Economics of Managing GHG In Agriculture

Dr. Cole Gustafson

North Dakota State Univ.

USDA Economists Group

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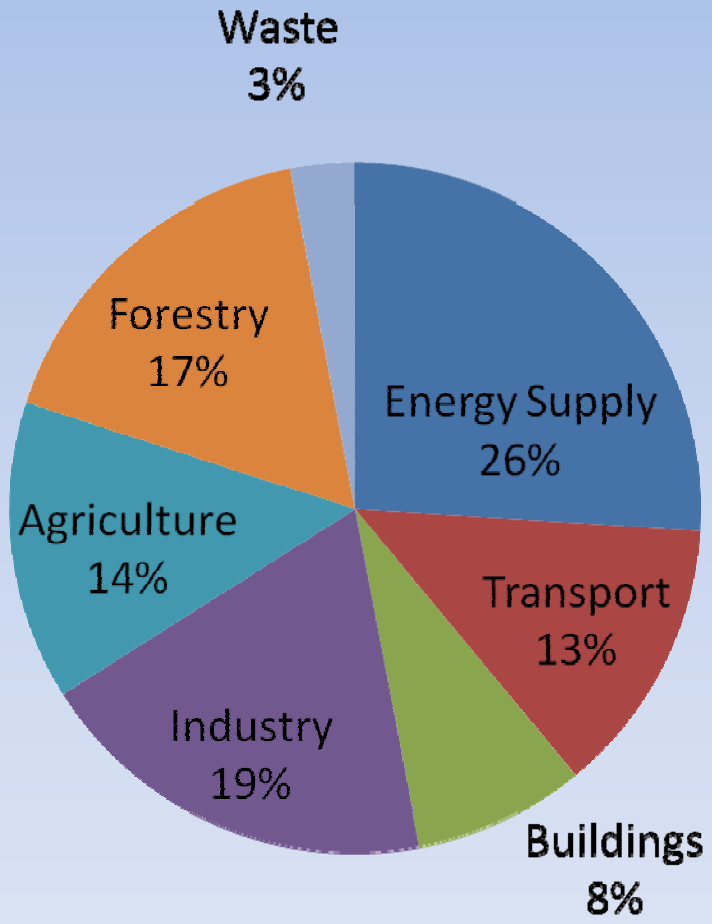
Agriculture and Forestry Are Targets

(Global Anthropogenic GHG Emissions)



IPCC Assessment Rpt. 4 (2007)

GHG - Economic Alternatives

- Regulation
- Laissez-Faire Market Approach
- Carbon Tax
- Cap and Trade

GHG - Economic Alternatives

- Regulation
  - Generally less favored by economists
  - High monitoring costs (upstream vs. downstream)
  - Unknown processes
  - Limits efficiency gains/creates rigidities
  - Accelerate response/capture economies
- Laissez-Faire Market Approach
- Carbon Tax
- Cap and Trade

2007 Energy Independence and Security Act

Updated 5/5/09

Renewable Fuel Volume Requirements for RFS2 (billion gallons)

Year	Cellulosic biofuel requirement	Biomass-based diesel requirement	Advanced biofuel requirement	Total renewable fuel requirement
2008	n/a	n/a	n/a	9.0
2009	n/a	0.5	0.6	11.1
2010	0.1	0.65	0.95	12.95
2011	0.25	0.80	1.35	13.95
2012	0.5	1.0	2.0	15.2
2013	1.0	a	2.75	16.55
2014	1.75	a	3.75	18.15
2015	3.0	a	5.5	20.5
2016	4.25	a	7.25	22.25
2017	5.5	a	9.0	24.0
2018	7.0	a	11.0	26.0
2019	8.5	a	13.0	28.0
2020	10.5	a	15.0	30.0
2021	13.5	a	18.0	33.0
2022	16.0	a	21.0	36.0
2023+	b	b	b	b

Why GHG Is Complicated

- Global in origins and impacts
- Effects are long term
- Indicators are stochastic
- Stock and flow process
- Effects are large with many potentially irreversible
- Uncertainty in science

Stern, AER, May 2008

Economic Aspects

- Risk and uncertainty
- Present value (individual vs. social *r*)
- Ethics
  - Across generations
  - Humans vs. others in environment
  - Developed vs. less developed countries
  - Regional impacts

GHG - Economic Alternatives

- Regulation
- Laissez-Faire Market Approach
  - Variable adoption pace
- Carbon Tax
- Cap and Trade


