Carbon Sequestration: Tradeoff of Land Retirement and Conservation on Working Land

Hongli Feng, Luba Kurkalova, Cathy Kling, and Phil Gassman

CARD, Iowa State University

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Funding of USDA conservation programs

Year	Land Retirement CRP, WRP (Billion/yr)	Working Land EQIP, WHIP (Billion/yr)	LR : WL
2001	1.8	0.2	9 : 1
2007	2.3	2.3	1 : 1

New direction in WL policy: Conservation Security Program (CSP)

- Goes beyond cost-sharing and technical assistance to fully compensate farmers for adopting conservation practices
- Annual payments and cost sharing
- 5 – 10 year contracts
- Performance oriented: 3 Tiers
  - I – one resource concern, part of farm
  - II – one resource concern, entire farm
  - III – all resource concerns, entire farm
- Implementation difficulties
  - First sign-up in priority watersheds

Issue

- On any given parcel of land only one practice, LR or WL can be adopted
- Policymaker's problem: How to choose between LR and WL if carbon sequestration is the goal?

This study

- Conceptual
  - How existence of pre-fixed split of budget between LR and WL affects efficiency
- Empirical
  - Application to Iowa

Problem setup

- N parcels of land (farms)
- Both LR and WL practices provide carbon benefits
- Policymaker can enroll each parcel in LR or WL
- Per acre costs and benefits of enrolling in LR and WL are known
- Given budget
- Maximize the amount of carbon sequestration benefits
- Problem: which parcels to enroll and in what practice
- 3 policy scenarios
  - No-prefixed split of funding between LR and WL
  - Fixed shares of funding,
    - 2 selection schemes

Combined policy: no prefixed budget split

- For each parcel i, choose

$$\left(\frac{b}{c}\right)_i^{\max} = \max\left\{\frac{b_i^{\mathrm{WL}}}{c_i^{\mathrm{WL}}}, \quad \frac{b_i^{\mathrm{LR}}}{c_i^{\mathrm{LR}}}\right\}$$

- Rank order by $\left(\frac{b}{c}\right)_i^{\max}$ from highest to lowest

- Enroll from the top into the program that provides the highest benefit per $ until total budget is exhausted

Pre-fixed budget split:
Budget = Budget ^{LR} + Budget ^{WL}

- Sequential selection: Enroll parcels for the LR first. After the LR budget is exhausted, enroll parcels for the WL program.
- Simultaneous selection: Enroll parcels for either the LR or the WL as long as the budgets are not exhausted. If one budget is completely spent, enroll for the other practice until the other budget is exhausted.
- In the past: sequential
- Now: more like simultaneous

Sequential selection; LR goes first

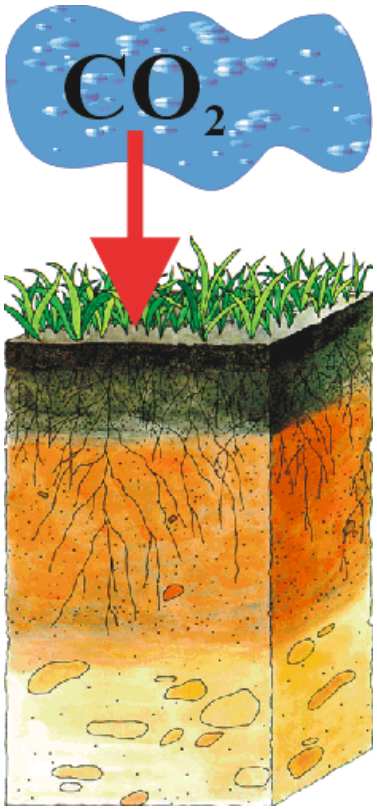
- Rank order by $\dfrac{b_i^{\mathrm{LR}}}{c_i^{\mathrm{LR}}}$ from highest to lowest
- Enroll into LR until the LR budget is exhausted
- Rank order the remaining parcels by $\dfrac{b_i^{\mathrm{WL}}}{c_i^{\mathrm{WL}}}$
- Enroll from the top of the new list until WL budget is exhausted

Simultaneous selection

- Rank order by highest to lowest $\left(\frac{b}{c}\right)_i^{\max} = \max\left\{\frac{b_i^{\mathrm{WL}}}{c_i^{\mathrm{WL}}}, \quad \frac{b_i^{\mathrm{LR}}}{c_i^{\mathrm{LR}}}\right\}$ from
- Enroll into the program that provides the highest benefit per $ until one of the budgets is exhausted
- Rank order the remaining parcels by the other benefit-to-cost ratio
- Enroll from the top of the new list until second budget is exhausted

