



Forestland Owners' Willingness to Participate in Carbon Market



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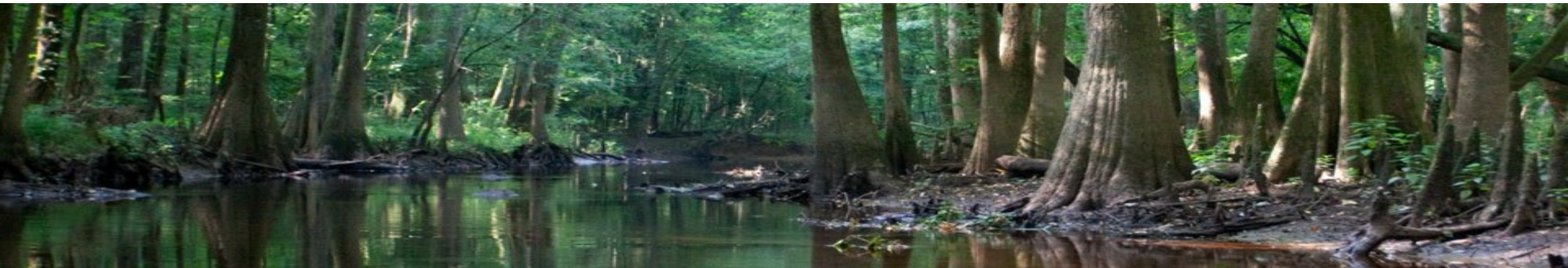
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Mustapha Alhassan contributed to this research in his personal capacity while at Clemson University as a Post-Doctoral Research Associate. The views expressed are his own and do not represent the views of the U.S. Geological Survey or the United States Government.



South Carolina Forestry

- Approximately 67% of the state's land area is forestland;
- Forestry contributes \$21 billion annually to the state's income (Khanal et al., 2017);
- Private owners hold 88% of the state's timberland (Brandeis et al., 2016).
- Provide support for almost 45,000 families (SC Forestry Commission, 2010);
- Only 20% of private owners manage forests for timber.



Objectives of Study



- Conducted by Clemson University from November 2017 to January, 2018.
 - To understand SC forestland owners' perceptions with respect to opportunities, benefits, and barriers to participating in a carbon market.
 - Estimate compensations forestland owners are willing to accept to participate in a carbon market.
 - Identify forest management practices they are willing to adopt
 - How information about climate change and U.S. withdrawal from the Paris Agreement impact willingness to participate in carbon market
 - Investigate forestland tenure in SC
- Estimate forestland availability in SC for carbon market.



