Putting the Hopes and Fears of Climate Change Legislation in Perspective

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Background

- **Fears:**
  - **Climate legislation will decimate agriculture.**
  - **Farmers will harvest carbon benefits rather than crops.**

- **Hope is that a climate bill can be structured so that:**
  - **Ag helps to reduce atmospheric carbon levels.**
  - **Ag benefits economically from doing so.**
  - **Biofuel mandates are adequately met.**
  - **Agricultural productivity and prices are not severely effected.**

Our Goal:
to identify policies that can meet these hopes.

Primary Drivers of POLYSYS Outcomes

- EISA demand
- Offset price and transaction costs
- Carbon cap exemption of fertilizers
- Carbon credit for herbaceous dedicated energy crops (below ground)
- Constraints on harvesting of crop residues

Scenarios Defined

Scenario	POLICIES	Carbon Price	Carbon Offsets	Crop Residues Constrained	Fertilizers Exempt
1. Baseline	Meet EISA	None	None	Soil erosion	Not Applicable
2. EPA Led	Meet EISA "Cap and Regulate"	High of $160	None	Soil erosion	No
3. Multiple Offsets / RCN	Meet EISA "Cap and Trade"	Up to $27	1. Conservation Tillage 2. Bioenergy Crops 3. Afforestation 4. Grasslands 5. Methane capture	Soil carbon neutral	Yes

EISA = Energy Independence & Security Act Renewable Fuel Standard

- **Offsets transaction costs:**
  - **Change in tillage practices 40% Afforestation 30%**
  - **Planting herbaceous energy crops 20% Methane capture 20%**

Offsets that could not be modeled due to data availability include:

- **AGRICULTURE. Nitrogen efficiency, alternative nitrogen application methods, seed improvements.**
- **LIVESTOCK. Changes in diet, improvements in diet efficiency, alternative management systems, intensive grazing.**
- **Future innovation in carbon-positive management practices.**

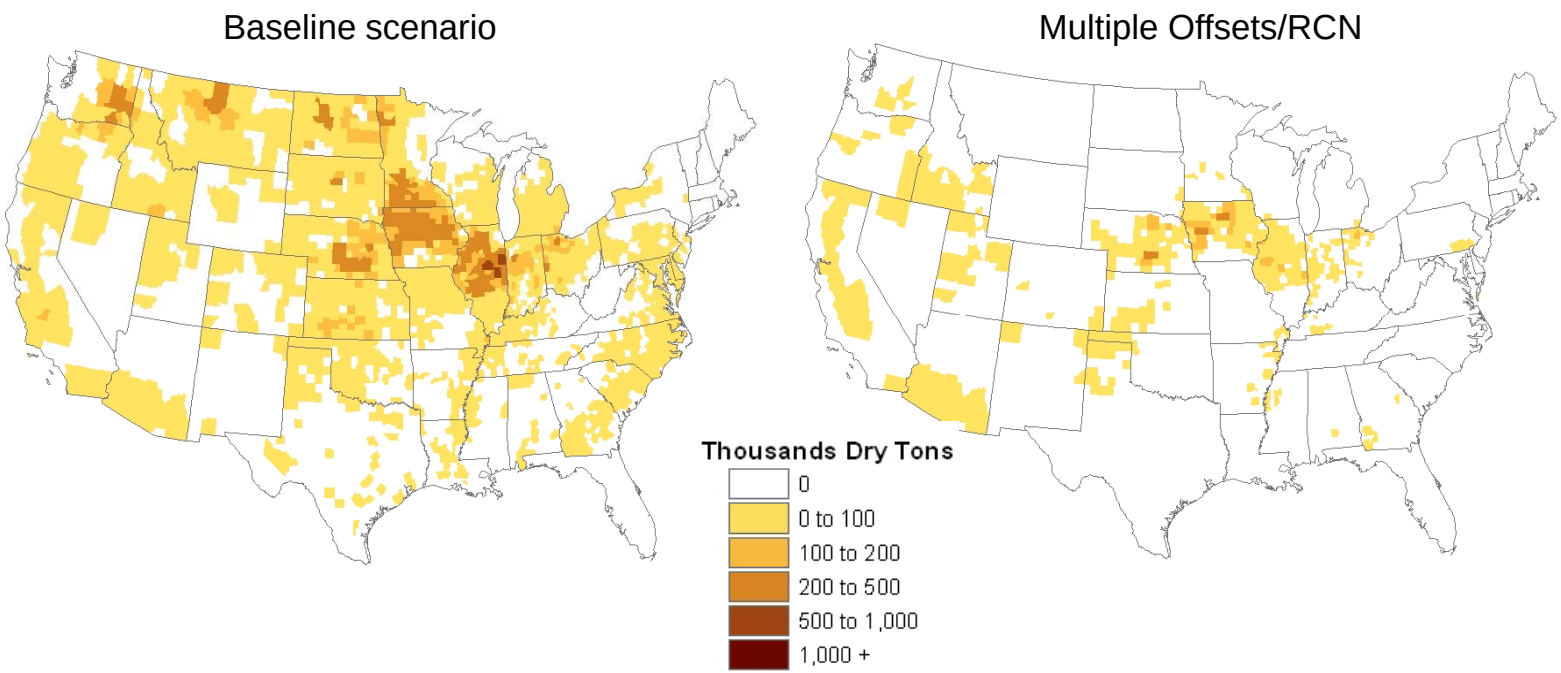
Economic returns highest under Cap-and-Trade in 8 of 9 crops analyzed

