

International Implications of Bioenergy and Forests

Forestry and Agriculture Greenhouse Gas Modeling Forum
September, 2011

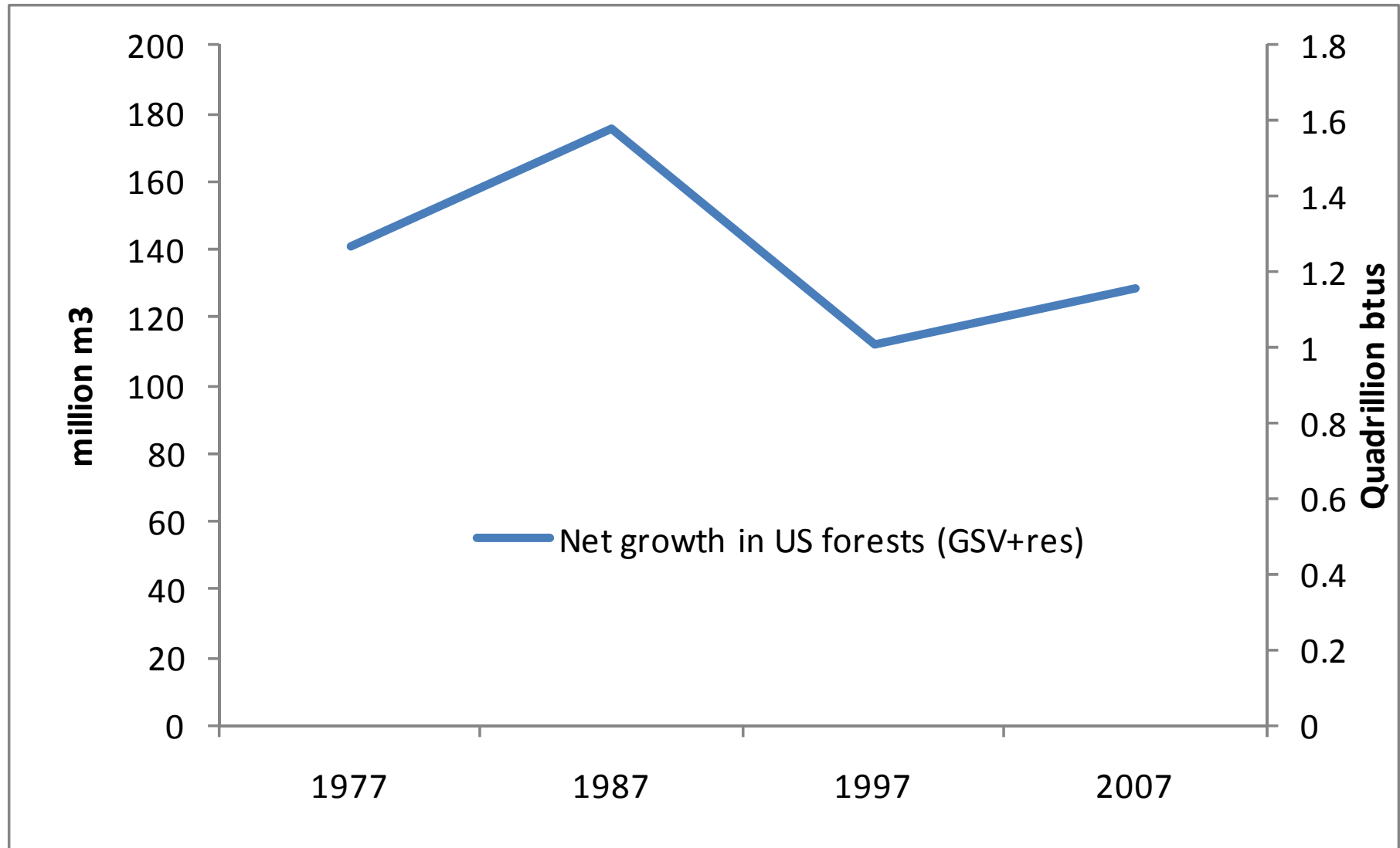
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Can we increase the share of energy from wood?