California's Compliance Carbon Market

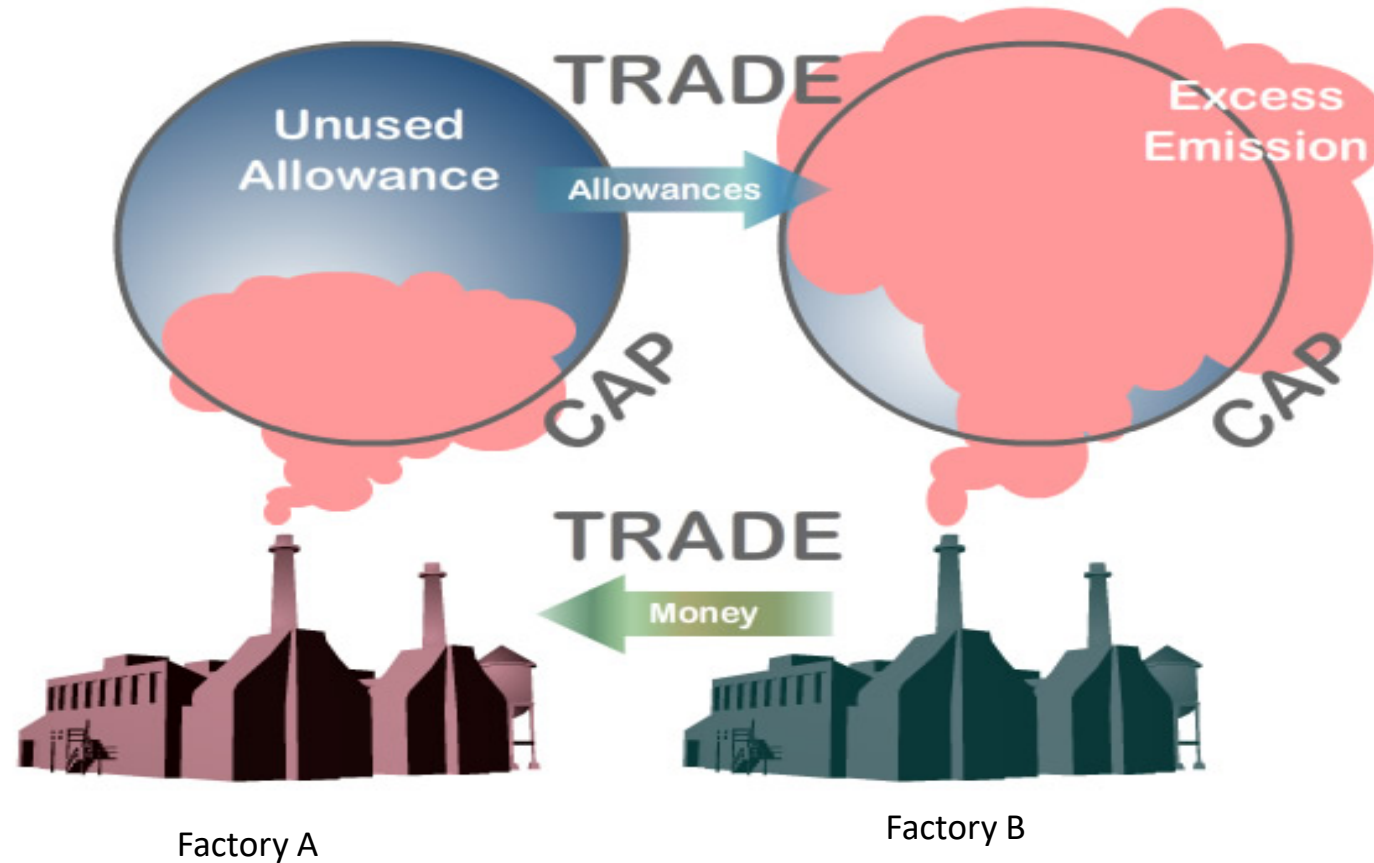


Figure 1: Cap and trade mechanism

Source: http://www.dartmouth.edu/~iispacs/Education/EARS18/California_2014/policy.html