Average Annual Change in Net Returns* & Carbon Payments by Scenario and Crop: 2010 - 2030
(Million US$)

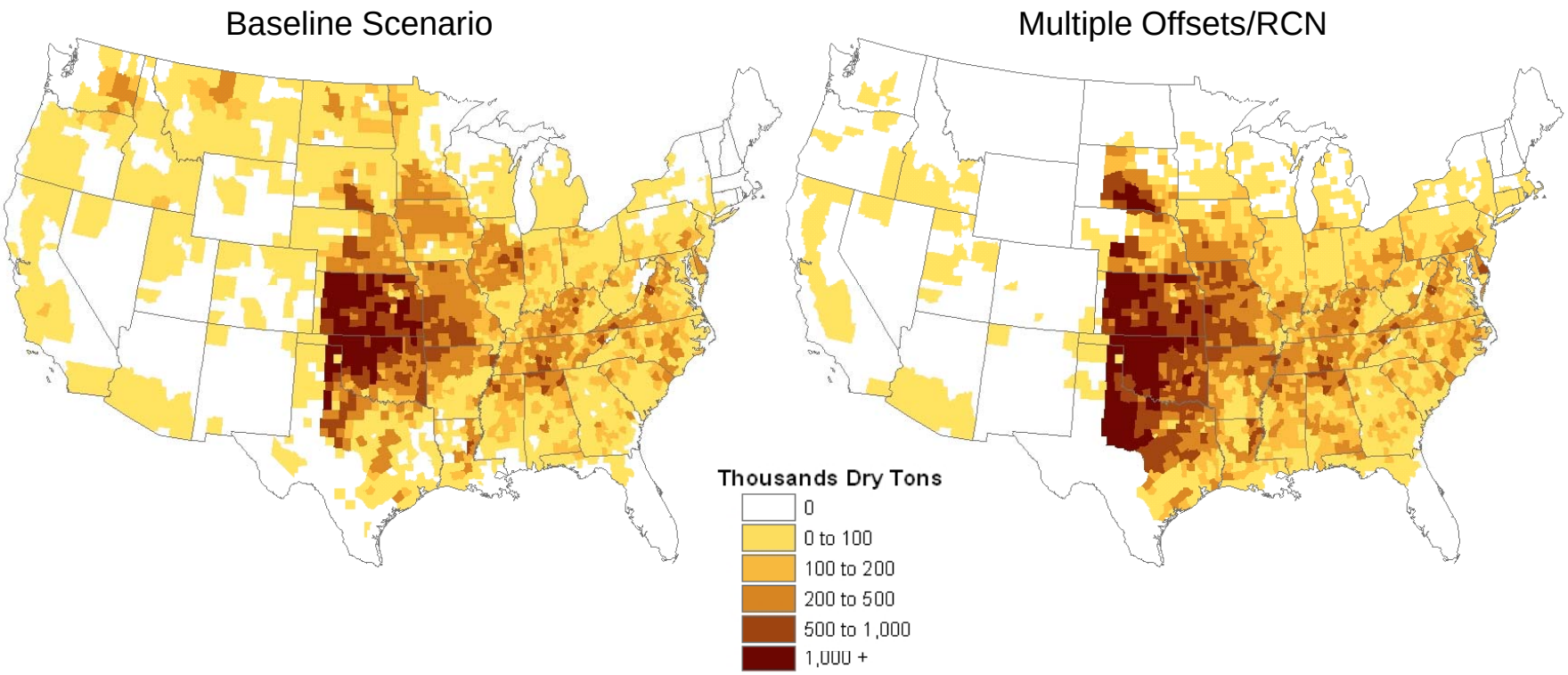
Crop	Baseline	Multiple RCN		Supreme Court / EPA	
	+EISA Net RETURNS	Average Change Crop Returns	Carbon Payments	Average Change Crop Net Returns	Carbon Payments
Corn	31,713	1,937	131	336	-
Grain Sorghum	438	40	4	(53)	-
Oats	73	11	5	(33)	-
Barley	511	36	7	3	-
Wheat	7,726	210	91	(494)	-
Soybeans	21,736	680	196	(411)	-
Cotton	451	20	3	(177)	-
Rice	2,811	(2)	1	(121)	-
Energy Crop	737	4,764	819	2,807	-

