COST-SHARE PROGRAM EFFECTS ON FOREST MANAGEMENT BY NON-INDUSTRIAL PRIVATE FOREST (NIPF) LANDOWNERS: *EVIDENCE FROM THE NORTHERN REGION*

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SOFEW

March 20, 2012

Motivation

- Program participation not a random process
- Propensity score matching (PSM) to randomize sample
- Behavior of cost-share participation vary across size of their forests

Cost-share programs

- Federal, state, local governments, and private organizations to promote:
  - Conversion of non-forest land into forested land,
  - maintain forest land cover,
  - Manage forests to protect watersheds and wildlife habitats,
  - foster better forest stewardship
  - Ensure long-term timber supplies

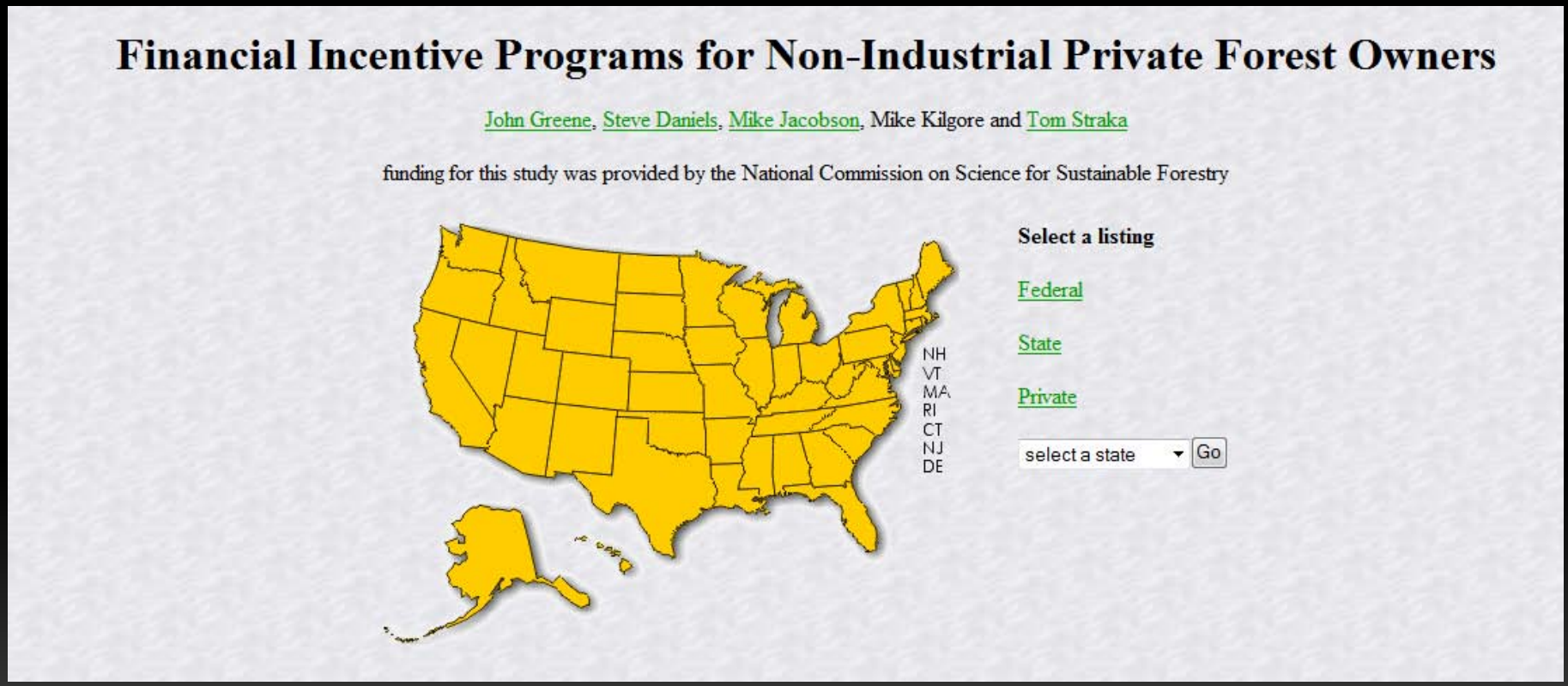
(Bullard and Straka 1988; Siikamäki and Layton 2007; Jacobson et al. 2009)

