Estimating contribution of carbon offset sales programs

Gregory Latta
glatta@uidaho.edu

University of Idaho

presented for:
SB1070
Clean Energy Jobs Work Group on Ag, Forests, Fisheries, Rural Communities, and Tribes
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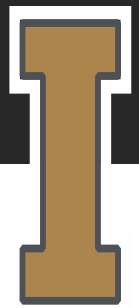

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OUTLINE

- Background on national work
  - 9 slides we will just bounce through to set context
- Regional work
  - Why you should be wary of numbers from hucksters like me
- Q & A
  - Time pending – academics are poor at time management

Federal Carbon Market Legislative History

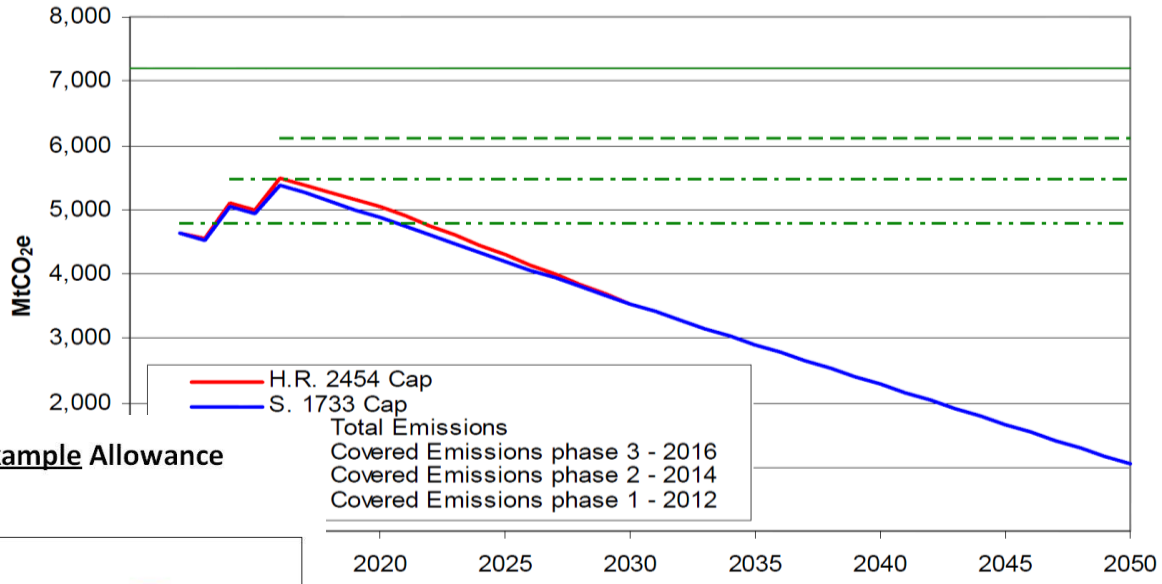
Bill Number and Title		Introduced	Reported by Committee	Passed	Sponsor
108th Congress					
S. 843	Clean Air Planning Act of 2003	9-Apr-03			Sen. Thomas Carper [D-DE]
110th Congress					
S. 280	Climate Stewardship and Innovation Act of 2007	12-Jan-07			Sen. Joseph Lieberman [I-CT]
S. 1766	Low Carbon Economy Act of 2007	11-Jul-07			Sen. Jeff Bingaman [D-NM]
S. 2191	Lieberman-Warner Climate Security Act of 2007	18-Oct-07	5-Dec-07		Sen. Joseph Lieberman [I-CT]
111th Congress					
H.R. 2454	American Clean Energy and Security Act of 2009	15-May-09	21-May-09	26-Jun-09	Rep. Henry Waxman [D-CA30]
S. 1733	Clean Energy Jobs and American Power Act	30-Sep-09	5-Nov-09		Sen. John Kerry [D-MA]

THEY ARE ALL KIND OF THE SAME

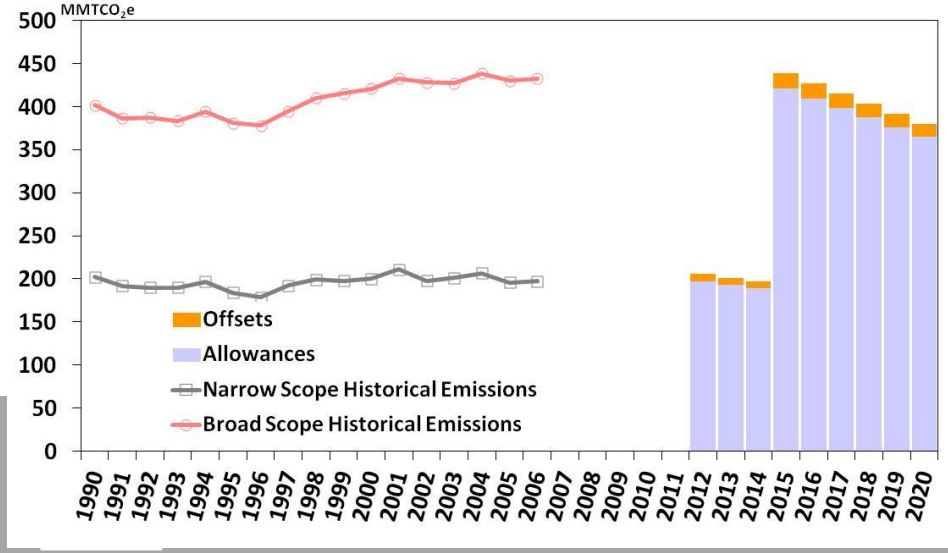
Emissions Cap Which Then Is Dropped Over Time