* Net Returns include market returns, government payments, carbon payments, and carbon costs

Potential quantities of crop residues harvested for ethanol feedstocks(2025)



Potential quantities of all biomass harvested for ethanol feedstocks, including crop residues and herbaceous grasses



No significant shifts in commodity crop land use under Cap-and-Trade

Estimated Land Use by Scenario, 2025
(million acres)

	Baseline	Multiple Offsets / RCN	Supreme Court/EPA
Corn	90.5	89.3	90.2
Soybeans	65.9	63.0	62.9
Wheat	52.0	50.8	50.5
Cotton	8.6	8.3	8.0
Rice	2.6	2.5	2.6
Hay	75.8	91.0	85.0
Ded. Energy Crops	49.5	76.4	66.9
Pasture	355.1	318.7	334.2
Total Land	688.8	689.2	689.6
(Pasture Converted)	*50.1*	*84.3*	*68.8*

A well designed Cap-and-Trade does not disrupt agricultural commodity markets

Commodity Prices (1)

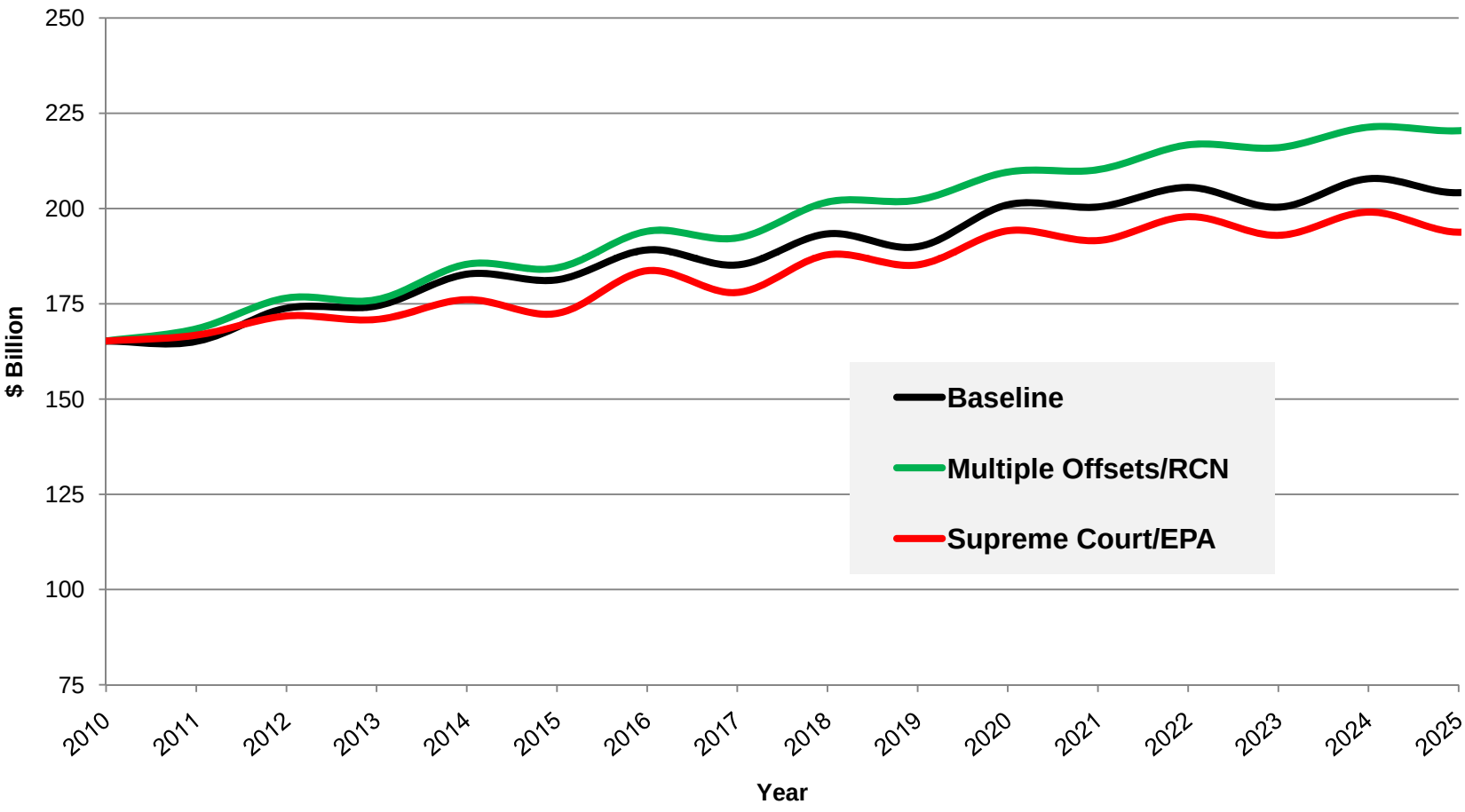
Corn ($/bushel)