Federal Cost-Share Programs

- Most established since the 1930s. Examples:
  - The Conservation Reserve Program (CRP),
  - Wetland Reserve Program (WRP),
  - Forest Legacy Program (FLP),
  - Wildlife Habitat Incentives Program (WHIP),
  - Environmental Quality Incentive Program (EQIP),
  - Landowner Incentive Program (LIP)

Greene, Straka, and Dee (2004); Greene et al. (2005)

State and Private Cost-share Programs



http://www.srs.fs.usda.gov/econ/data/forestincentives/

Participation and Expenditure

- Some 528,000 forest landowners in U.S. have participated in cost-share programs
- 21% of U.S. forests enrolled in cost-share program at one point.
- Billions of dollars invested in recent years

Butler (2010), USDA Economic Research Service (1997); Wiebe and Gollehon (2006)

Positive Effects of Cost-Share --Past Studies

- Increased regeneration and timber supply
  - Flick and Horton (1981), Royer and Moulton (1987), Lee, Kaiser, and Alig (1992), de Steiguer (1984), Bullard and Straka (1988), Hardie and Parks (1991)

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- Afforestation
  - Drummond and Loveland (2010)

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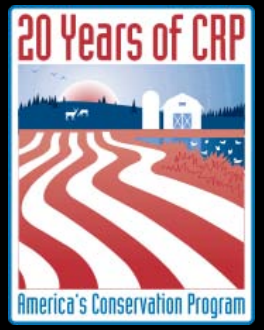
- Afforestation
  - Drummond and Loveland (2010)
- Positive findings in Europe
  - Siikamäki and Layton 2007; Ovaskainen et al. 2006

Studies Questioning Effects

- Fail to address environmental concerns
- Not mainly used by NIPF landowners but by industrial landowners
- CRP payments may not affect landowners' attitudes on adopting riparian buffers, strips forests or grass land between agricultural land and water sources to reduce agricultural run-off.



Bastos and Lichtenberg 2001; Romm et al. (1987); Mehmood and Zhang (2002); Valdivia and Poulos (2009)

Potential Substitution Effect

- Some forest landowners would have adopted conservation practices without cost-share programs

- Hence, positive effects of cost-share programs may be over-stated
  - (Boyd 1984; Bliss and Martin 1990; Kluender, Walkingstick, and Pickett 1999; Zhang and Flick 2001; Sun 2007).

Common Methods Used

- Least Squares
  - e.g. Brooks 1985: Kula and McKillop 1988; Hardie and Parks 1991; Lee, Kaiser, and Alig 1992; Zhang and Flick 2001; Kline, Butler, and Alig 2002
- Seemingly Unrelated Equations
  - e.g. Alig 1986
- Logistic
  - e.g. Hyberg and Holthausen 1989; Royer and Moulton 1987; Nagubadi and Zhang 2005; Valdivia and Poulos 2009
- Probit
  - e.g. Löyland, Kringstad, and H. Öey 1995; Nagubadi et al. 1996

Not A Random Event

- All above studies assume that participation in a cost-share program is a randomly distributed event
- Hence, program participation is modeled as an exogenous variable independent of land or landowner factors (Beach et al. 2005)
- However, cost-share programs are chosen by participants rather than assigned stochastically, making participation a non-random treatment

Propensity Score Matching Method

- Re-sample the data and exclude unmatched observations
  - So D is randomized for given p(**X**)
  - Data luxury
  - Similar to experimental data

- $T = E\{E[Y_1 | p(\boldsymbol{X}), D=1] - E[Y_o | p(\boldsymbol{X}), D=0] | D=1\}$

Estimation

- First, estimate probit models to obtain p(***X***). $dp(\boldsymbol{X})/d\boldsymbol{X} = \boldsymbol{\beta}'\phi(\boldsymbol{X}'\boldsymbol{\beta})$,
- Then, one to one nearest neighbor
- Finally, the average treatment effect was estimated using equation

- $T = 1/n * \sum\{Y_1 | p(\boldsymbol{X}), D=1\} - 1/n * \sum\{Y_0 | p(\boldsymbol{X}), D=1\}$