Figure 1 – S. 1733 and H.R. 2454 Cap Levels

Federal



Historical Emission Trends Relative to Example Allowance and Offset Levels



Regional (California)

http://www.epa.gov/climatechange/economics/pdfs/EPA_S1733_Analysis.pdf
http://www.arb.ca.gov/cc/capandtrade/meetings/121409/capcalc.xls

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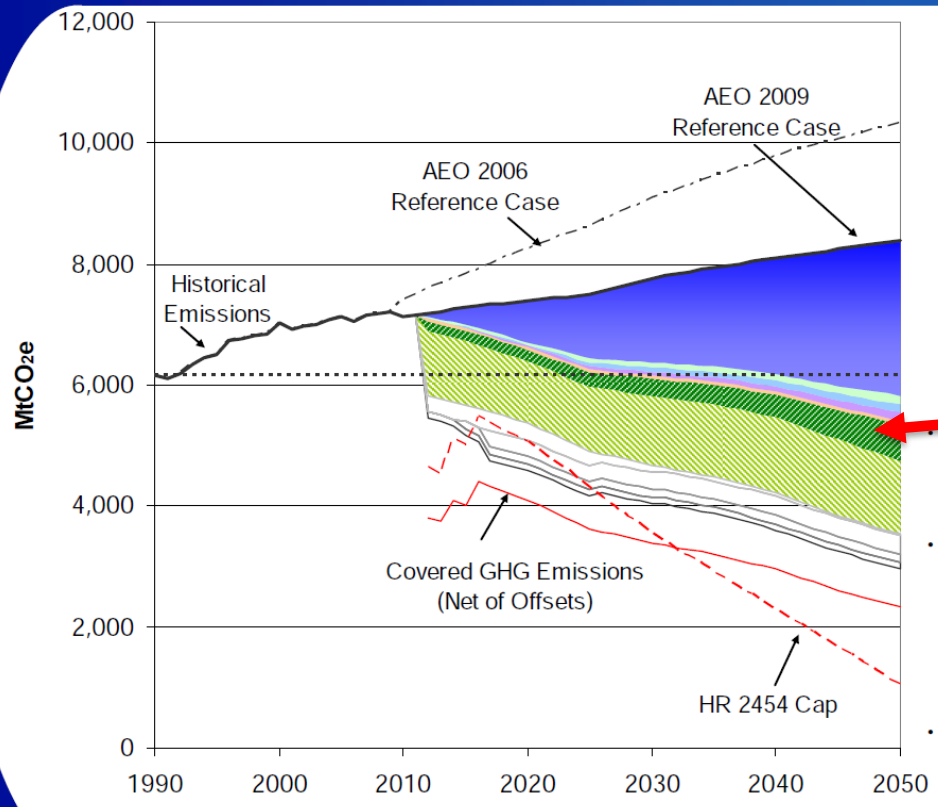
OFFSETS ARE TYPICALLY A SMALL PART OF A LARGER SOLUTION

Total US GHG Emissions & Sources of Abatement

Scenario 1 - Reference & Scenario 2 – H.R. 2454 (ADAGE)



- The updated reference case for this analysis is based on AEO 2009, and the old reference case from EPA's S. 2191 analysis was based on AEO 2006.
- Cumulative 2012-2050 GHG emissions are 14% (51 bmt) lower in the AEO 09 baseline compared to the AEO 06 baseline in ADAGE due to the inclusion of EISA, lower initial (2010) GDP ($13.2 trillion in AEO 09 vs $14.6 trillion in AEO 06), and a lower projected GDP growth rate (2.5% in AEO 09 vs 3.0% in AEO 06).
- International forest set-asides, discounted offsets, NSPS provisions for landfill and coal mine methane, and the HFC cap all provide additional abatement that does not help to meet the main cap.

EPA Analysis of H.R. 2454

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EPA MODELS AND CORRESPONDING GHG MITIGATION

S. 280 Sectors		Economy-wide Computable General Equilibrium (CGE) Models		Models Used to Provide Inputs to CGEs				Partial Equilibrium Model (Uses CGE Outputs)
		ADAGE	IGEM	NCGM	FASOM	GTM	MiniCAM	IPM
Domestic	Electricity Generation	All GHGs	All GHGs					CO_2
	Transportation	All GHGs	All GHGs					
	Industry	All GHGs	All GHGs	CH_4, N_2O, F-gases				
	Commercial	All GHGs	All GHGs					
	Agriculture (& Forestry)	All GHGs	All GHGs		CO_2, CH_4, N_2O			
	Residential	All GHGs	All GHGs	CH_4, N_2O,				
International Credits*				CH_4, N_2O, F-gases		CO_2	CO_2, CH_4, N_2O, F-gases	

* International allowance and domestic offset markets were analyzed using EPA's spreadsheet tool which combines results from the NCGM, FASOM, GTM and MiniCAM models.

