Do Land Conservation Programs Crowd in or Crowd Out Each Other's Conservation?

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Interaction among conservation programs

- Conservation programs interact with one another
  - Compete, complement, co-operate by sharing costs, etc.

- Interaction affects
  - Acres preserved
  - Spatial distribution of preserved acres

- Spatial pattern or contiguity affects conservation benefits
  - With same acreage, a large tract generates higher conservation benefits than multiple small parcels that are not adjacent to one another

Previous studies

- Albers, Ando, and Chen (2008, JEEM)
  - How public conservation activities affect the conservation location of private land trusts
  - Township level analysis
  - Find mixed results

- Parker and Thurman (2010, Land Econ.)
  - How federal conservation programs affect private conservation effort
  - County level analysis
  - Find mixed results

Our study

- How existing programs react to a newly introduced conservation program that focuses on hotspots
- Use parcel level data
- Dealing with unobservables

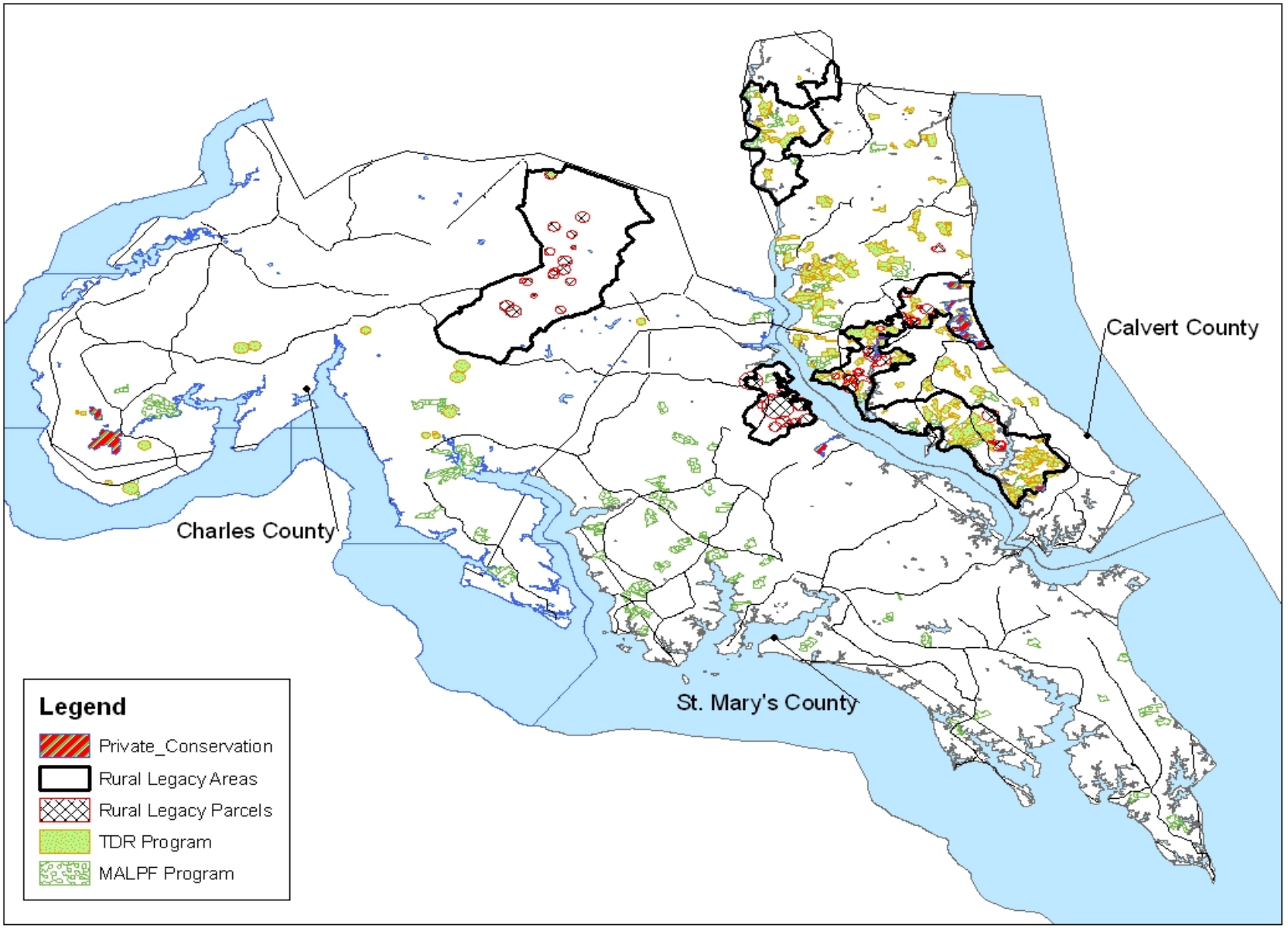
Rural Legacy (RL) program in Maryland

- Introduced in 1997 and aims to preserve large contiguous blocks of agricultural, forest, and ecologically important land
- County governments or non-profit organizations design Rural Legacy Areas and apply for funds to preserve the parcels within the areas
- Continuous funding is provided until all parcels are preserved

Existing farmland preservation programs in MD

- PDR/TDR programs, Maryland Environmental Trust, and private conservation organizations
- Critics say those programs do not prevent fragmentation and conversion

RL areas in three Southern Maryland counties



Interaction: crowding effects

- RL program crowds out the preservation effort of other programs
  - RL program preserve inexpensive parcels and force the other programs to preserve expensive parcels that are less affordable compared to the parcels outside RL areas
  - RL program increases landowners' willingness-to-accept to preserve their land
- RL program crowds in the preservation effort of other programs
  - RL program provides matching funds for other programs and makes the expensive parcels more affordable than the parcels outside RL areas
