Will Carbon Find a Home on the Range? A Monte Carlo Simulation

Authors
John P. Ritten[1], Christopher T. Bastian[2], Benjamin S. Rashford[1]

[1]Assistant Professor, Department of Agricultural and Applied Economics, University of Wyoming,
[2]Associate Professor, Department of Agricultural and Applied Economics, University of Wyoming

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Introduction

As concerns over global climate change increase, there is growing interest in the potential for agricultural lands to provide ecosystem services related to carbon sequestration. Many geologic sequestration techniques remain unproven and cost prohibitive. Research suggests , however, that terrestrial sequestration is currently economically and environmentally viable . Rangelands are a major land cover in the United States, and particularly the West, accounting for nearly half of the 800 million acres of grazing lands in the U.S. While the per acre carbon capture potential of rangelands may be less than either crop or forest lands, existing research indicates that even modest changes in carbon storage on rangelands can potentially alter the global carbon cycle. The Chicago Climate Exchange has recently initiated a Rangeland Soil Offset program to allow carbon credit trading for carbon sequestered in certain geographic areas defined by USDA Land Resource Regions (Figure 1). Sequestration rates for rangelands in non-degraded states range from 0.12-0.27 metric tons per acre per year. Yet little research exists regarding the economic viability of enrollment in this program. Moreover, in April of 2009, the U.S. Environmental Protection Agency (EPA) ruled Carbon Dioxide to be a pollutant, and that it must be regulated per the Clean Air Act. This has fueled a widespread debate, with congress now considering a cap and trade bill aimed at controlling the amount of carbon emissions in the USA. Research regarding the potential benefits of enrollment in the program under proposed Cap and Trade legislation will be useful for producers considering program enrollment and for analysts interested in research regarding carbon sequestration on rangelands.

Objectives

Examine the firm-level economic consequences of producers enrolling in the Chicago Climate Exchange (CCX) Rangeland Soil Carbon Offset program for both:

- Historical prices for a contract begun in 2005 and running through 2009, and
- Projected prices given pending Cap and Trade legislation

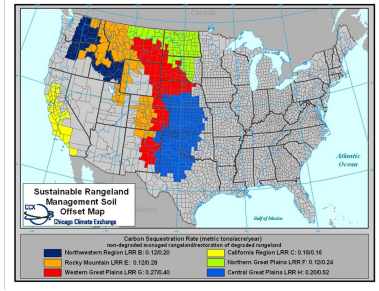

Figure 1. Lands eligible for Rangeland Management Carbon Offset Program

Data and Methods

- For Monte Carlo Analysis, closing prices for 2005-2209 were used (see figure 2).
- Minimum trading requirement of 10,000 tons of CO2 requires most producers to use the services of an aggregator.
- Most aggregators charge 8-10% of revenues (Ribera et al., 2009)
- We modeled a 10% fee (AgraGate, 2009).
- Trading fees consist of $0.20 per credit (CCX, 2009).
- 10% of all acres using an aggregator are subject to verification. These costs vary across aggregators, we use $0.10/acre (AgraGate, 2009).
- All contracts are for a minimum of 5 years (CCX, 2009).
- 20% of credits earned each year are held in reserve until the final year of the contract, which can have an impact on overall profitability (See figure 3).
- A Monte Carlo simulation was conducted with 1,000 draws across annual prices for 2005 through 2009 to determine a range of revenue streams of associated contracts – See Table 1.
- Five year contracts were also modeled over three projected carbon price streams for proposed Cap and Trade Legislation (AEP, 2004) – See Table 2 for price forecasts and Figure 4 for revenue outcomes.