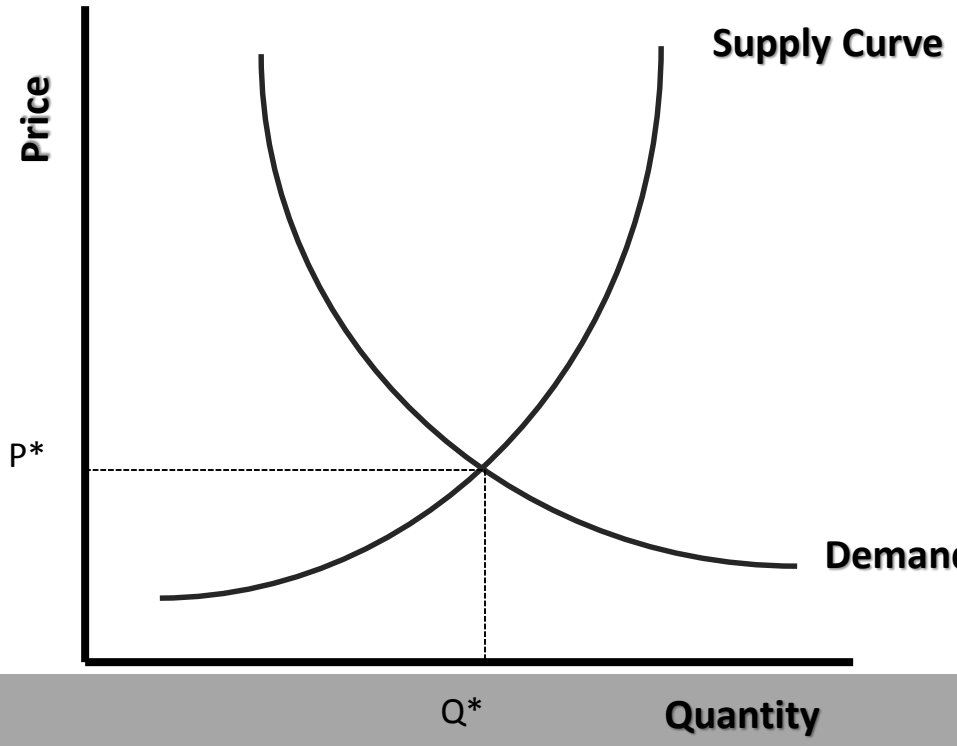
ADAGE	Applied Dynamic Analysis of the Global Economy (Ross, 2007)
IGEM	Intertemporal General Equilibrium Model (Jorgenson, 2007)
IPM	Integrated Planning Model (EPA, 2007)
NCGM	EPA's non-CO_2 GHG spreadsheet tools for estimating projections and mitigation of CH_4, N_2O, and F-gases (EPA, 2005)
FASOMGHG	Forest and Agriculture Sector Optimization Model, GHG version (EPA, 2005)
GTM	Global Timber Model (Sohngen, 2006)
MiniCAM	Mini-Climate Assessment Model (Edmonds, 2005)

EPA Analysis of S. 2191

15

WHY USE A MARKET MODEL?

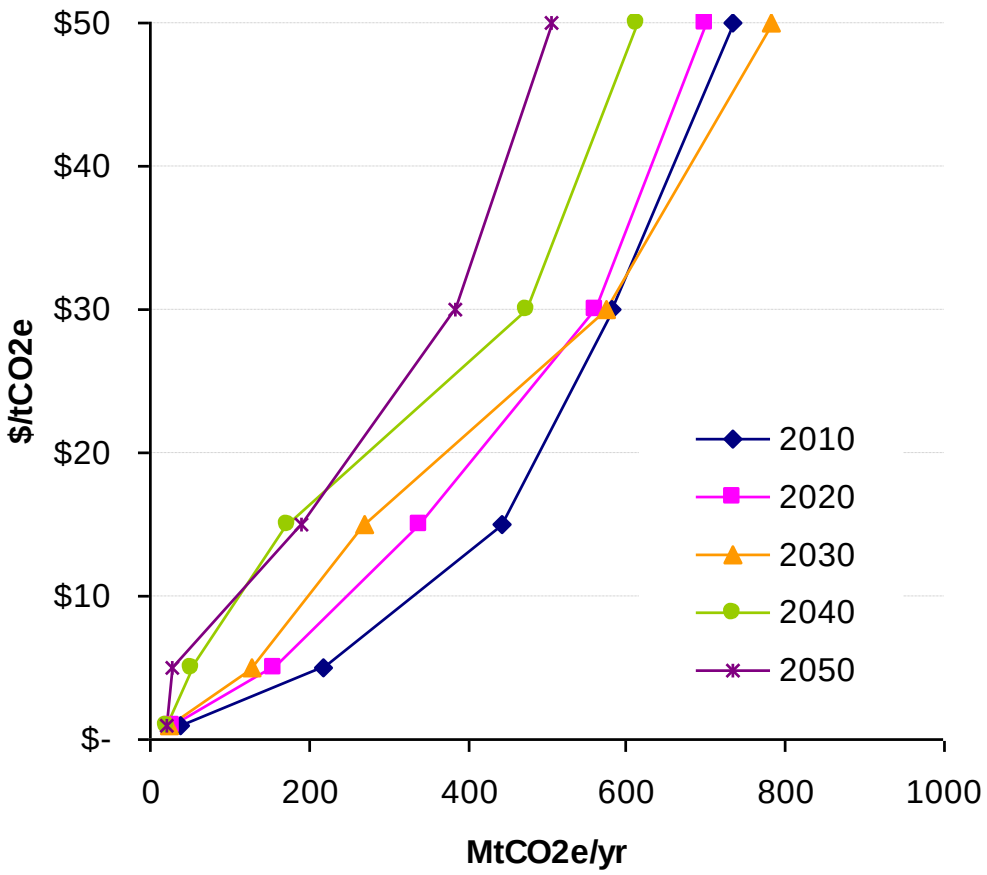
- **Equilibrium model**
  - Price endogenous (one to many regions, one to many industries or sectors, one to many products)