	2015	2020	2025
Baseline	3.60	4.16	3.91
Multiple Offsets /RCN	3.64	4.45	4.08
Supreme Court/EPA	3.73	4.65	4.06

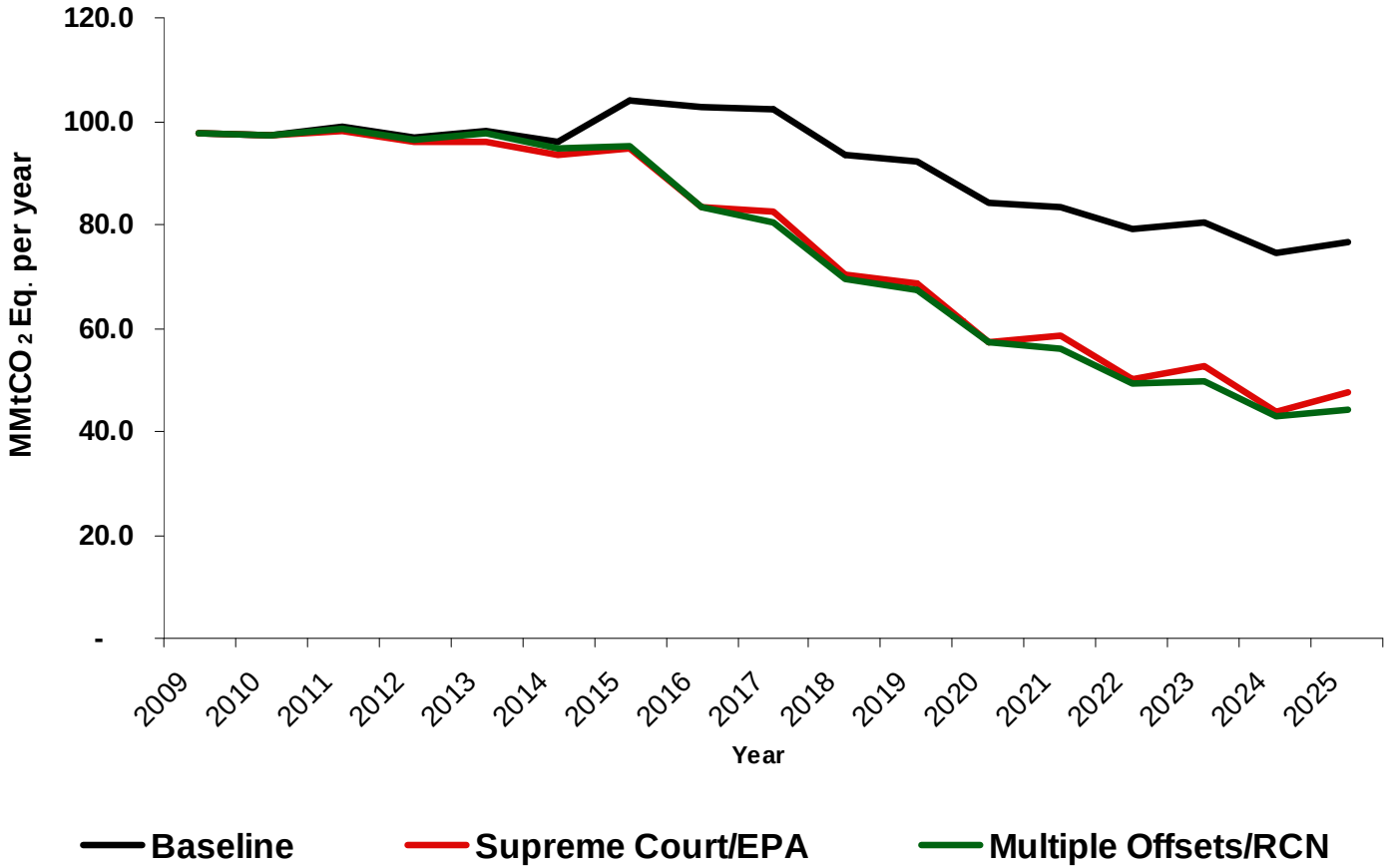
Soybeans ($/bushel)