Forests Offsets

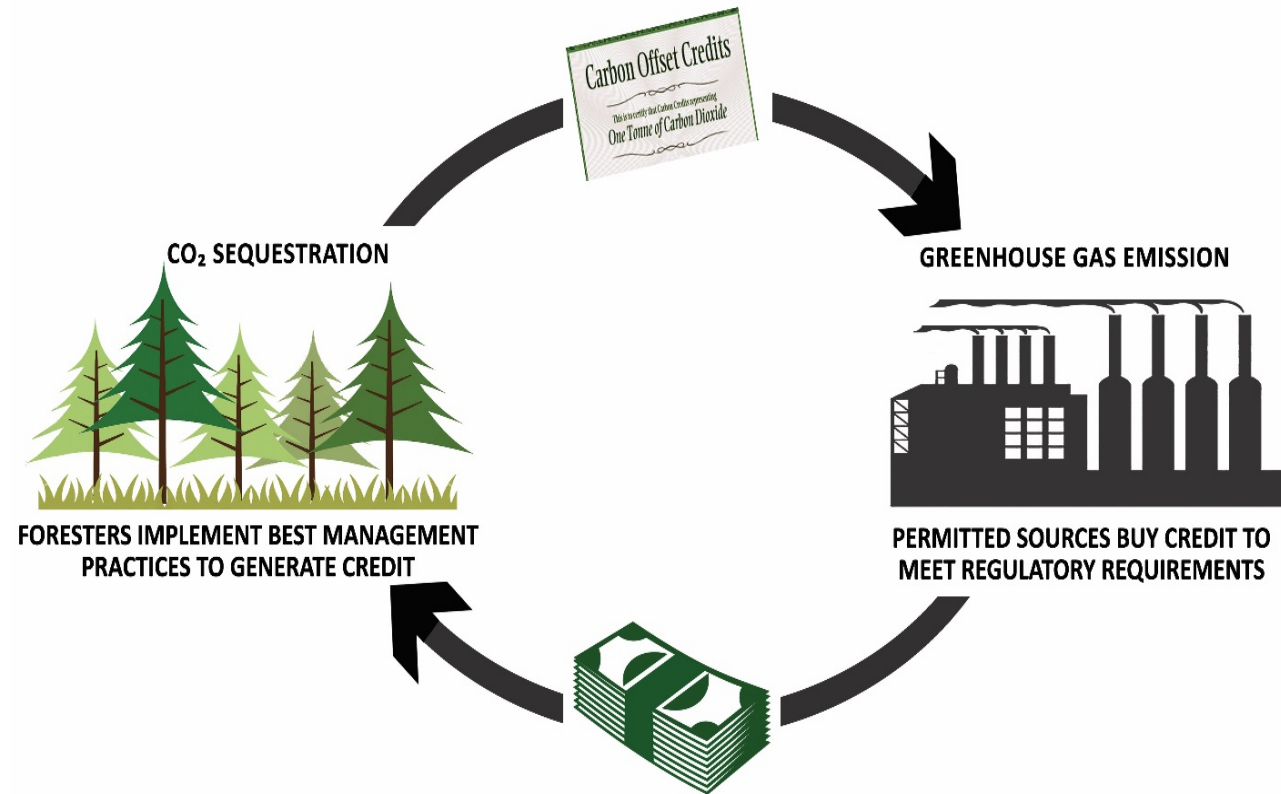


Figure 2: Forestry and carbon offset

Source: <https://www.clemson.edu/extension/publications/files/forestry-wildlife/fw15-carbon-offsets-for-sc-family-forest-landowners.pdf>



Survey of Forestland Owners

- Sent out a mail and online survey to 3000 private forestland owners with 100 acres minimum.
 - Questions included current forest management practices
 - Climate change and risk perceptions
 - Willingness to create and sell carbon credits

Would you be willing to accept \$..... per acre per year on your forestland for a period of 100 years of easement in order to create and sell carbon credits in California's carbon market?

- U.S. Withdrawal from the Paris Agreement

*... Efforts so far made by global leaders to combat climate change include the Paris Agreement. The Paris Agreement was negotiated in 2015 by many countries including the United States to hold global temperature rise below certain levels, through nationally determined contributions of reductions in emissions of carbon dioxide and other GHGs. It entered into force with over 80 countries, representing over 60% of global emissions, ratifying the agreement by the end of 2016. **The Paris Agreement remains in force but the United States announced its withdrawal in 2017.***

Results



Table 1: Summary statistics and definition of selected variables (N = 784)

Variable	Definition	Mean	Std. Dev.	Min	Max
Bid	Dollar amount offered to forestland owners.	33.33	20.97	7	65
Forestland	Total forestland (acres)	1,820.96	6,939.91	100	80,000
Credit acres	Forestland to use in carbon market	1,292.41	5,762.22	20	70,000
Years owned	Number of years owned	26.97	19.82	1	150
Aggregation	Whether owner is willing to combine forestland with owners to participate (1 if yes; 0 if no).	0.79	0.41	0	1
Gender	1 if male; 0 otherwise.	0.71	0.45	0	1
Education	Level of education in years.	17.05	1.95	9	19
Income	Average 2016 household income in dollars.	138,476.1	64,958.15	5000	212,500



Results (Cont.)