Empirical application

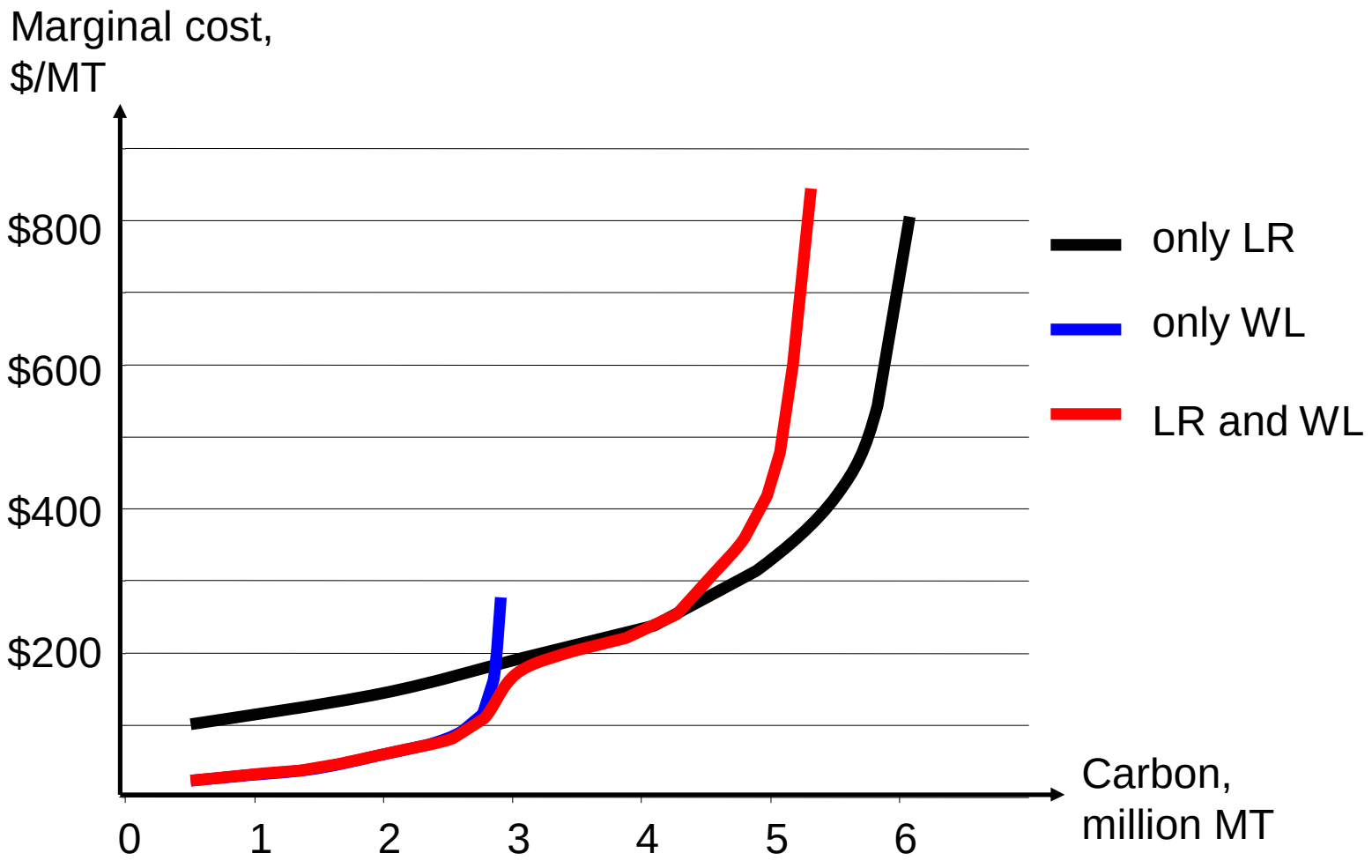
- Iowa
- ~13,000 1997 NRI cropland points
- WL practice: conservation tillage



Data summary

	c_i^{WL} ($/acre)	c_i^{LR} ($/acre)	b_i^{WL} (MT/acre)	b_i^{LR} (MT/acre)
Min of county averages	0.4	77.8	0.03	0.04
Average	7.1	120.3	0.16	0.31
Max of county averages	27.9	153.1	0.34	0.65

Marginal cost curves, carbon



Budget = $100 million/yr

Budget allocation	Carbon, MMT/yr	Average cost, $/MT/yr
Endogenous 99.6% WL	2.8	35.6
Simultaneous 10% WL	1.9	53.7
Sequential, LR first 10% WL	1.8	54.7
Simultaneous 50% WL	2.5	39.7
Sequential, LR first 50% WL	2.5	39.8

Final Remarks

- Empirical findings for Iowa
  - WL dominates LR
  - Significant losses due to pre-fixed budgets
- Ongoing and future research
  - Upper Mississippi River Basin
  - Interaction between federal and state conservation programs