- **Offsets change the costs of supply**
- **Then demand changes**
- **And that demand change is carried through to other markets**
- **In a theoretically consistent manner**

DOMESTIC FOREST AND AGRICULTURE INPUTS TO LARGER EPA ANALYSIS

Marginal Abatement Cost Curves (MACs) -
mitigation supply curves



U.S. EPA, 2009. *Updated Forestry and Agriculture Marginal Abatement Cost Curves. Memorandum to John Conti, EIA, March 31, 2009.*

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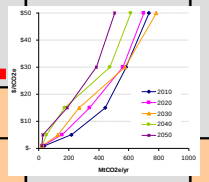
International Credits*				CH_4, N_20, F-gases		CO_2	CO_2, CH_4, N_20, F-gases	



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THE MARGINAL ABATEMENT COST CURVES

With C prices:

- Harvest falls
- Prices rise

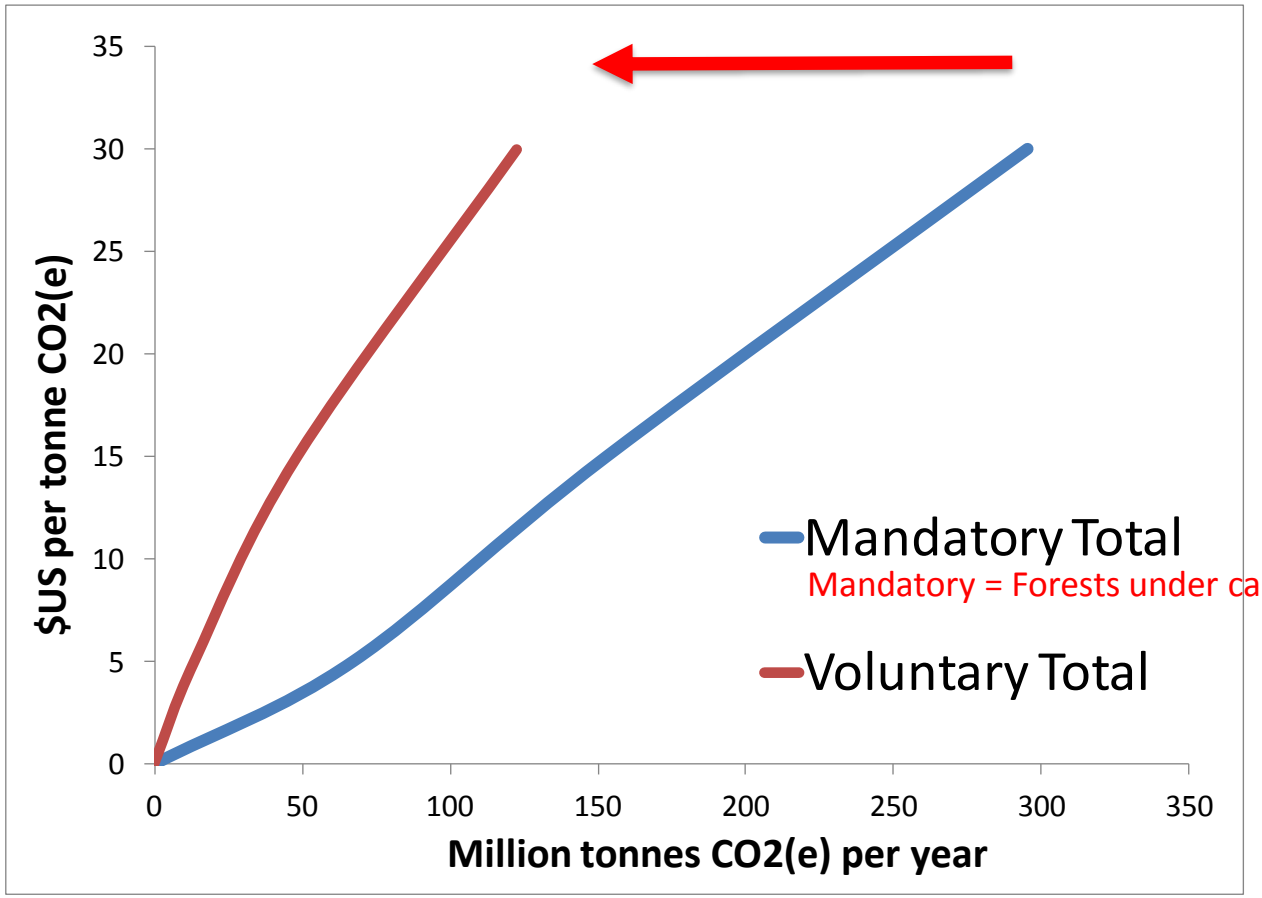
So when voluntary:

In C program

- Harvest falls
- Prices rise

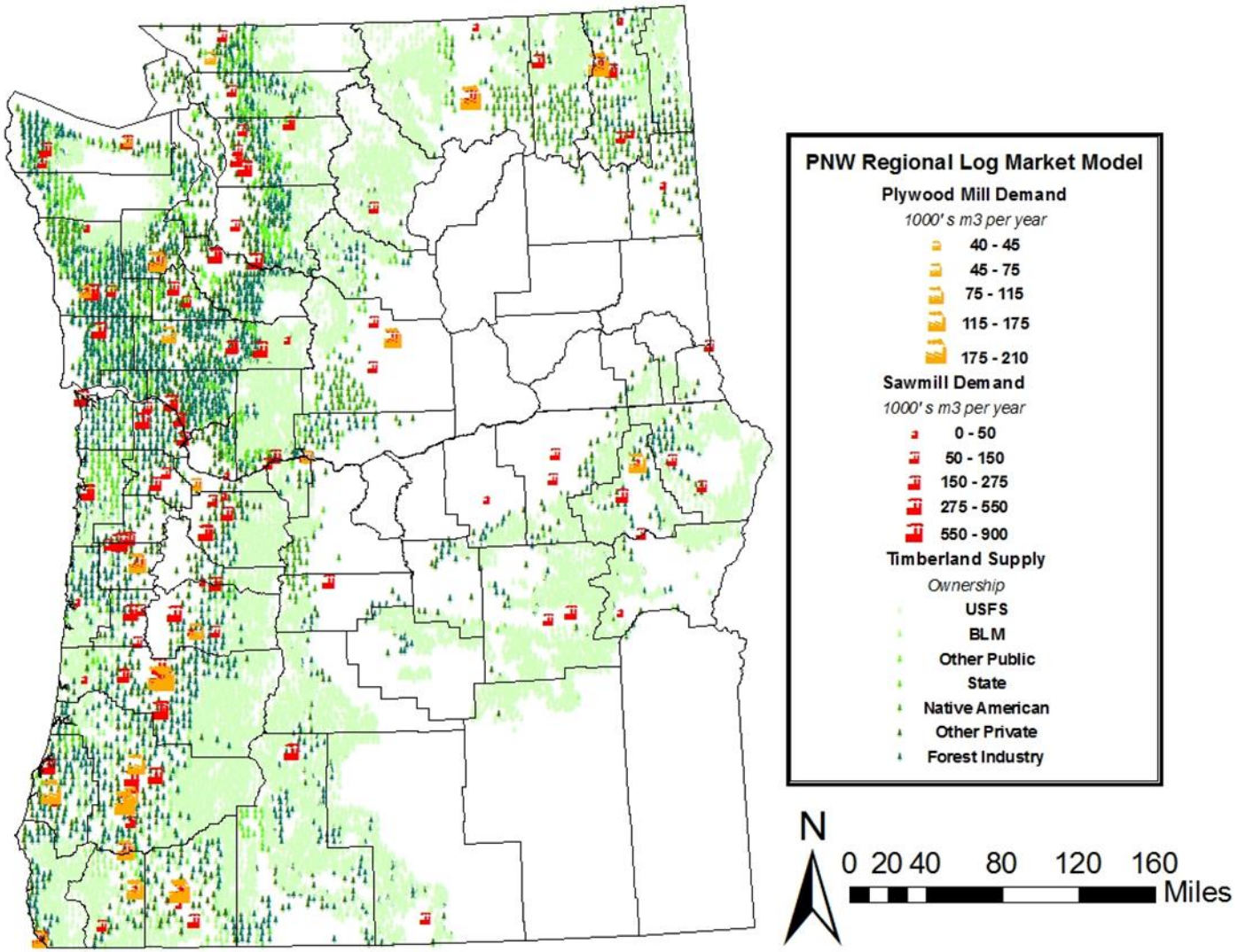
Out of C program

- People harvest more taking advantage of the higher price

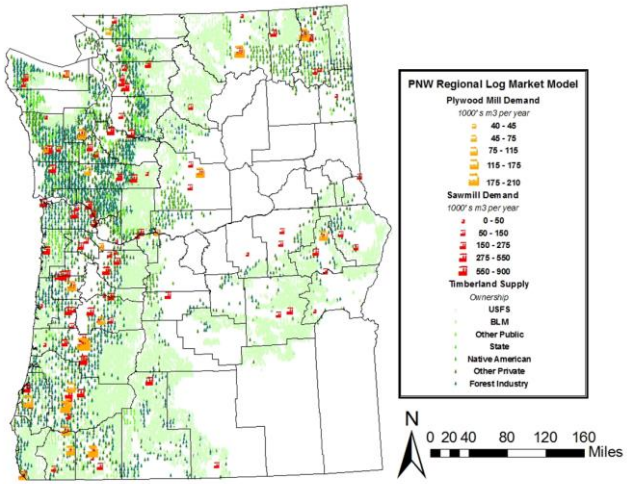


Both Mandatory and Voluntary are a tax/subsidy system (you get paid to sequester, you pay when you emit)

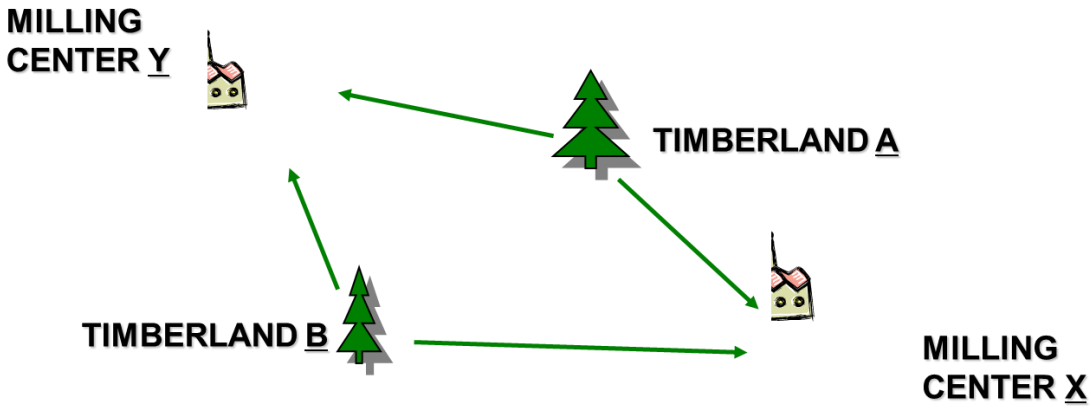
REGIONAL WORK – SPATIAL REPRESENTATION



REGIONAL WORK



Model of Regional Log Market



- Market balance must be found across all milling centers and log sources
- Log buyers trade-off sources to minimize costs
- Log sellers trade-off destinations to maximize net returns
- Optimizes all time periods at once

SO BACK TO THE NUMBERS YOU WERE GIVEN

Looks Fabulous (*sign me up*), but as you can guess from the prior slides they come with a host of caveats

Private Landowner Participation

CO2_Price	C_In	C_Out	Participation
0	-	6,469,550	0%
1	334,552	6,134,999	5%
5	1,845,675	4,623,875	29%
10	2,390,395	4,079,155	37%
25	3,100,907	3,368,643	48%
50	3,440,477	3,029,073	53%

Private Landowner Offset Payments

Country	Forest Carbon Value (@ $10/credit)	Forest Carbon Value (@ $25/credit)
Benton	$19,124,888	$56,517,824
Clackamas	$20,600,813	$54,816,101
Clatsop	$46,310,499	$125,925,785
Columbia	$29,061,914	$83,322,442
Coos	$45,070,778	$149,976,944
Curry	$41,480,298	$130,233,536
Douglas	$123,029,595	$372,735,676
Hood River	$6,993,241	$16,333,792
Jackson	$58,110,066	$175,532,881
Josephine	$35,109,823	$92,430,808
Lane	$78,133,638	$236,146,815