アルミ
あきかんはリサイクル
295g
CO2
エコプロダクツ2008出展
カーボンフットプリント
暫定表示
アルミ缶（製造元：東洋製罐）
に伴うCO2排出量120gです。
原料栽培から容器の
リサイクルまで、ビールづくりの
全段階における1缶あたりの
CO2排出量を表示しています。
SAPPORO
4 901880 000000
SAMPLE

GHG – Part of Farm Value Equation

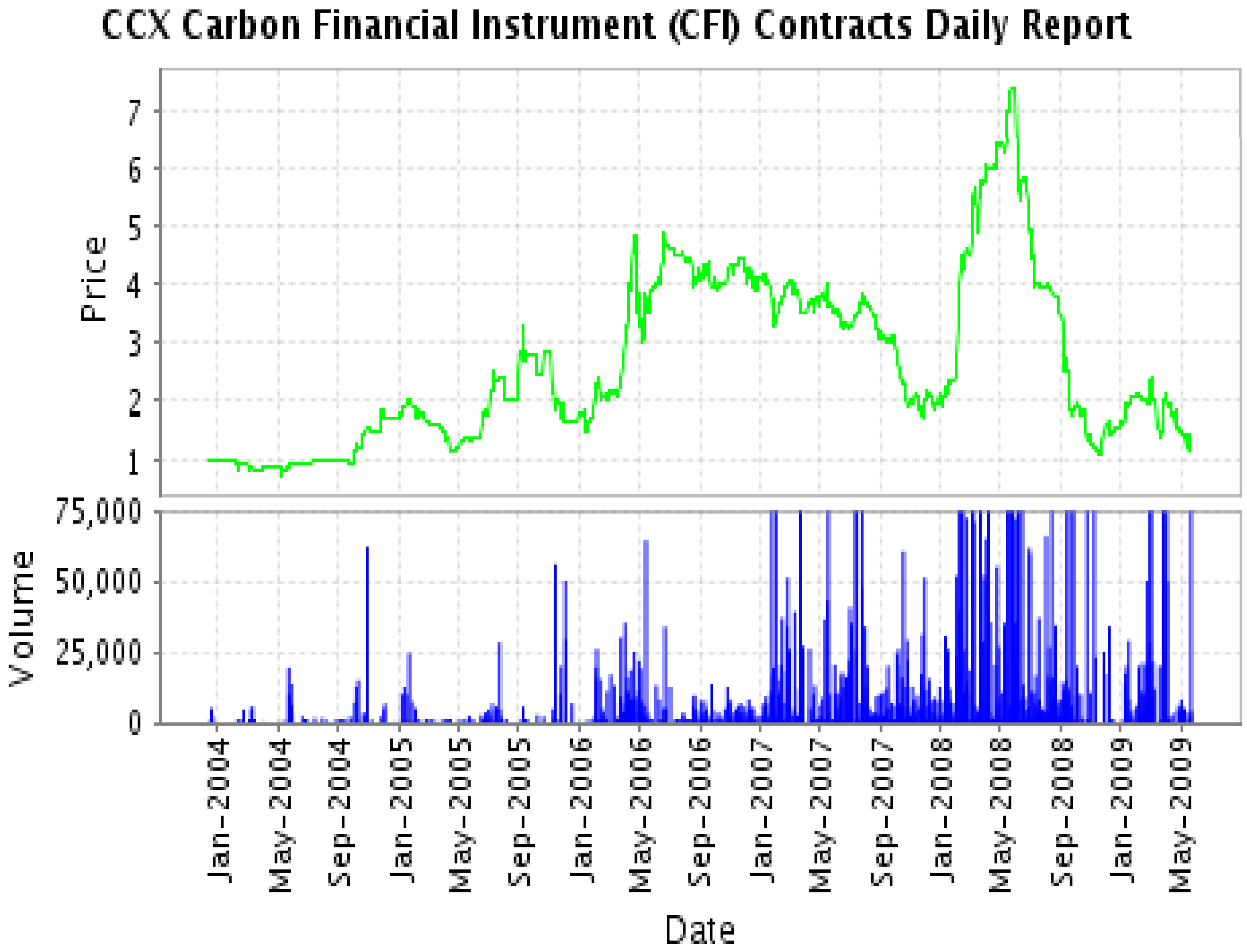
- Crop/Lvstk Insurance
- Lenders

GHG - Economic Alternatives

- Regulation
- Laissez-Faire Market Approach
- Carbon Tax
  - Tax aversion
  - Price is known, Quantity is uncertain
  - Firms can develop optimal response
  - Deadweight losses
  - Revenue can aid adjustment/disadvantaged
- Cap and Trade