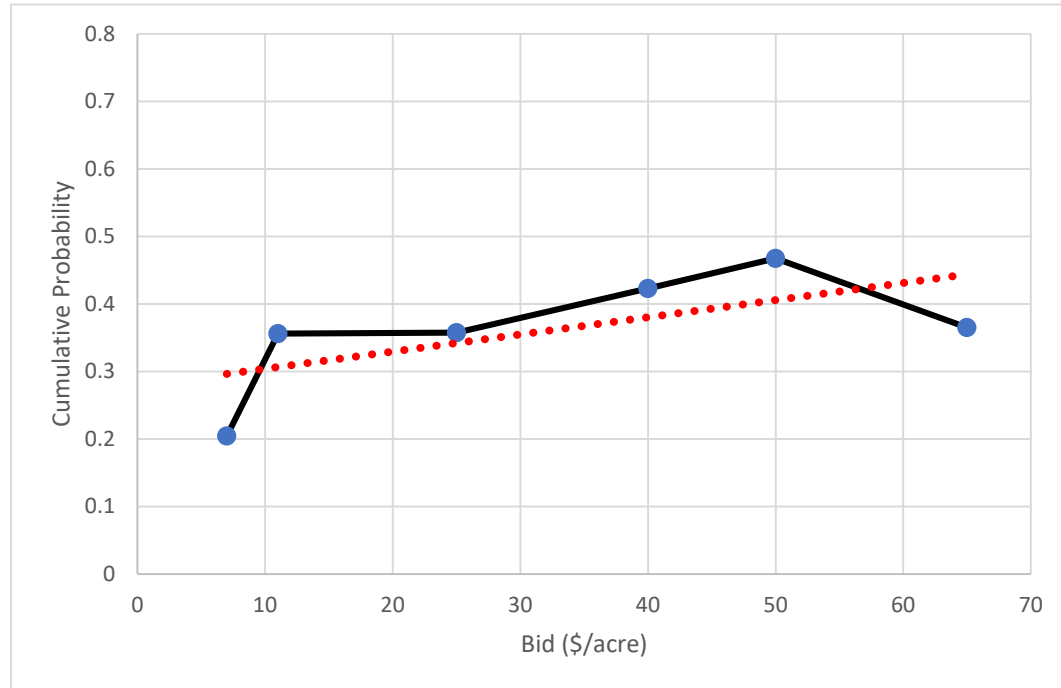


Figure 3: Cumulative probability of yes responses to the bids

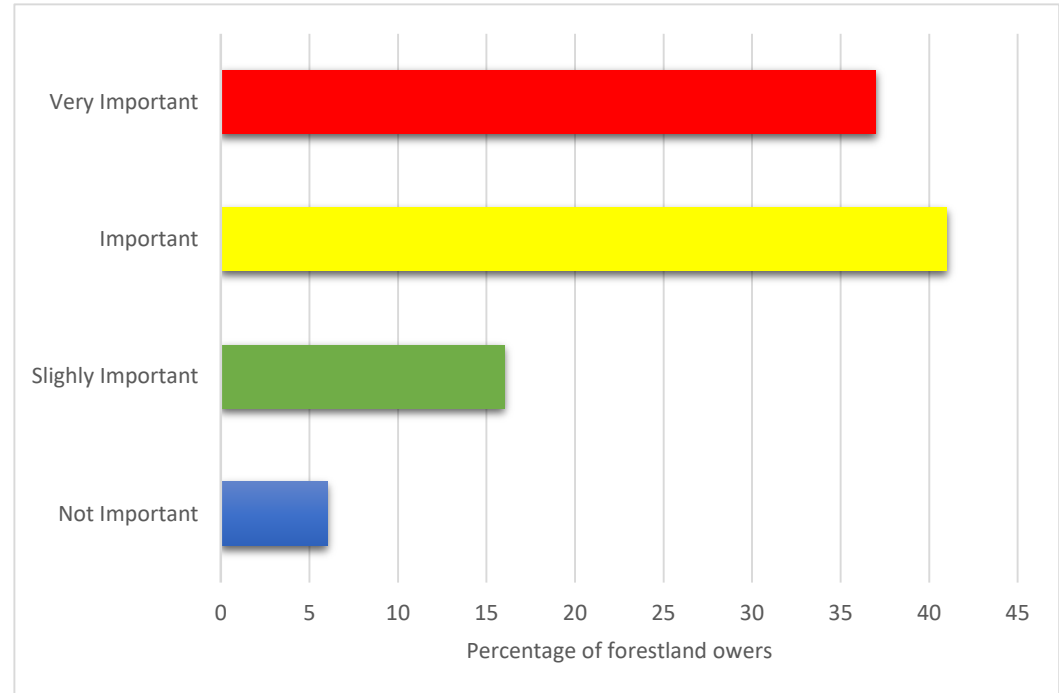


Figure 4: Forestland owners' responses to importance of ecosystem services (carbon sequestration, water quality improvement, wildlife habitat protection, nutrient cycling, and recreation).

Results (Cont.)