- Around 2% of total energy
 - 2 Quadrillion btus, 8 billion ft³, or 226 million m³
- Doubling to 4 Quads, or 4%, would require an additional 226 million m³
- Do we have it?

How much more wood is possible?

Net growth of US private forests



Methods

- Can source wood for biomass from timber or from slash
- Add biomass energy into global land use model
 - Include via regional demand functions for biomass energy or constraints.
 - Include costs for harvesting slash and transporting to mill.

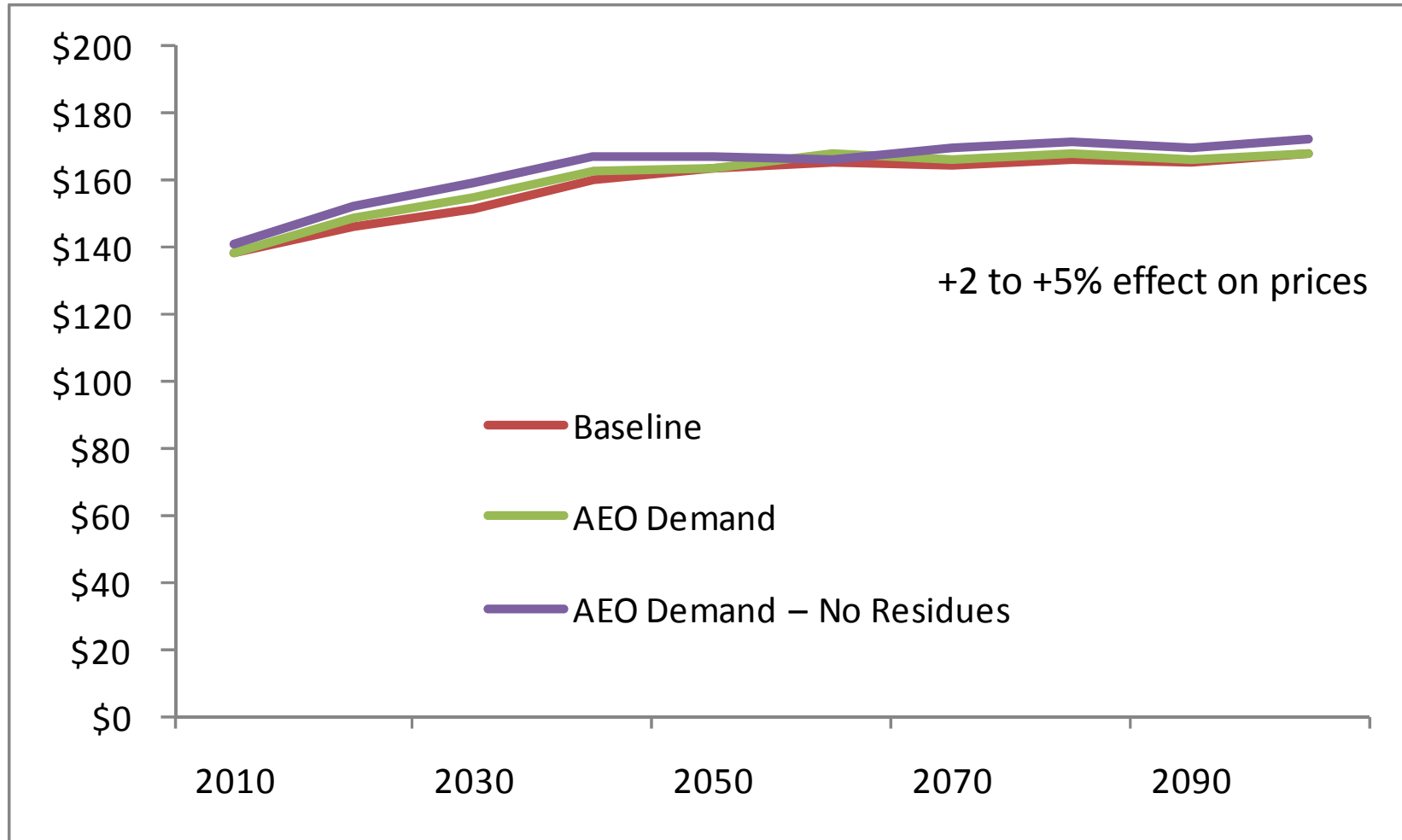
$$MC = \tau + \phi * q$$

Biomass Constraints

From US DOE Annual Energy Outlook, 2010

Biomass Region	2010	2020	2030	2040-2150
	Million m3/yr			
South	23.1	53.4	83.2	105.5
Northeast	7.0	14.0	21.0	28.0
N Central/Great Lakes	7.5	15.0	22.5	25.0
West	1.4	3.4	3.8	3.8
Pacific Northwest	1.9	7.9	8.7	8.7
USA Total	40.9	93.7	139.3	171.0