  - Economies of scale exist in RL areas

Illustration of multiple casual effects and identification strategies

	Pre-1997	Post-1997
Non-RL area	E_X	$E_X + E_C + E_\theta$
RL area	$E_X + E_\phi$	$E_X + E_\phi - E_C + E_{RL} + E_\theta$

Econometric method
-Propensity Score Matching method

- Construct observably the same parcels within and outside RL area and compare their preservation status
  - Matching parcels in and out of RL areas based on the estimated propensity score that parcels are included in RL areas

- Procedure:
  - Logit model – compute propensity to be treated – use both variables that impact parcels being included in RL areas and a parcel's preservation status
  - Use this propensity to create a weighted counterfactual for each parcel within RL areas
  - Average Treatment on the Treated: the mean difference in the land value between matching treated and matched control parcels

Outcomes, study areas and data

- Outcomes: likelihood of preservation and acres preserved
- Study area: 3 counties in Maryland--Charles, Calvert, and St. Mary's
- Data: Agricultural and forest parcels that are 3 acres and larger

Rate and acres of preservation for RL and non-RL parcels before and after 1997 (acres>=10)

		RL parcels	non-RL parcels
pre-1997	Proportion of parcels being preserved	0.067	0.021
		(0.25)	(0.143)
	preservation acres	3.195	0.714
		(18.47)	(10.89)
	# of parcels	720	6865
post-1997 including parcels preserved by RL program			
	Proportion of parcels being preserved	0.19	0.041
		(0.39)	(0.2)
	preservation acres	16.07	2.53
		(61.2)	(19.48)
	# of parcels	720	6865

Note: Standard deviation is in the parenthesis

Effects of rural legacy program on land preservation

		Rate	Acres
Predisposition effect E_{ϕ}	Strategy one	0.026	1.57
	Strategy two	0.026	1.57
Crowding effect E_C	Strategy one	-0.01	1.18
	Strategy two	-0.008	-0.2
Net effect of RL program E_{RL}	Strategy one	0.055	11.75
	Strategy two	0.06	9

Conclusion

- Empirical analysis supports a crowding-in effect of RL program on the preservation effort of existing programs
- RL parcels are predisposed to be preserved
- RL program increase the likelihood and average size of a parcel being preserved.