Lincoln	$46,707,952	$107,787,524
Linn	$44,186,241	$128,248,619
Marion	$14,677,181	$36,835,691
Multnomah	$1,395,661	$4,781,853
Polk	$13,101,591	$34,256,657
Tillamook	$23,598,513	$62,794,651
Washington	$10,218,089	$32,211,125
Yamhill	$10,378,180	$24,243,933
Totals	$667,288,963	$1,925,132,655

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- Large payments go to high stocks on program (*is there additionality you could enroll just some of your stands there?*)
- Plots enroll vs. forests ()
- Carbon transactions costs are averaged – for small acreage owners this might dramatically underestimate costs (*and thus returns and participation*)
- There is NO RISK in this modeling
  - In terms of forest growth and markets
  - In terms of carbon market existence and pricing

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CLOSING THOUGHTS

While it is great that landowners could benefit from carbon revenue remember:

- The ultimate goal is a reduction in GHG emissions
- If a carbon offset program produces no additional offsets and it is used to offset real emissions then you will fail to achieve the policy target
- Additionality (*that the offsets are truly additional to what would have happened in the absence of the program*) Leakage (*that nearby forest owners don't just emit more now because you delayed harvest*) and Permanence (*that the avoided emissions remain avoided* *for lack of a better term*) will always be an issue
- A well designed offset quantification methodology can minimize these issues