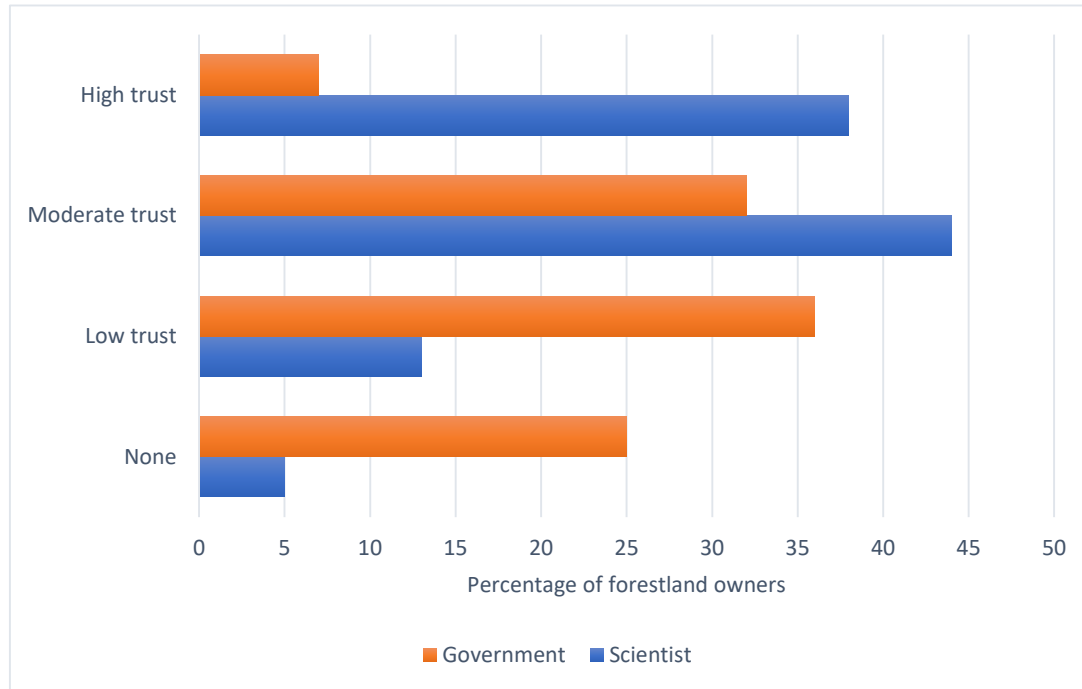


Figure 5: Comparing forestland owners' trust of source of climate change information.