	2015	2020	2025
Baseline	10.64	9.47	10.32
Multiple Offsets /RCN	10.75	9.49	11.30
Supreme Court/EPA	10.71	9.36	11.42

Crop Returns by Selected Scenario: 2010 – 2025

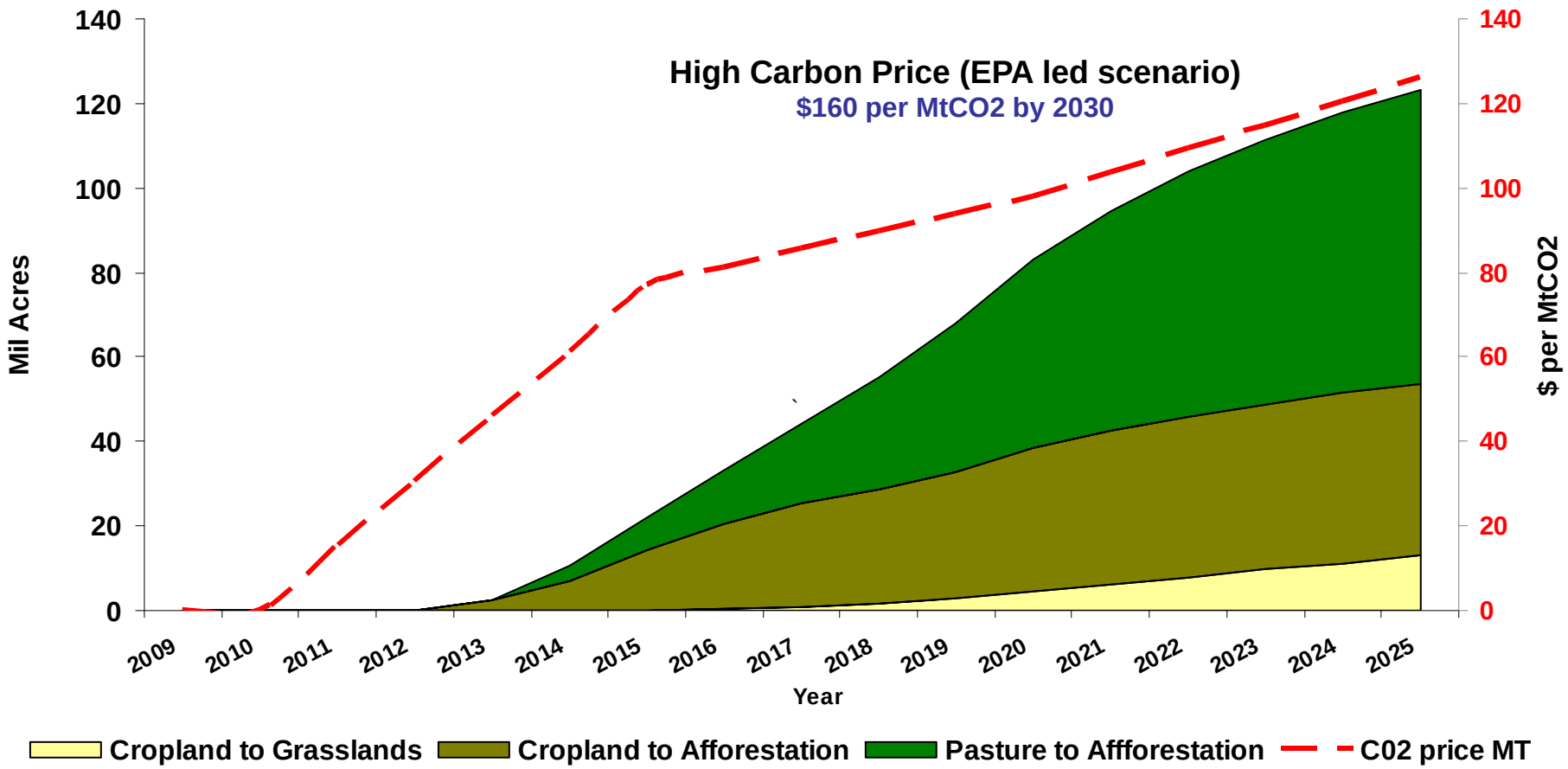


Annual net carbon emissions from crop agriculture* decline



*Net effect of carbon emissions from agricultural inputs and soil carbon sequestration. Does not include reductions from renewable fuels displacing fossil fuels.

Afforestation on cropland only occurs at very high carbon prices



What about Cattle?

Analysis of the impacts on the Beef Sector involve two extreme treatments:

1. **FORAGE REPLACEMENT. Increased forage productivity in pastureland makes-up for any forage losses due to shift of pastureland to energy dedicated crops**
2. **HERD REDUCTION. Loss of forage due to shift of pastureland to energy dedicated crops can only be met by reduction in number of animals.**

(reality will lay somewhere in between)

Sector-wide, little variation of net returns under both treatments

BEEF Sector Impacts
(% changes from baseline)

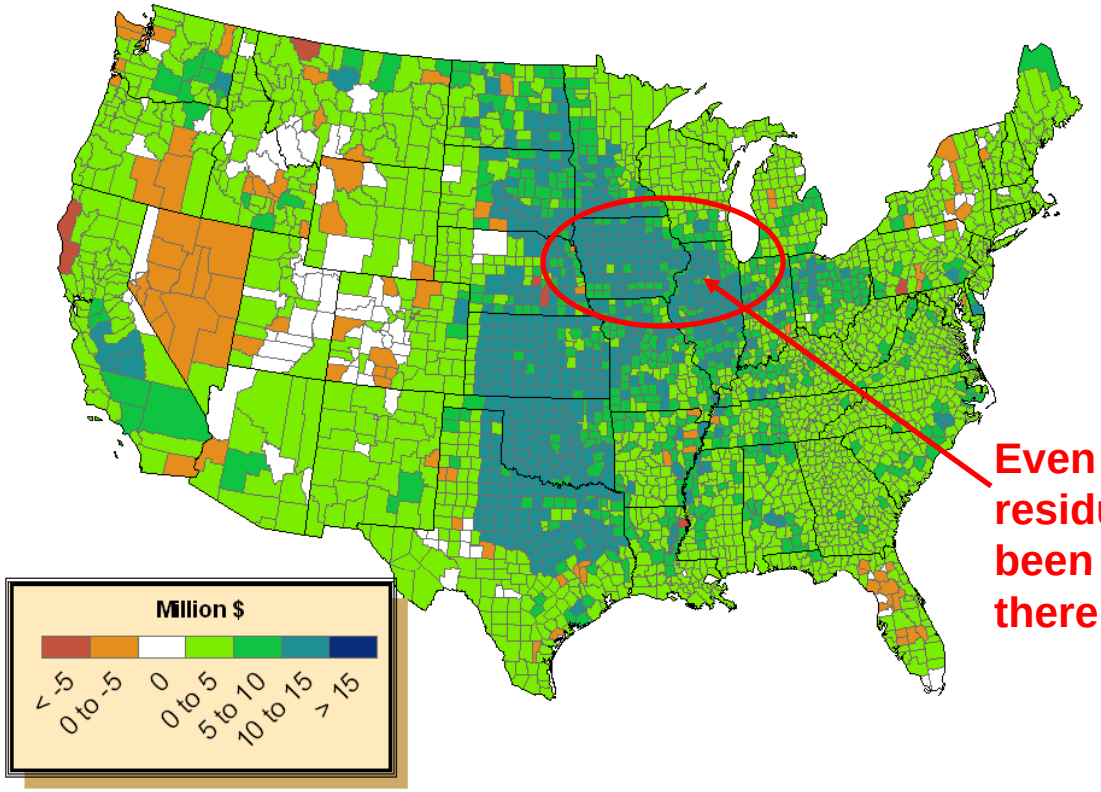
Variable	Forage Replacement		Herd Reduction	
	2025	Average 2010 - 2025	2025	Average 2010- 2025
INVENTORY	0.0	-0.0	-14.1	-4.0
PRODUCTION	-0.1	-0.1	-8.4	-2.1
BEEF CATTLE FARM PRICE	0.9	0.5	6.0	1.6
NET RETURNS	1.1	0.6	-0.5	0.2