- Fyi – I haven't calculated it with precision yet, but the truly additional (full sector participants and non-participants) carbon sequestration

The research on these issues and how they related to offset quantification methodology is poor *(but we are working on it)*

- *We have an ongoing Additionality and Leakage study*
- *We have another looking at Permanence (varying offset contract length)*

SOME RELEVANT LITERATURE

- That we talked about today
  - Western Oregon:
    - Latta, G.S., Adams, D.M., Bell, K.P., and J.D. Kline. 2016. Evaluating land-use and private forest management responses to a potential forest carbon offset sales program in western Oregon (USA). Forest Policy and Economics 65(1): 1-8.
  - National:
    - Latta, G., D. Adams, R. Alig and E. White. 2011. Simulated effects of mandatory versus voluntary participation in private forest carbon offset markets in the United States. Journal of Forest Economics 17(2): 127-141.
- Others
  - Im E.H., D.M. Adams, G.S. Latta. 2010. The impacts of changes in federal timber harvest on forest carbon sequestration in western Oregon. Canadian Journal of Forest Research 40: 1710-1723.
  - Im, E., D.M. Adams and G.S. Latta. 2007. Potential impacts of carbon taxes on carbon flux in western Oregon private forests. Forest Policy and Economics 9(8):1006-1017.
  - Baker J.S., B.A. McCarl, B.C. Murray, S.K. Rose, R.J. Alig, D. Adams, G. Latta, R. Beach, and A. Daigneault. 2010. Net farm income and land use under a U.S. greenhouse gas cap and trade. Policy Issues (PI7) 7:1-5
  - Adams, D. R. Alig, G. Latta and E. White. 2011. Regional impacts of a program for private forest carbon offset sales. Journal of Forestry 109(8): 444-453.

BONUS SLIDES

Both bonus slides from:

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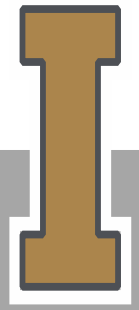
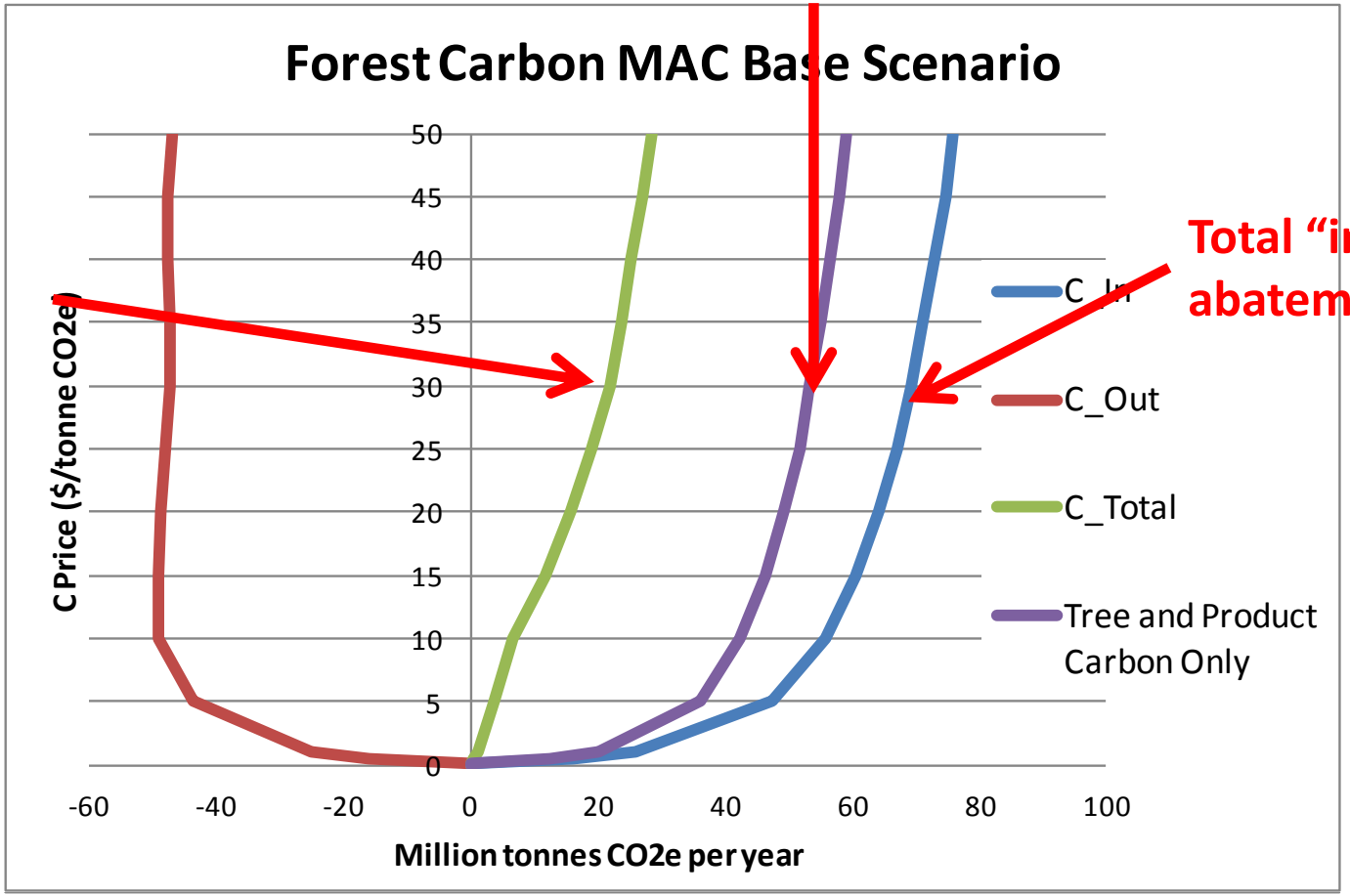