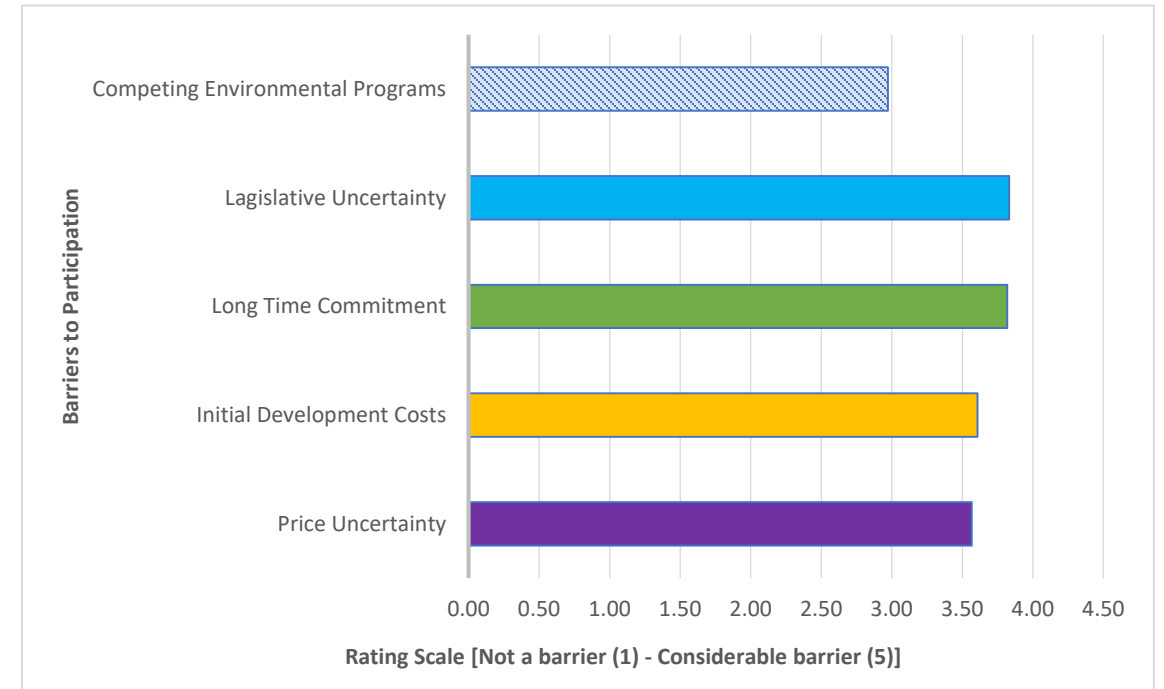


Figure 6: Forestland owners perceived barriers to participation in carbon market.

Results (Cont.)

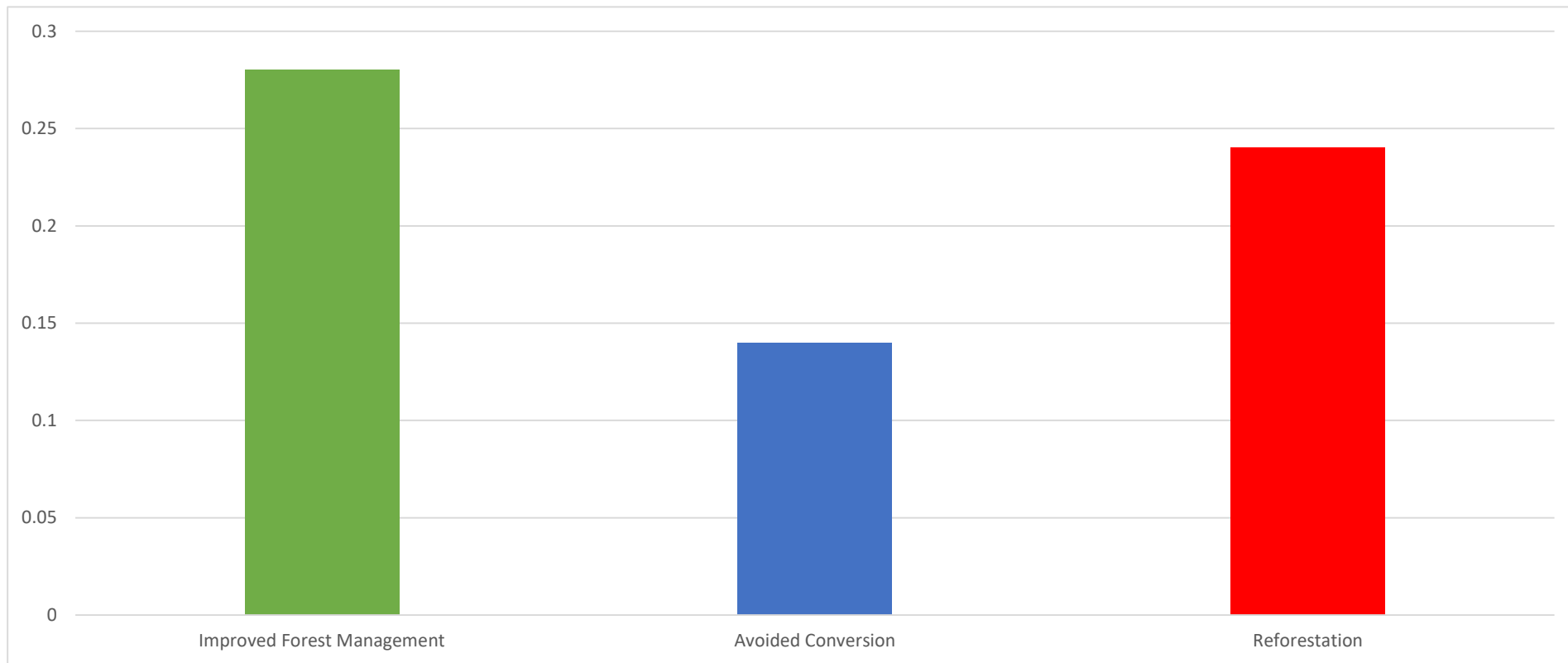


Figure 7: Likelihood of adoption of forest management practices to participate in carbon market.