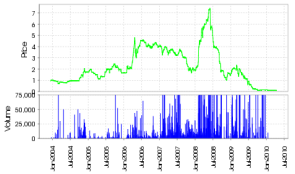

Figure 2. Historical carbon prices (2005 vintage) and trading volume

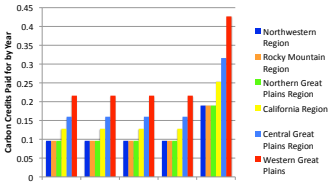

Figure 3. Schedule of credits earned each year

Table 1. Results from Monte Carlo Simulation

Land Resource Region(s)		2005 Payment per Acre	2006 Payment per Acre	2007 Payment per Acre	2008 Payment per Acre	2009 Payment per Acre	Total Payments per Acre	NPV per Acre	Average Annual Payment per Acre
Northwest Region, Rocky Mountain Region, Northern Great Plains Region	Mean	$0.04	$0.19	$0.16	$0.21	$0.13	$0.73	$0.59	$0.15
	Standard Deviation	$0.03	$0.11	$0.07	$0.21	$0.27	$0.37	$0.28	$0.07
	Minimum	$0.00	$0.00	$0.00	$0.00	$0.00	$0.20	$0.17	$0.04
	Maximum	$0.19	$0.69	$0.45	$2.26	$4.83	$5.28	$3.82	$1.06
California Region	Mean	$0.08	$0.28	$0.24	$0.32	$0.21	$1.13	$0.91	$0.23
	Standard Deviation	$0.04	$0.14	$0.09	$0.27	$0.35	$0.47	$0.35	$0.09
	Minimum	$0.00	$0.00	$0.04	$0.00	$0.00	$0.25	$0.20	$0.05
	Maximum	$0.32	$0.90	$0.59	$2.38	$3.87	$5.01	$3.71	$1.00
Central Great Plains Region	Mean	$0.12	$0.38	$0.33	$0.41	$0.27	$1.51	$1.22	$0.30
	Standard Deviation	$0.05	$0.17	$0.12	$0.35	$0.50	$0.65	$0.48	$0.13
	Minimum	$0.00	$0.05	$0.08	$0.00	$0.00	$0.40	$0.35	$0.08
	Maximum	$0.36	$1.47	$0.84	$3.03	$5.50	$6.49	$4.92	$1.30
Western Great Plains Region	Mean	$0.20	$0.54	$0.48	$0.60	$0.39	$2.21	$1.79	$0.44
	Standard Deviation	$0.07	$0.23	$0.15	$0.46	$0.65	$0.83	$0.62	$0.17
	Minimum	$0.04	$0.08	$0.14	$0.00	$0.00	$0.89	$0.76	$0.18
	Maximum	$0.48	$1.50	$1.30	$3.40	$7.71	$9.70	$7.12	$1.94

Results

- Results from the Monte Carlo analysis using 2005-2009 prices indicate a relatively wide range of modest revenues from the current CCX contracts and carbon market environment.
- While some scenarios were favorable, the majority of draws were not likely to induce producer participation in the current CCX program.
- Contract structures that hold 20% of credits earned in reserve until contract end can decrease participation value in times of falling prices (as experienced in 2008-present); however, the structure can add value if prices rise (as may be expected under Cap and Trade legislation).
- Current carbon prices are not likely to encourage producer participation.
- Low projected cap and trade legislation will also not encourage producer participation.
- Medium and high projections may make carbon sequestration a viable option for producers.

Table 2. Projected Carbon Prices (per ton) Under Various Cap and Trade Scenarios

	2011	2012	2013	2014	2015
High	$23.00	$24.50	$26.00	$27.50	$29.00
Medium	$13.50	$14.38	$15.25	$16.13	$17.00
Low	$4.00	$4.25	$4.50	$4.75	$5.00

Source: AEP (2004)

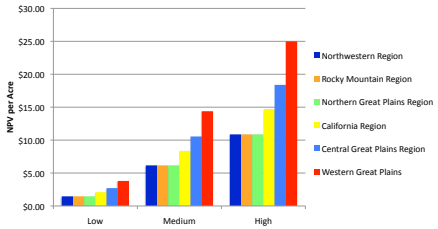

Figure 4. Schedule of Per Acre Payments Under Various Cap and Trade Projections

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Contact: John Ritten, University of Wyoming
Department of Ag and Applied Economics
2753 State Highway 157, Lingle, WY 82223.

Office: 307-837-2000
jritten@uwyo.edu

UNIVERSITY OF WYOMING

DEPARTMENT OF Agricultural and Applied Economics
COLLEGE of Agriculture and Natural Resources