GHG - Economic Alternatives

- Regulation
- Laissez-Faire Market Approach
- Carbon Tax
- Cap and Trade
  - Quantity known, Price uncertainty
  - Low administrative cost
  - Risk aversion
  - Free credits (slow response, incumbent advantage, reduced public revenue)


CCX Carbon Financial Instrument (CFI) Contracts Daily Report
Price
7
6
5
4
3
2
1
Volume
75,000
50,000
25,000
0
Jan-2004
May-2004
Sep-2004
Jan-2005
May-2005
Sep-2005
Jan-2006
May-2006
Sep-2006
Jan-2007
May-2007
Sep-2007
Jan-2008
May-2008
Sep-2008
Jan-2009
May-2009
Date

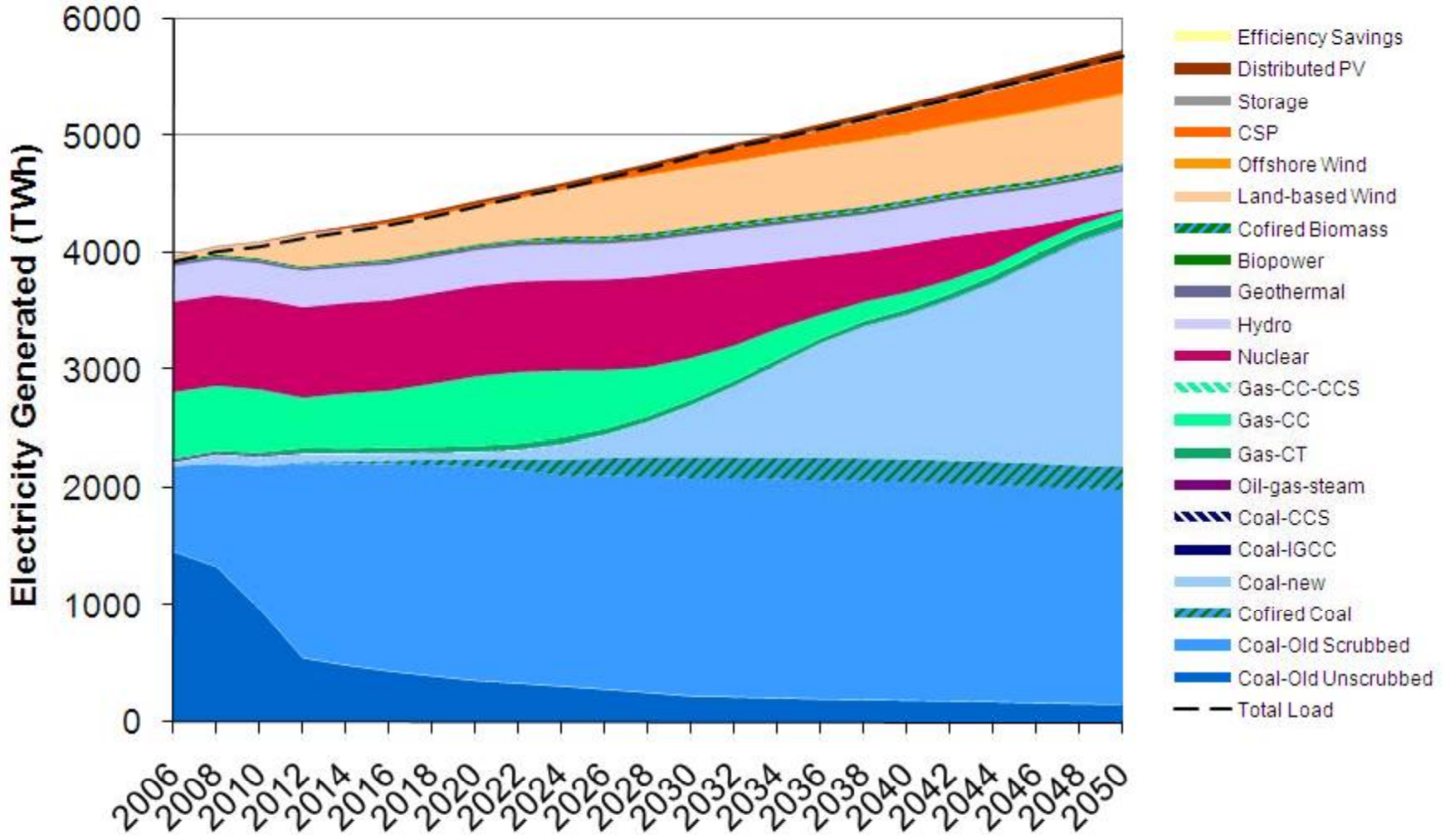

Vermeer


ERSATILE

Capital Market Constraints

- Credit market turmoil
- Low equity reserves
  - Low margins
  - Sweeps
- Lack of production benchmarks