Improvements & Extensions

- Check robustness using all parcels rather than parcels >10 acres
- Examine the crowding effects on individual programs separately
- Study parcels adjacent to the boundary of Rural Legacy Areas.
- Study how the crowding effects affect land conversion within and outside the RL areas

Thank you!

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	# of parcels	720	6865
post-treatment exclude parcels preserved by RL program			
	preservation rate	0.138	0.041
		(0.35)	(0.2)
	preservation acres	7.86	2.53
		(30.9)	(19.5)
	# of parcels	676	6865

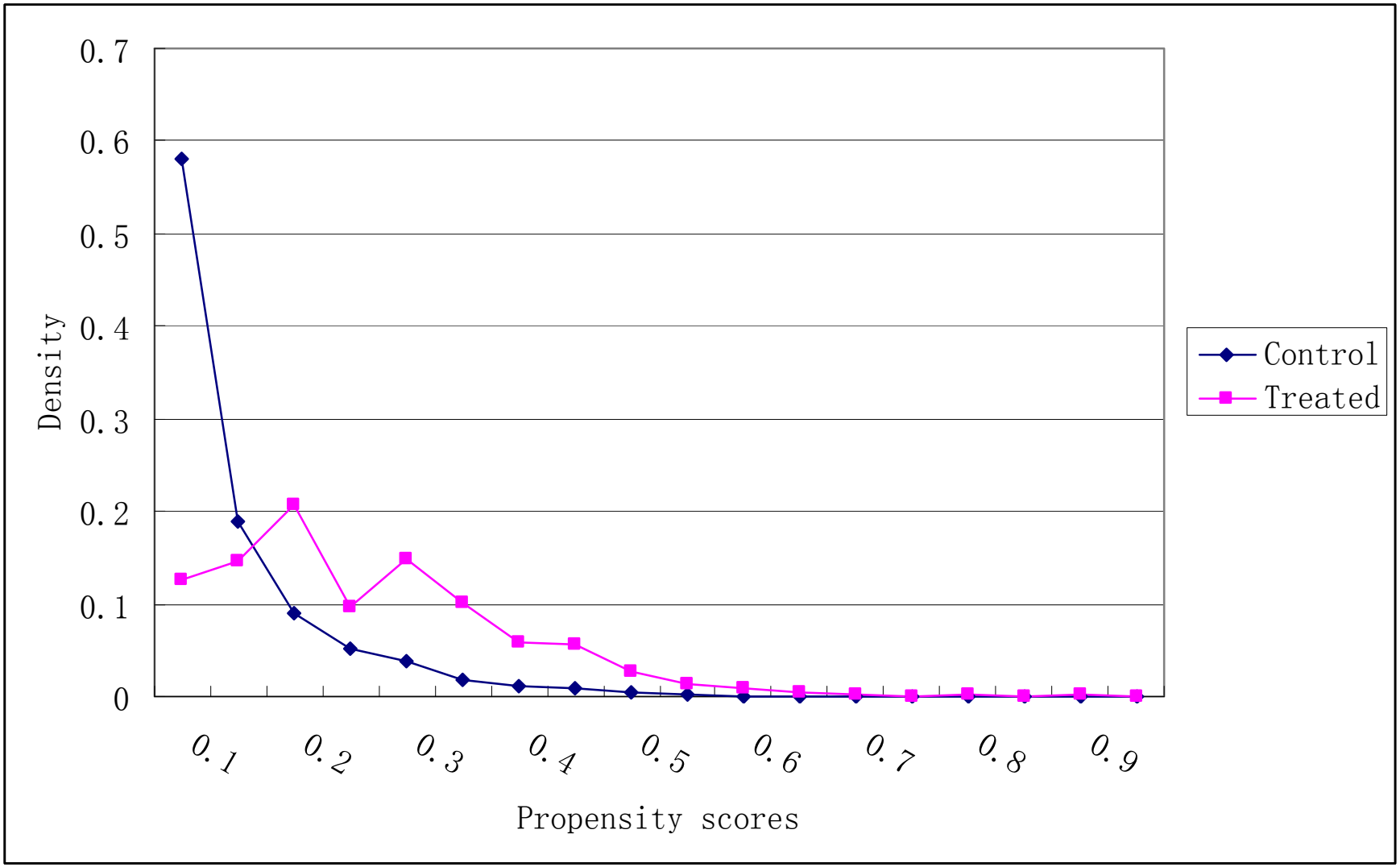
Note: The values are the proportion and acres preserved and standard deviation is in the parenthesis

