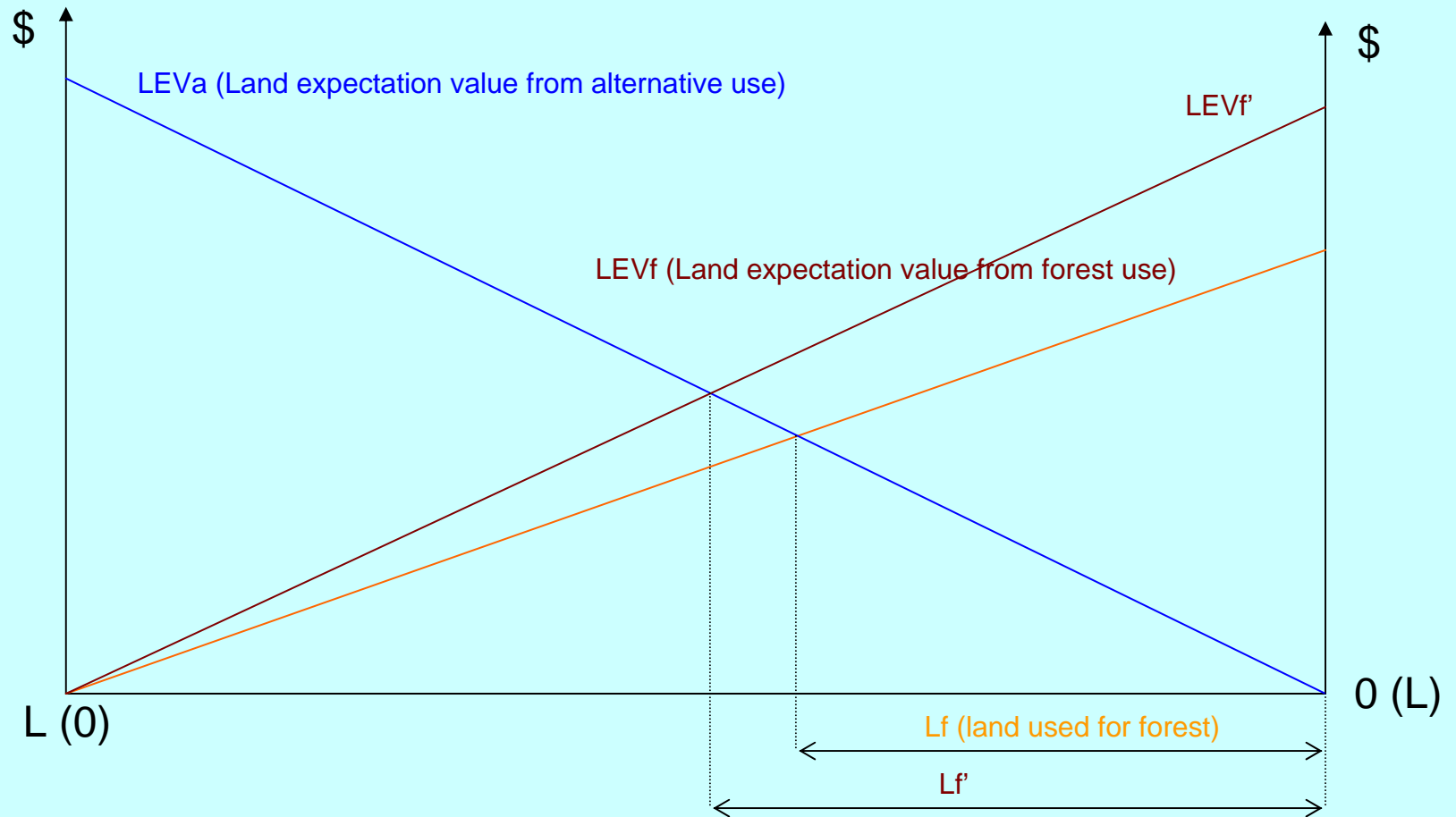
Yet, forest bioenergy offers a variety of environmental and social benefits.