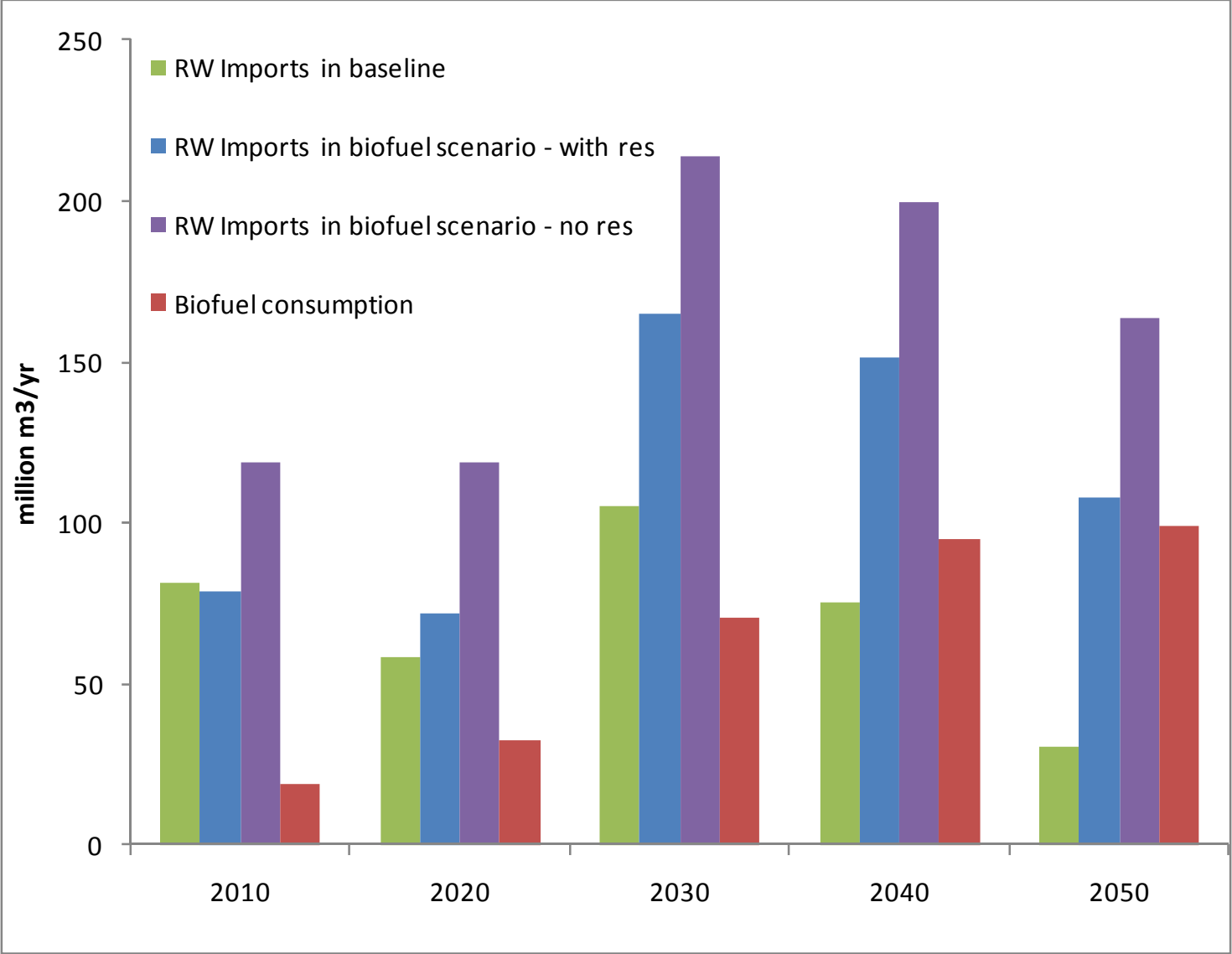
Global Price Effect



US Outputs

US Roundwood Production (for timber and energy markets, excluding residues) (million m ³ /yr)				Wood for Bioenergy (including residues)		Residues only	
Year	Baseline	AEO Demand	AEO Demand – No Residues	AEO Demand	AEO Demand – No Residues	AEO Demand	AEO Demand – No Residues
2010	447.8	447.3	448.7	20.8	67.3	48.3	0.0
2020	473.7	473.4	474.5	33.7	90.4	58.0	0.0
2030	432.0	448.8	441.0	68.4	133.4	65.4	0.0
2040	467.8	496.5	481.9	92.0	159.6	68.1	0.0
2050	517.6	540.5	534.9	97.4	170.7	74.1	0.0

US Imports



Change in Carbon

Change -- without electricity offsets Change -- with electricity offsets

Year	Baseline	AEO Demand	AEO - No Res	AEO Demand	AEO - No Res
Billion tons CO2					
2010	183.64	0.00	0.00	0.00	0.00
2020	181.67	-0.06	-0.20	0.59	0.43
2030	183.25	0.71	-0.41	2.22	1.07
2040	187.14	1.63	-0.49	4.40	2.25
2050	190.48	2.02	-0.88	6.29	3.36

Results with Land Fixed