McNemar test

- The McNemar test suggested by Austin (2007) for dichotomous variables was used to test the statistical significance

Data

- National Woodland Owner Survey Data for Northern U.S. 20 states
  - from 2002 to 2006
- Sampling with a stratified random technique
- Questions about the
  - forest land they own,
  - their reasons for owing the forest land,
  - how they managed it,
  - their intentions for the future of their forests,
  - their demographics and others

Independent Variables

- ***X***, 26 of them
  - Forest landowner's demographics
  - their forest location
  - their forest area
  - types of ownership
  - years of ownership
  - and motivation of ownership

Dependent Variables

- Participation *D*
- Management variables (***Y***,13 of them)

TIMB_HVST	CHM_APPL
MANAG_PLAN	F_BUY
TREE_PLANT	F_AFFO
SITE_PREP	F_DEFFO
FIRE_REDU	F_SELL
ROAD_MAINT	F_SUBDIV
HABITAT_IMP	

Owner groups by Forest Acres	Group 1 10 to 99 acres			Group 2 100 to 999 acres			Group 3 ≥1,000 acres		
Management Variable	Cost-Share	Non-Cost-Share	Difference	Cost-Share	Non-Cost-Share	Difference	Cost-Share	Non-Cost-Share	Difference
TIMB_HVST	0.77	0.62	0.15	0.86	0.80	0.05	0.96	0.94	0.02
MANAG_PLAN	0.45	0.11	0.34	0.66	0.23	0.43	0.83	0.48	0.35
TREE_PLANT	0.45	0.28	0.17	0.45	0.30	0.16	0.50	0.17	0.33
SITE_PREP	0.25	0.05	0.20	0.25	0.08	0.18	0.42	0.10	0.31
HABITAT_IMP	0.32	0.15	0.17	0.37	0.33	0.04	0.33	0.44	-0.10
CHM_APPL	0.20	0.08	0.12	0.26	0.12	0.14	0.27	0.19	0.08
F_AFFO	0.08	0.02	0.05	0.08	0.03	0.05	0.13	0.02	0.10
Number of matched pairs		275			374			48	

Implication the Differences

- Differences theoretically represent participation effects
- In our case, the differences are changes in proportion of landowners practice certain management as a result of cost-share program participation

Forest Plan and Cost-Share

- Proportions of landowners adopting forest plans was 0.39 more than that of similar owners without cost-share (0.19) nationally
  - Difference 0.34, in group 1 (≥10 but < 100 acres)
  - Difference 0.43, in group 2 (≥ 100 but <1000 acres)
  - Difference 0.35, in group 3 (≥ 1000 acres)
- Interpretation:
  - A cost-share participant in this region was 39% more likely to write forest management plans than a similar non-participant.
  - It was expected

Tree planting, Site Preparation, Chemical Application and Cost-Share

- A forest landowner with cost-share did
  - Tree planting, 18% more likely
  - Site preparation, 20% more likely
  - Chemical application, 13% more likely

  than a similar non-participant.

Habitat Improvement and Cost-Share

- The estimated effect on the proportion of owners who practice habitat improvement was
  - 0.17 for group 1, 17% more likely
  - 0.05 for group 2, no significant effect
  - Insignificant group 3, no significant effect

Afforestation

- The estimated effect on the proportion of owners who stated she will convert non-forest land into forest land is
  - 0.05 group 1, 5% more likely
  - 0.05 for group 2, 5% more likely
  - Insignificant group 3, no significant effect

Harvest and Cost-Share

- Effects of cost-share participants on harvest
  - 0.15 group 1, 15% more likely
  - 0.05 for group 2, no significant effect
  - 0.02 for group 2, no significant effect
- So, slightly Increased timber supply

Summary

- Cost-share use: 11%, 21%, 32% by three groups, awareness is the major obstacle.
- Effects are generally positive:
  - Management plans, tree planting, site preparation, Chemical application are affected more among owners of all groups.
  - Afforestation, Harvest, Habitat improvement by owners less than 1000 acres but greater than 9 acres are more greatly affected.
  - Harvest by small owners are affect more.—Supply
- For conservation, cost-share on small owners are more effective.