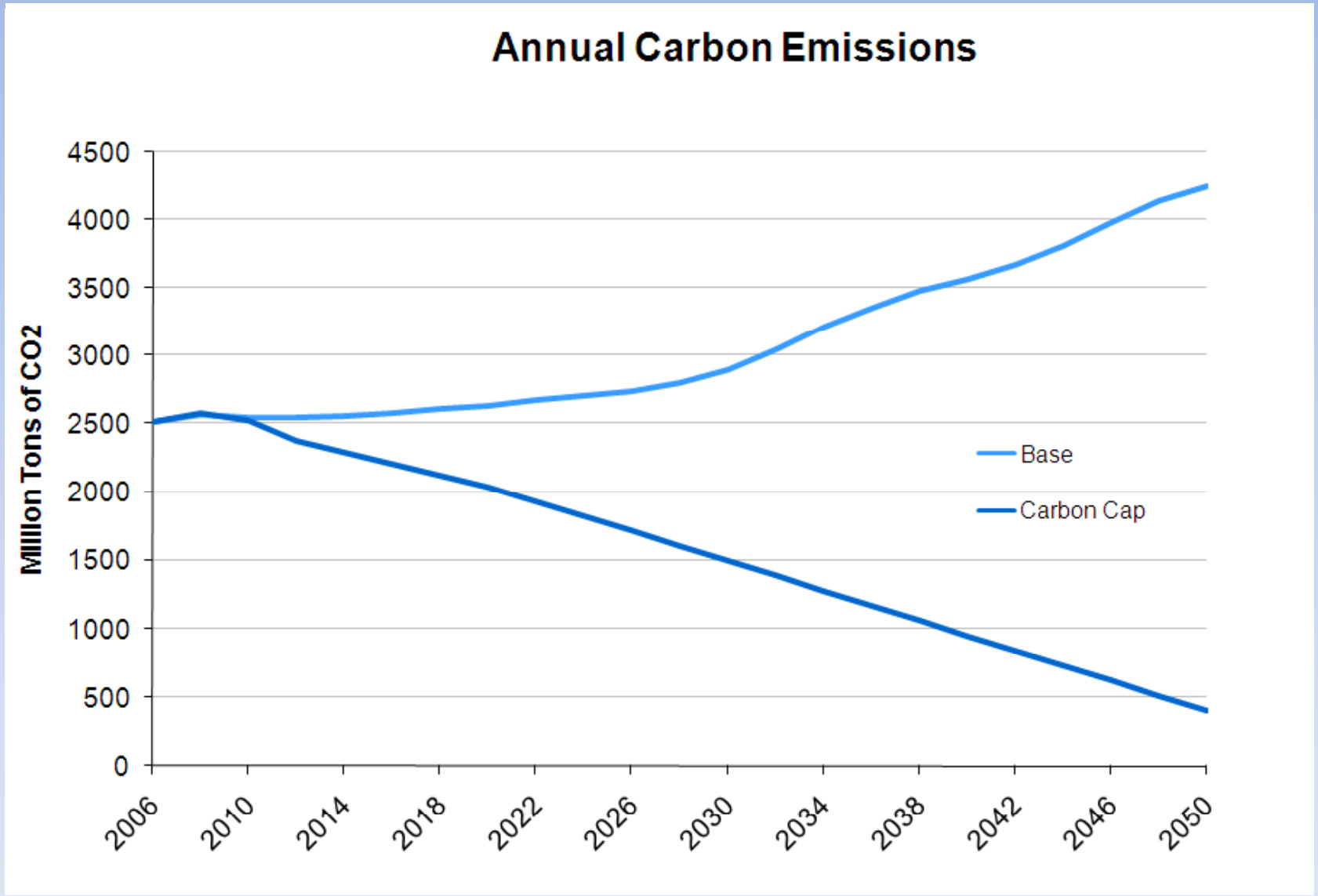
Base Case Generation



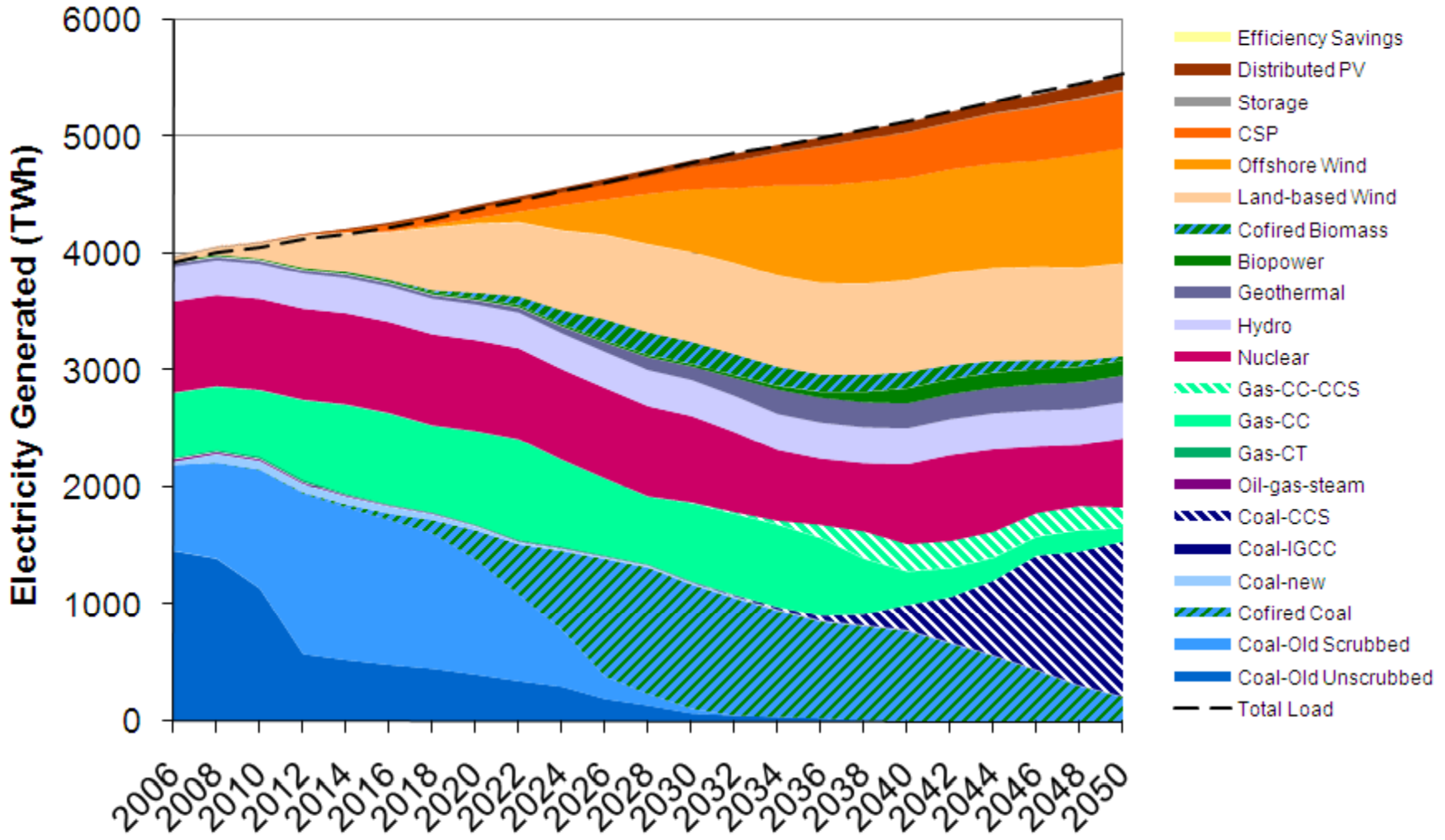
Carbon Case Inputs/Assumptions

- Carbon cap: By 2050 reduce U.S. electric sector carbon emissions to 20% of 2005 emissions
- Technology cost/performance from *20% Wind Energy by 2030* study
- Annual Energy Outlook 2009 Reference Case fuel prices and electric demands
- Climate case projection of PV in buildings from UCS Climate Analysis
- Carbon allowances are assumed to be allocated through an auction system. No assumption is made with respect to the use of the auction revenues.