Summary of Key Findings

- Estimated WTA was \$66.94 per acre per year.
- Forestland owners with higher values of forest ecosystem services such as carbon sequestration, water quality improvement, and recreation are more willing to participate in carbon markets.
- Average forestland tenure in SC is 27 years
- About 79% of forestland owners agreed to aggregate with other owners.
- Some forestland owners indicated they needed more information to decide whether or not to participate.
- The U.S. withdrawal from the Paris Agreement does not impact SC forestland owners' willingness to participate in carbon market.

Next Steps

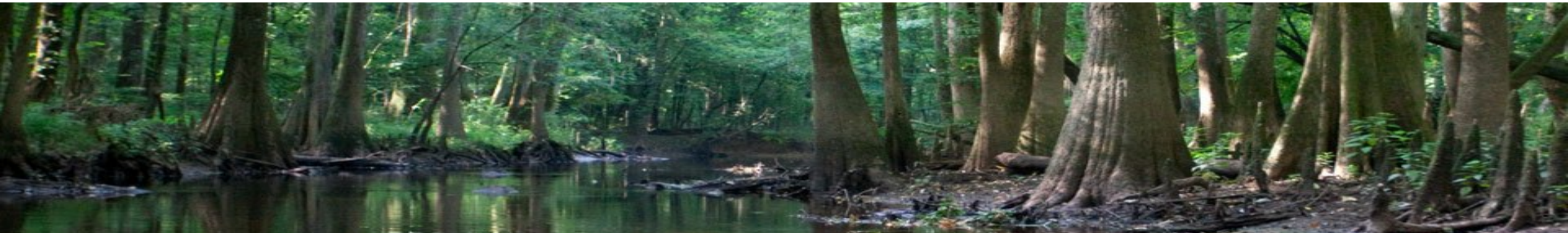


- Given forest carbon and WTA values:
 - Forestland availability analysis to determine value of annual carbon credits in SC.
 - Benefit-cost analysis of implementing carbon market in SC.



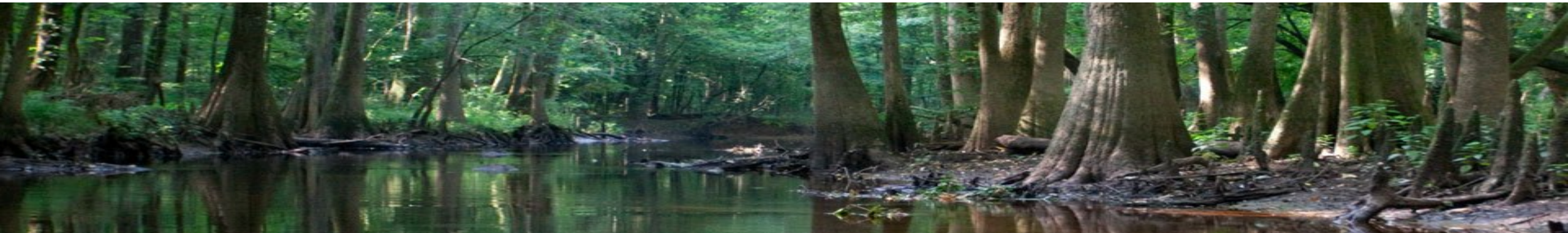
Acknowledgment

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Thank You!



References



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- Khanal, P.N., Straka, T.J. and Willis, D.B., 2017. Economic Contribution Analysis of South Carolina's Forestry Sector, 2017. *South Carolina State Documents Depository*.
- South Carolina Forestry Commission (2010) *South Carolina's Statewide Forest Resource Assessment and Strategy. Conditions, Trends, Threats, Benefits, and Issues*.