Regional impacts of Cap-and-Trade predominantly positive

Total Net Returns*, 2025

Multiple Offsets / RCN <u>Forage Replacement</u>

changes from baseline



Even areas where residue harvesting has been constrained, there is a net benefit.

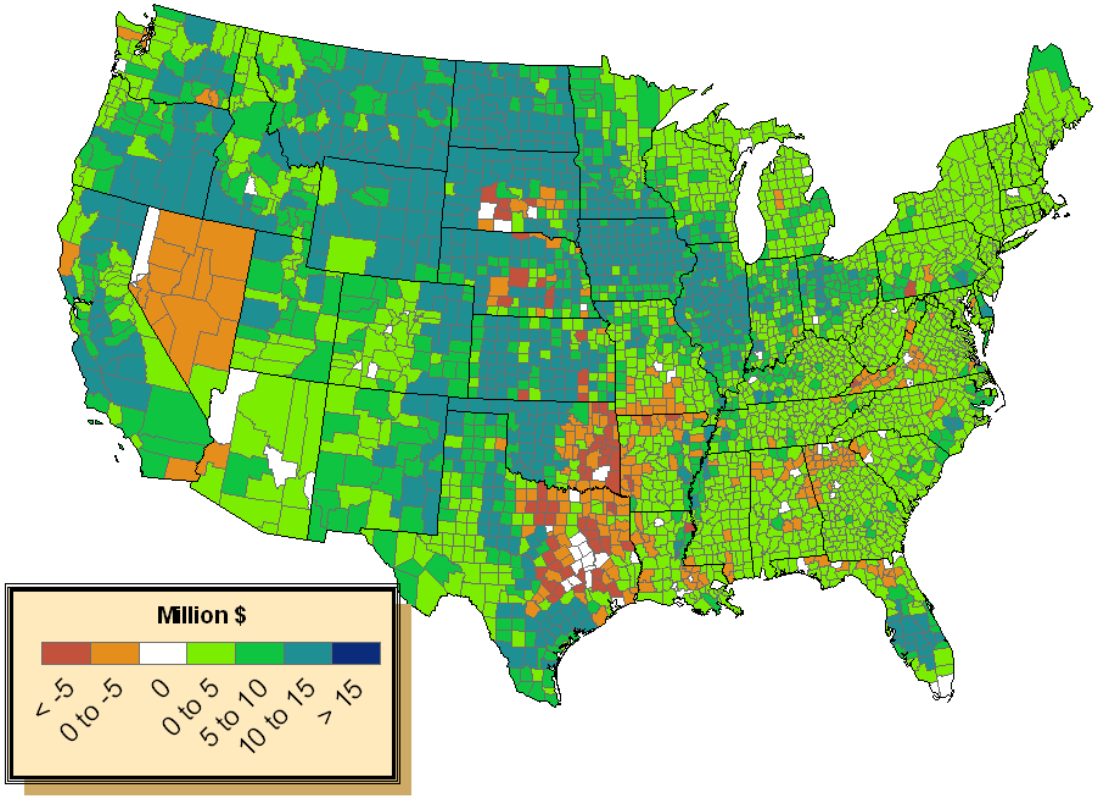
*** Includes agriculture, livestock, forest residues, methane**

However, regional impacts vary by livestock treatment

Total Net Returns*, 2025

Multiple Offsets / RCN Herd Reduction

changes from baseline



* Includes agriculture, livestock, forest residues, methane

Key Findings

Under a properly constructed Cap-and-Trade program:

- **Net returns to agriculture are positive and exceed baseline projections for 8 of 9 crops analyzed**
- **At projected carbon prices of up to $27 per MtCO2eq, afforestation of cropland will not occur**
- **Cap-and-trade does not result in major shifts in commodity crop land use**
- **Crop and beef markets are not disrupted**

Critical Components

to making climate legislation work for agriculture

(PLUS assure biofuel and climate policies mesh)

- **Offer carbon offsets to biomass crops for below-ground carbon sequestration.**
- **Restrict residue harvesting to the carbon neutral level.**

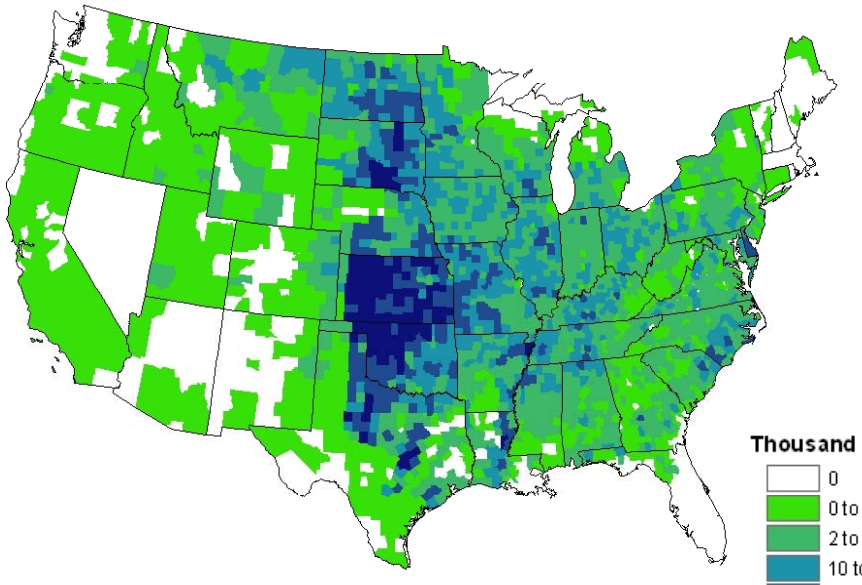
Thanks !

Bio-based Energy Analysis Group
http://beag.ag.utk.edu/

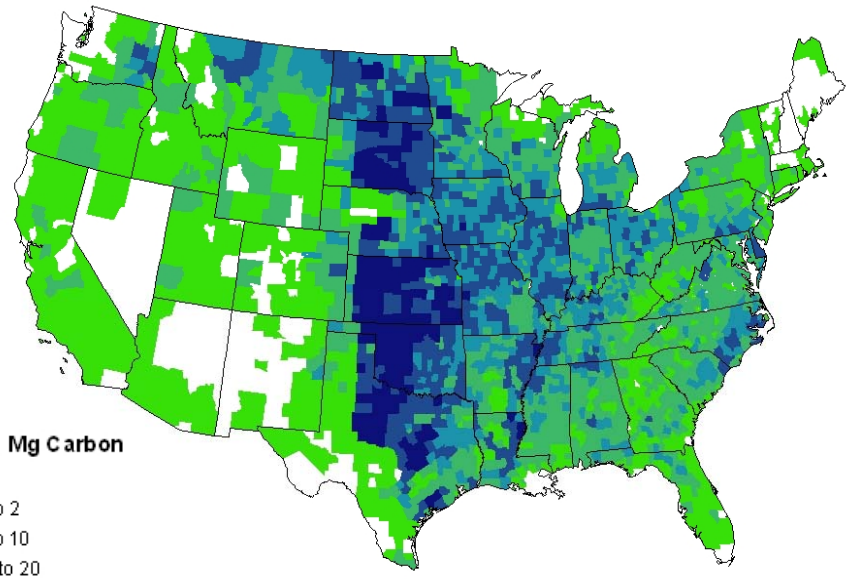
Agricultural Policy Analysis Center
http://agpolicy.org/

Annual soil carbon gain from conservation tillage and grassland sequestration

Baseline



Multiple Offsets/RCN



Thousand Mg Carbon

- 0
- 0 to 2
- 2 to 10
- 10 to 20
- 20 to 50
- > 50