Generating electricity from logging residues is a viable option for mitigating CO₂ emissions

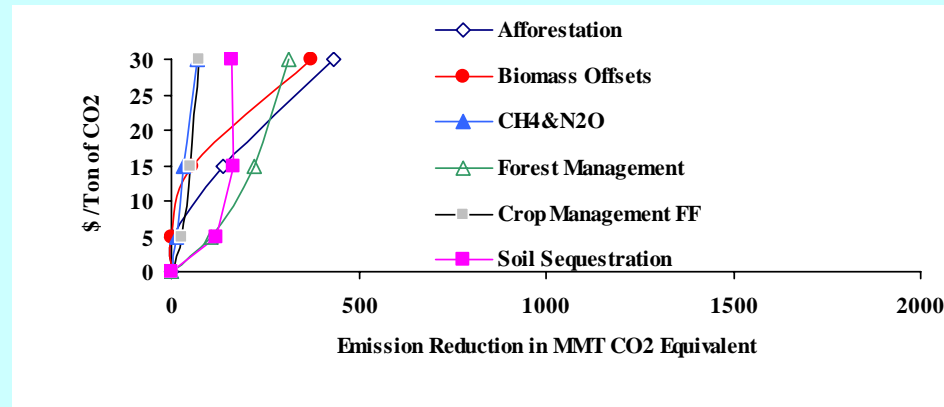
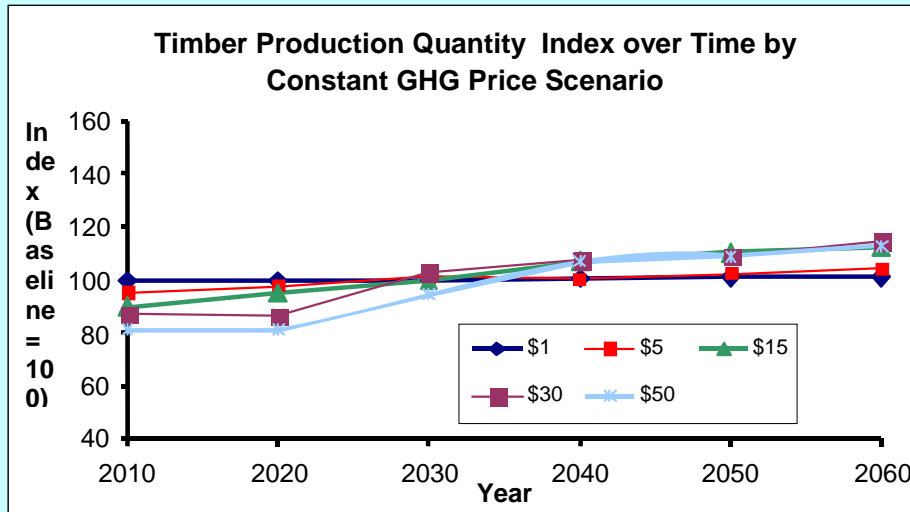
Can the complementarity between bioenergy production and forest sustainability occur?

Forest land use



Increased returns from sales of biomass and carbon could lead to expansion of forest land.

Relationships among timber production, carbon values, and bioenergy development: the case of the U.S.



Near term substitutes, long run complements

Source: Bruce McCarl 2007

How to achieve the complementarity between bioenergy production and forest sustainability?

- Consider environmental, economic, and social criteria when making bioenergy decisions
- Mechanisms
 - Command and control
 - Market-based
 - Certification
 - Incentive programs
 - etc.

Summary

Potential impacts on forest management:

- increase landowners' revenues via the sales of biomass and potentially carbon
- likely alter forest rotation length
- encourage thinning and stand improvement, enhancing forest productivity and health

Summary (cont'd)

- Whether or not forest bioenergy development is good or bad to sustainable forest management is largely dependent on **what**, **how**, and **how much** forest biomass is produced/used.
- Not all forests should be tapped for energy production.
- Environmental impacts (i.e. those on soil, water, wildlife) of forest bioenergy development are uncertain and varied.
- With sound planning and management, utilization of forest biomass for energy production can complement sustainable forest management.
- Forest bioenergy production should and can be integrated with sustainable forest management.

Summary (cont'd)

- Incorporate economic, environmental, and social considerations into bioenergy decision-making

entailing the applications of

Integrative Sciences and Integrative Management

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Thank you!

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