		US Roundwood Production (for timber and energy markets, excluding residues) (million m ³ /yr)		Wood for Bioenergy (including residues)		Residues only	
Year	Baseline	AEO Demand	AEO Demand – No Residues	AEO Demand	AEO Demand – No Residues	AEO Demand	AEO Demand – No Residues
2010	447.8	450.9	448.1	18.6	67.3	50.7	0.0
2020	473.7	475.8	474.0	32.2	90.4	59.6	0.0
2030	432.0	435.5	431.0	70.5	133.3	63.5	0.0
2040	467.8	473.8	471.4	94.9	158.2	64.9	0.0
2050	517.6	523.6	522.4	98.8	168.8	71.8	0.0

Why is it so hard to increase output?

- Marginal costs of extracting “residues” are high
- Marginal costs of competing with alternatives
- Marginal opportunity costs of increasing production.
- Opportunity costs are much lower elsewhere

US Carbon – Land Fixed

		Change -- without electricity offsets		Change -- with electricity offsets	
Year	Baseline	AEO Demand	AEO - No Res	AEO Demand	AEO - No Res
Billion tons CO2					
2010	183.64	0.00	0.00	0.00	0.00
2020	181.67	-0.12	-0.26	0.53	0.37
2030	183.25	-0.30	-0.87	1.22	0.61
2040	187.14	-0.20	-1.24	2.57	1.50
2050	190.48	-0.78	-1.89	3.50	2.33