Propensity score estimation

Pseudo R2 = 0.1779	Log likelihood = -5927.4692	
Dependent Variable	In/out of Rural Legacy areas	
Independent Variables	Estimated Coef.	Std Err.
Acres	0.0083**	0.0024
Miles to Washington DC	-0.0300	0.0204
% cropland_1997	1.0040**	0.1670
% forest_1997	-0.0634	0.1377
% special habitat	0.9904**	0.2097
On public sewer	-0.0251	0.5053
Zoning density per acre	-3.9806	3.7404
% estuarine	2.4142**	0.7200
Waterfront property	0.8767**	0.1387
% acres with depth to bedrock>72 inch	-4.2090	4.6463
% acres with floodplain soil	1.4719**	0.4274
% acres with soil erodability low and very low	3.6582**	0.4052
% acres with permeability medium or rapid	-2.0566**	0.3979
Observations	25779	

* significant at 5%; ** significant at 1%

Distribution of estimated propensity score



The effect of Rural Legacy designation on land value per acre

	Normal Kernel Matching (bandwidth=0.01)	Biweight Local Linear Matching (bandwidth=0.1)
Pre-1997		
ATT	-610	-535
	(1,116)	(1,112)
# matched RL parcels	545	545
# matched non-RL parcels	5,857	5,855
Post-1997		
ATT	-1,058	-1,130
	(1,424)	(1,403)
# matched RL parcels	288	288
# matched non-RL		

Available grants for the Rural Legacy Areas in Calvert, Charles, and St. Mary's Counties

	Calvert County		Charles County	St. Mary's County	
	Calvert Creeks	North Calvert	Zekiah Watershed	Mattapany	Huntersville
RL approved in	1998	2004	1998	2006	1998
RL expanded in			2001		2005
RL grants					
2008	750,000	833,590	500000	500,000	
2007			3000000	1,500,000	
2006				1,500,000	300,000
2005		350,000			
2004	600,000		202,218.56		
2003	1,500,000		1,000,000		
2002			1,000,000		
2001			1,500,000		3,700,000
2000	1,800,000		1,000,000		800,000
1999	2,000,000		500,000		1,500,000
1998			1,500,000		
Total to date	6,650,000	1,183,590	10,202,218.56	3,500,000	6,300,000

Note that the information on geographic distribution of RL grants in FY1998, and total available grants for FY2002 are not identified.

Source: Maryland Board of Public Work –after meeting agenda summary (1998-2008).