IMPROVED FOREST MANAGEMENT RESULTS

What you paid them for

What you really got

Total "in" abatement



C_Total = All Carbon Pools (both in and out of C market) = The net mitigation at a given price

C_In = All Carbon Pools (In C market)

C_Out = All Carbon Pools (Out of C market)

Tree and Product Carbon Only = The mitigation that the buyers paid for

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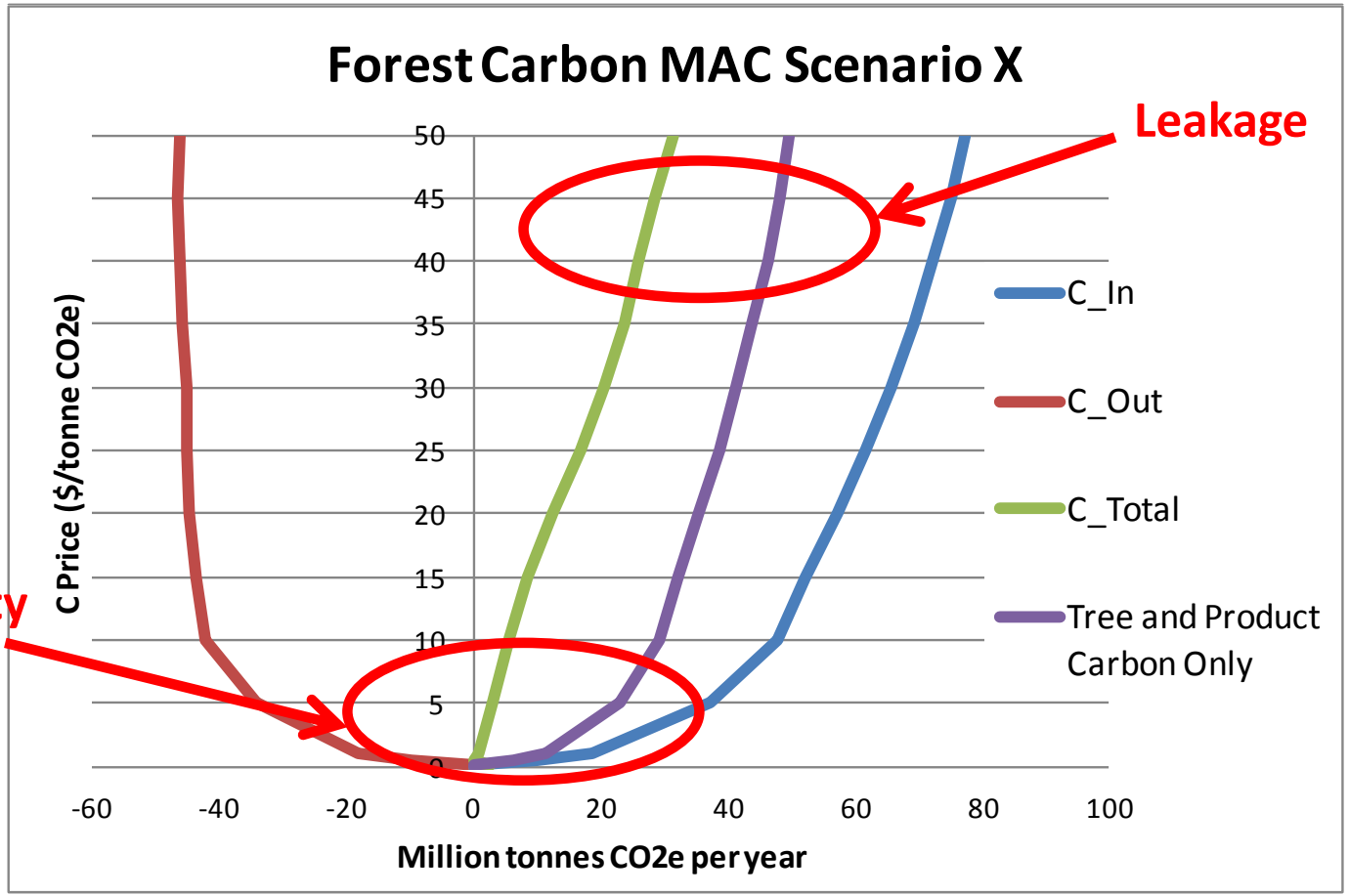
IMPROVED FOREST MANAGEMENT RESULTS



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