Appendix



Table 1: Summary statistics and definition of selected variables (N = 784)

Variable	Definition	Mean	Std. Dev.	Min	Max
Valuation:					
Yes/no	Response to the bid (1 if yes; 0 for no).	0.32	0.47	0	1
Bid	Dollar amount offered to forestland owners.	33.33	20.97	7	65
Forestland & Ecosystem Services:					
Forestland	Total forestland (acres)	1820.96	6939.91	100	80000
Credit acres	Forestland to use in carbon market	1292.41	5762.22	20	70000
Years owned	Years owned.	26.97	19.82	1	150
Easement	If forestland is in easement (1 if "yes"; 0 for "No").	0.23	0.42	0	1
Ecosystems1	How important are ecosystem services to you (1 if very important; 0 otherwise).	0.37	0.48	0	1
Ecosystems2	How important are ecosystem services to you (1 if important; 0 otherwise).	0.41	0.49	0	1
Ecosystems3	How important are ecosystem services to you (1 if slightly important; 0 otherwise).	0.16	0.37	0	1
Ecosystems4	How important are ecosystem services to you (1 if not important; 0 otherwise).	0.06	0.24	0	1
Aggregation	Whether owner is willing to aggregate forestland with others to participate (1 if yes; 0 if no).	0.79	0.41	0	1
Information & Trust:					
Paris	Information on Paris Accord.	0.49	0.5	0	1
Scientist1	How much you trust information about climate change from a scientist (1 if high; 0 otherwise).	0.38	0.49	0	1
Scientist2	How much you trust information about climate change from a scientist (1 if moderate; 0 otherwise).	0.44	0.5	0	1
Scientist3	How much you trust information about climate change from a scientist (1 if low; 0 otherwise).	0.13	0.34	0	1
Scientist4	How much you trust information about climate change from a scientist (1 if none; 0 otherwise).	0.05	0.22	0	1
Government1	How much you trust information about climate change from government (1 if high; 0 otherwise).	0.07	0.25	0	1
Government2	How much you trust information about climate change from government (1 if moderate; 0 otherwise).	0.32	0.47	0	1
Government3	How much you trust information about climate change from government (1 if low; 0 otherwise).	0.36	0.48	0	1
Government4	How much you trust information about climate change from government (1 if none; 0 otherwise).	0.25	0.43	0	1
Sociodemographic:					
Gender	1 if male; 0 otherwise.	0.71	0.45	0	1
Education	Level of education in years.	17.05	1.95	9	19
Income	Average 2016 household income in dollars.	138476.1	64958.15	5000	212500

Appendix (Cont.)



Variable	Restricted Model		Unrestricted Model	
	Coeff. (Std. Err.)	Marg. Eff. (Std. Err.)	Coeff. (Std. Err.)	Marg. Eff. (Std. Err.)
Bid	0.007 (0.003)**	0.003 (0.001)**	0.008 (0.003)**	0.003 (0.001)**
Paris	-0.03 (0.13)	-0.01 (0.05)	0.01 (0.14)	0.004 (0.05)
Forestland	0.000004 (0.00001)	0.000002 (0.000005)	0.0000003 (0.00001)	0.0000001 (0.000005)
Easement	0.001 (0.15)	0.0005 (0.06)	-0.009 (0.16)	-0.003 (0.06)
Ecosystems2	-0.37 (0.15)**	-0.14 (0.06)**	-0.41 (0.15)***	-0.16 (0.06)***
Ecosystems3	-0.57 (0.19)***	-0.22 (0.07)***	-0.55 (0.20)***	-0.21 (0.08)***
Ecosystems4	-0.98 (0.33)***	-0.38 (0.13)***	-0.87 (0.38)**	-0.34 (0.14)**
Scientist2			-0.11 (0.16)	-0.04 (0.06)
Scientist3			-0.06 (0.24)	-0.02 (0.09)
Scientist4			-0.88 (0.46)*	-0.34 (0.18)*
Government2			-0.30 (0.27)	-0.12 (0.10)
Government3			-0.42 (0.28)	-0.16 (0.11)
Government4			-0.60 (0.31)*	-0.23 (0.12)*
Gender	0.32 (0.18)*	0.12 (0.07)*	0.33 (0.19)*	0.13 (0.07)*
Education	-0.007 (0.03)	-0.003 (0.01)	-0.02 (0.04)	-0.008 (0.01)
Income	0.000001 (0.000001)	0.0000005 (0.0000004)	0.000002 (0.000001)	0.0000006 (0.0000004)
Constant	-0.50 (0.61)		0.12 (0.68)	
Log likelihood	-257.51		-241.13	
Chi2	26.77***		41.13***	
Mean WTA (\$)	68.80		66.94	
Median WTA (\$)	70.51		63.68	
Obs.	401		387	