The Maryland Agricultural Land Preservation Foundation (MALPF) available funds and preservation costs per acre statewide

Fiscal Year	Annual Net new MALPF acreage	Annual new funding for easement acquisitions ($)	Per acre acquisition costs($)	Per acre easement value($)	Per acre Fair Market Value (FMV) ($)	Per acre Agricultural Use Value (formula)($)	Per acre accepted asking price($)
1993	8,341	11,472,760	1016*	1185*	2460*	1312*	1213*
1994	6,783	11,000,311	1617	2920	3639	718	1918
1995	7,851	11,120,874	1384	2235	3040	792	1633
1996	6,552	10,109,481	1537	2205	2977	773	1697
1997	11,797	16,324,722	1382	2193	2848	655	1470
1998	12,460	20,378,116	1634	2364	3027	666	1688
1999	14,241	23,109,183	1619	2345	3012	667	1650
2000	18,781	32,609,436	1683	2405	3129	724	1818
2001	12,966	25,246,645	1944	2511	3201	690	2223
2002	19,283	37,582,057	1958	2717	3,468	751	2676
2003	15,307	33,687,626	2199	3071	3,756	686	2400
2004	2,448	7,315,417	2982	4257	4,914	657	3779
2005	6,687	22,246,850	2802	4534	5,293	759	3189
2006	8,628	39,443,428	4492	7634	8,424	790	5475
2007	15,161	90,980,431	5952	9496	10,341	845	8010
Total	265,691	490,980,431					

* Value is for 1977-1993

Source: The Maryland Agricultural Land Preservation Foundation five year annual reports, Fiscal Year 2003-2007.

Effect of Rural Legacy designation on land preservation from strategy one

Normal Kernel Matching (bandwidth=0.01)	Rate ATT (se.)	Acres ATT (se.)
Pre-1997		
(1) Predisposition effect		
# RL parcels: 720	0.026	1.57
# non-RL parcels: 6898	(0.01)	(0.73)
Post-1997		
(2) A combination of crowding, predisposition and net effect		
# RL parcels: 672	0.101	10.96
# non-RL parcels: 6722	(0.013)	(0.39)
Pre-1997 RL vs. post -1997 non-RL		
(3)A combination of crowding and predisposition effect		
# RL parcels: 729	0.036	0.39
# non-RL parcels: 6848	(0.01)	(0.78)
E_{ϕ} --non-RL program = (1)	0.026	1.57
E_{C} --Crowding effect = $(1)-(3)$	-0.01	1.18
E_{RL} --Net impact of RL program = $(2)+(1)-2*(3)$	0.055	11.75

Effect of Rural Legacy designation on land preservation from strategy two

Normal Kernel Matching (bandwidth=0.01)	Rate		Acres	
	ATT	Se.	ATT	Se.
Pre-treatment				
(1) Predisposition effect # RL parcels:720 # non-RL parcels: 6865	0.026	(0.01)	1.57	(0.73)
Post-treatment—exclude parcels preserved by RL program				
(2) A combination of crowding and predisposition # RL parcels: 628 # non-RL parcels: 6722	0.041	(0.011)	1.97	(1.28)
Post-treatment—include parcels preserved by RL program				
(3)A combination of crowding and predisposition effect # RL parcels: 672 # non-RL parcels: 6722	0.101	(0.013)	10.96	(2.38)
E_{ϕ} non-RL program $=(1)$	0.026		1.57	
E_C crowding effect $=\frac{1}{2}[(1)-(2)]$	-0.008		-0.2	
E_{RL} Net effect of RL program $=(3)-(2)$	0.06		9	

Identification strategies

- Matching parcels in and out of RL areas based on the estimated propensity score that parcels are included in RL areas
- Multiple causal effects: predisposition effect, crowding effect, and net effect of RL program. Time effect may also be involved
- Strategy one: Matching pre-treatment outcome for RL and non-RL parcels; post-treatment RL and not RL parcels; post-treatment non-RL parcels and pre-treatment RL parcels
- Strategy two: Matching by including or excluding parcels that are preserved by RL program

Advantage of designated preservation areas

- Critics say existing programs (PDR, TDR programs and so on)
  - No targeting for high benefits
  - Do not prevent fragmentation and conversion
    - Requirement for soil quality
    - Farmland
    - Lack of budget to preserve expensive large parcels

- Concentrated program in targeted preservation area may reduce fragmentation, conversion and provide greater benefits