Carbon Emissions (base vs cap)

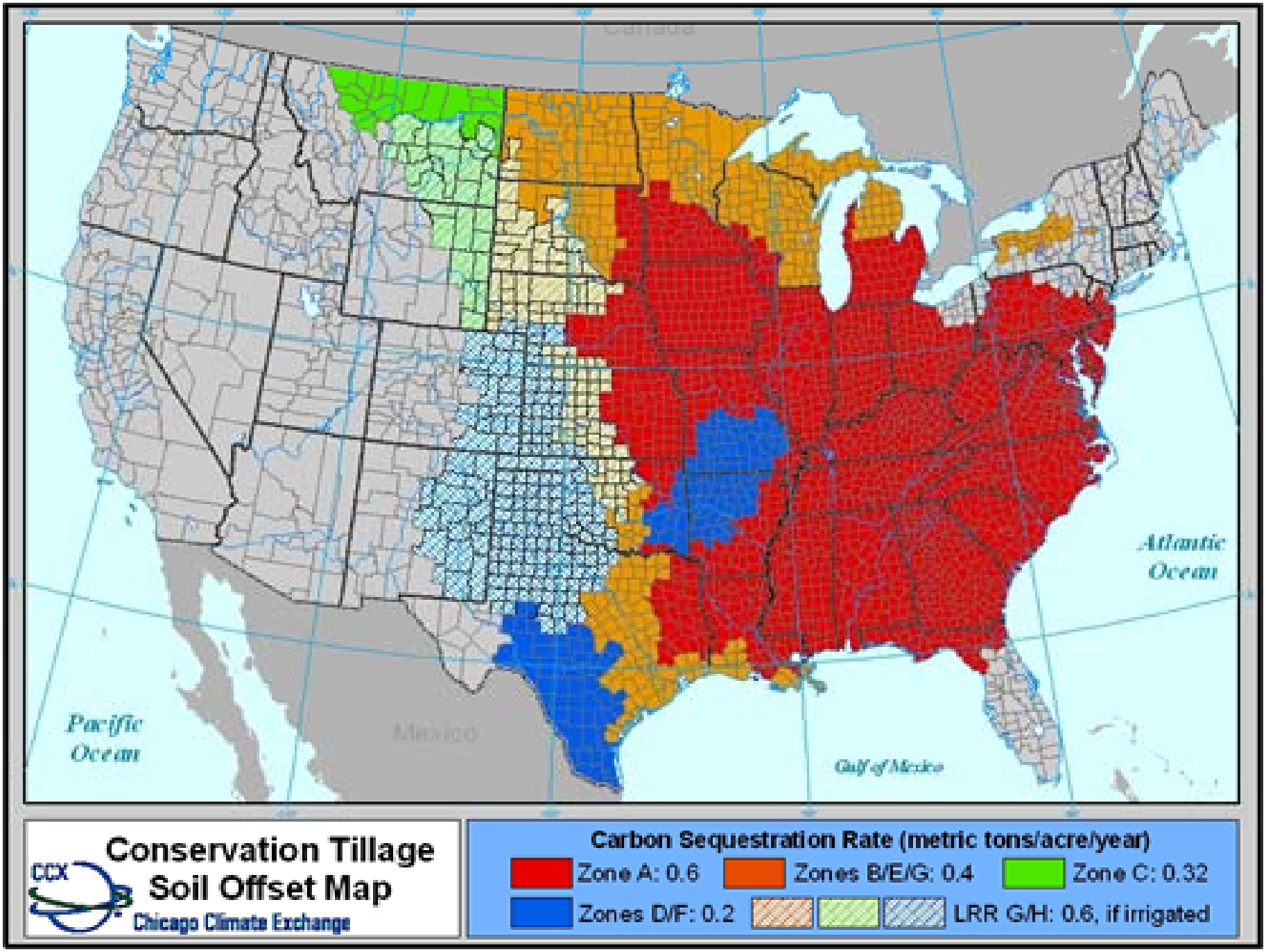


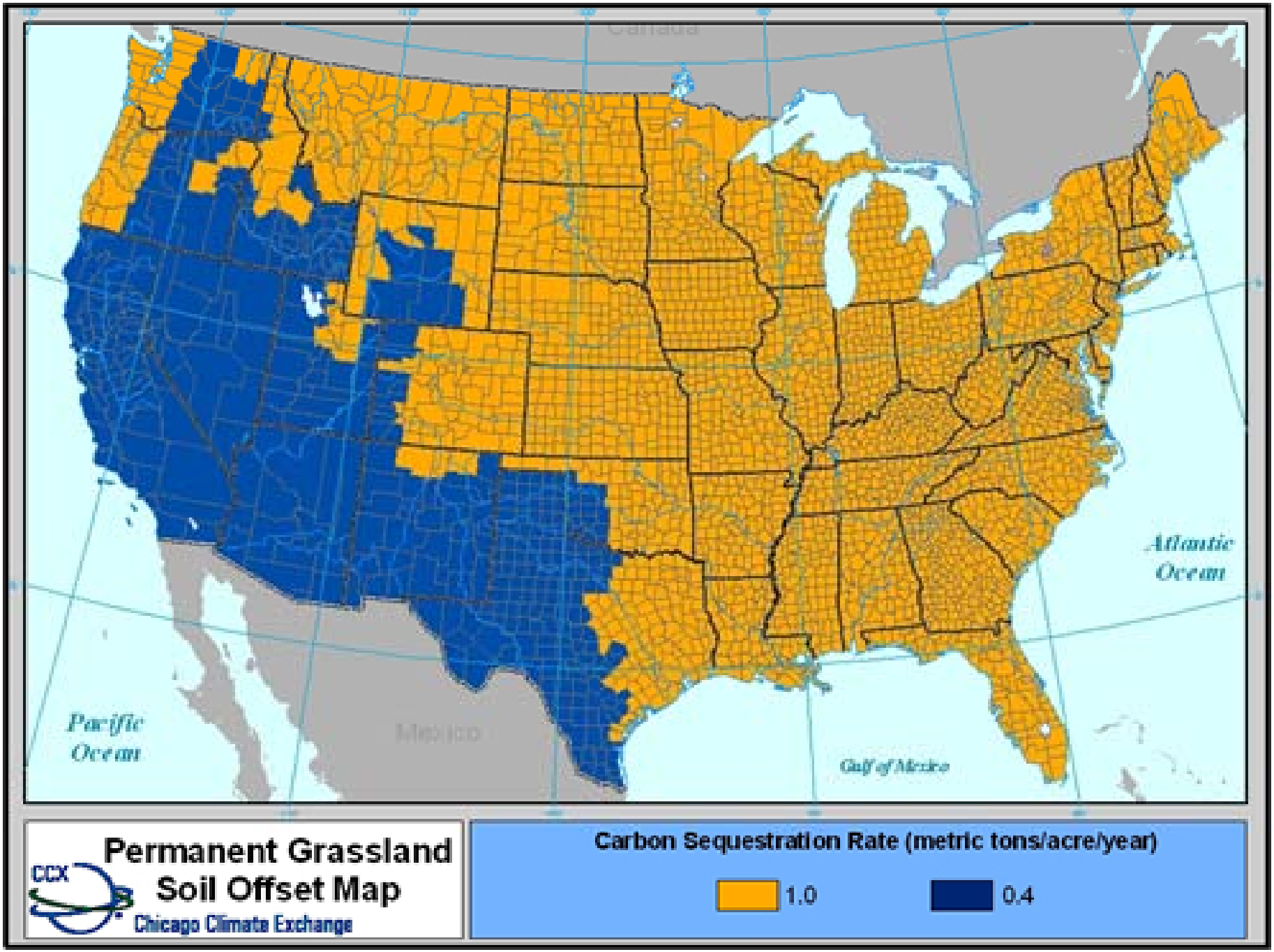
Carbon Cap: Generation

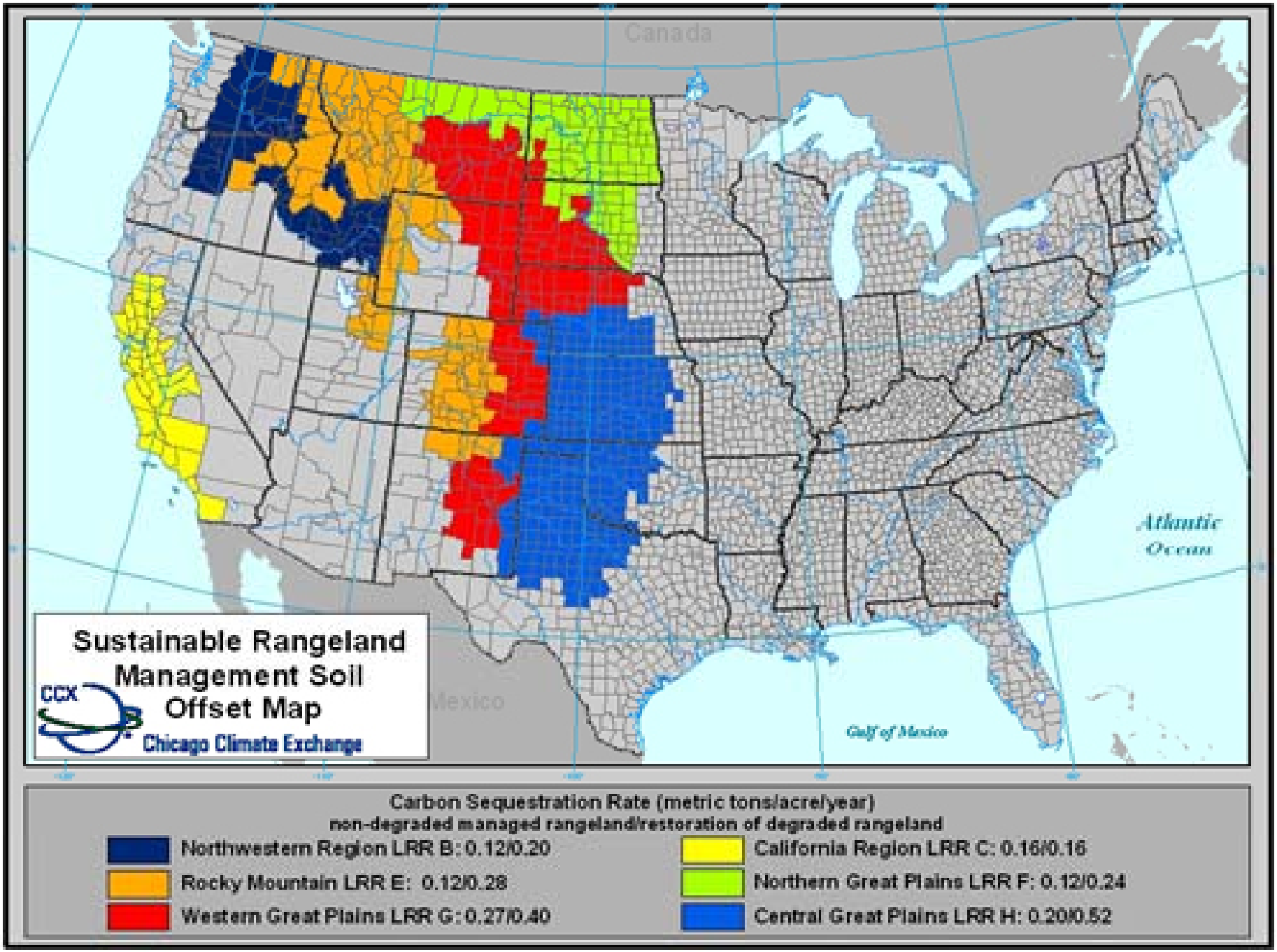


Ag Carbon Credit Opportunities

- Conservation Tillage
- Grassland
- Range


Canada
Atlantic Ocean
Pacific Ocean
Mexico
Gulf of Mexico
Conservation Tillage Soil Offset Map
CCX
Chicago Climate Exchange
Carbon Sequestration Rate (metric tons/acre/year)
Zone A: 0.6
Zones B/E/G: 0.4
Zone C: 0.32
Zones D/F: 0.2
LRR G/H: 0.6, if irrigated


Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Permanent Grassland Soil Offset Map
CCX
Chicago Climate Exchange
Carbon Sequestration Rate (metric tons/acre/year)
1.0
0.4


Canada
Mexico
Atlantic Ocean
Gulf of Mexico
Sustainable Rangeland Management Soil Offset Map
CCX
Chicago Climate Exchange
Carbon Sequestration Rate (metric tons/acre/year)
non-degraded managed rangeland/restoration of degraded rangeland
Northwestern Region LRR B: 0.12/0.20
Rocky Mountain LRR E: 0.12/0.28
Western Great Plains LRR G: 0.27/0.40
California Region LRR C: 0.16/0.16
Northern Great Plains LRR F: 0.12/0.24
Central Great Plains LRR H: 0.20/0.52

Agricultural Carbon Credit Markets

- North Dakota Farmers Union (more acres)
  - 42 states, 5.3 million acres
  - 1.7 million in ND
  - Rotational grazing fastest growing segment
- Iowa Farm Bureau (more tons)
  - No-till/forests

Questions?

cole.gustafson@ndsu.edu

(701) 231-7096