Options for Improving Conservation Programs: Evidence from Economics Experiments on the Design of Enrollment Mechanisms

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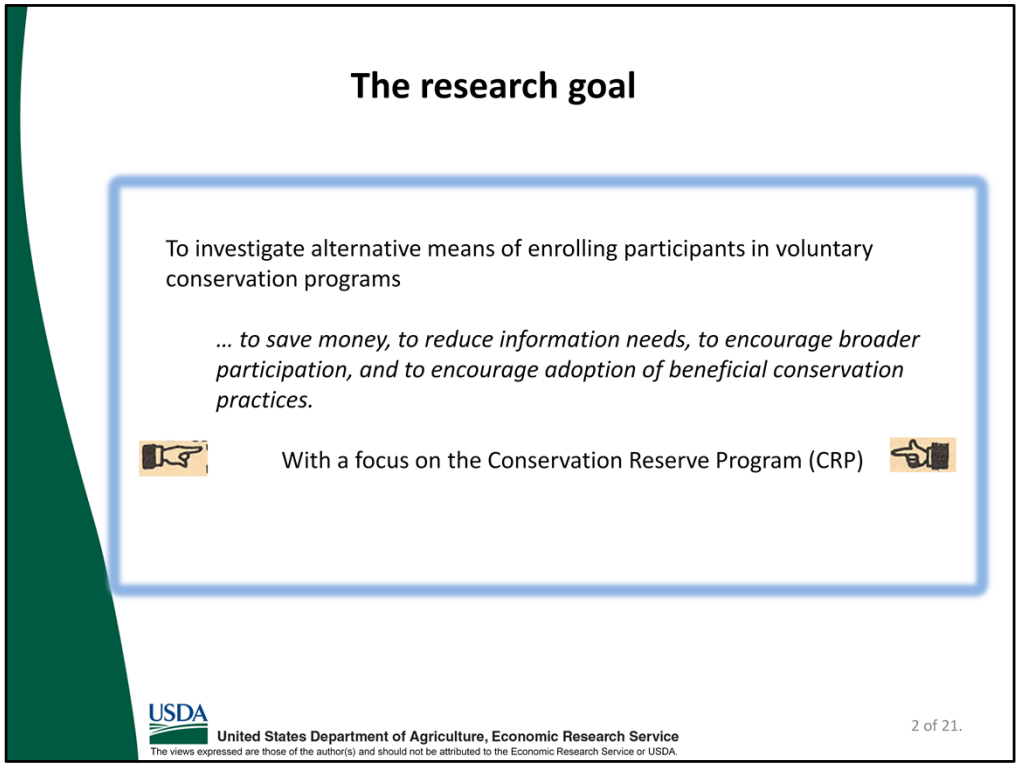
Presented at the Agricultural Markets for Ecosystem Services: Greenhouse Gases, Conservation Practice Adoption, and Behavioral Responses Workshop, August 8 2013, Washington DC



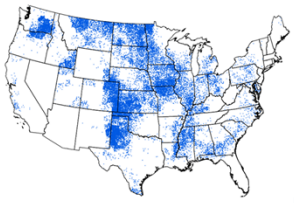
For several years ERS has been considering enrollment mechanisms and conservation policy.
Of particular interest is the CRP, hence we have focused on research questions that can be readily applied to aspects of the CRP.

Outline

1. Describe the Conservation Reserve Program and its enrollment mechanism : voluntary participation + the EBI + bid caps
2. Drawbacks of bid caps: toy example and experimental results
3. Alternative designs: quota and reference price experimental results

What is the Conservation Reserve Program (CRP)

- Established in 1986.
- As of May 2013, about 27m ac of cropland are retired under 10 to 15 year contracts.
- Originally targeted at highly erodible land.
- Since mid-1990s, a broader array of concerns:
  - Soil erosion
  - Water quality
  - Air quality
  - Wildlife habitat
  - Enduring benefits
  - Carbon sequestration



Dec 2012 CRP acreage
1 dot = 1,000 acres .

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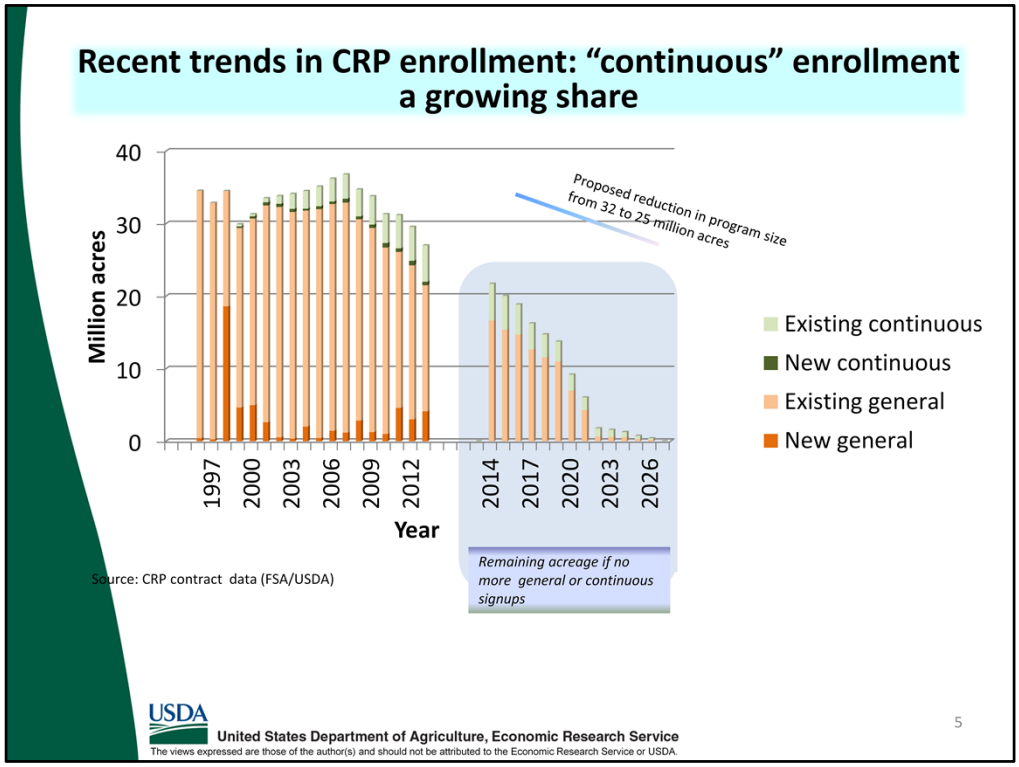
The CRP is USDA's largest conservation policy.
While shrinking, both in relative terms (share of USDA conservation budget) and absolute terms (acreage), it still is important –
it's 27 million acres accounting for about $1.9 billion a year in conservation payments.

So, improvements in how the CRP enlists lands could be beneficial.



This shows program acreage (as of Sept 30 of the listed year)

Peak acreage was in 2007 (36.8 million acres).
Since then, "general" signup acreage has dropped, while continuous acreage has been constantly increasing.

General signups occur more-or-less yearly, For several weeks FSA accepts offers from landowners. These offers list parcel locations,
an asking price, and conservation practice to be installed. FSA computes an EBI score for each offers, ranks them, and the chooses a fraction
of the offers (i.e.; 70%).

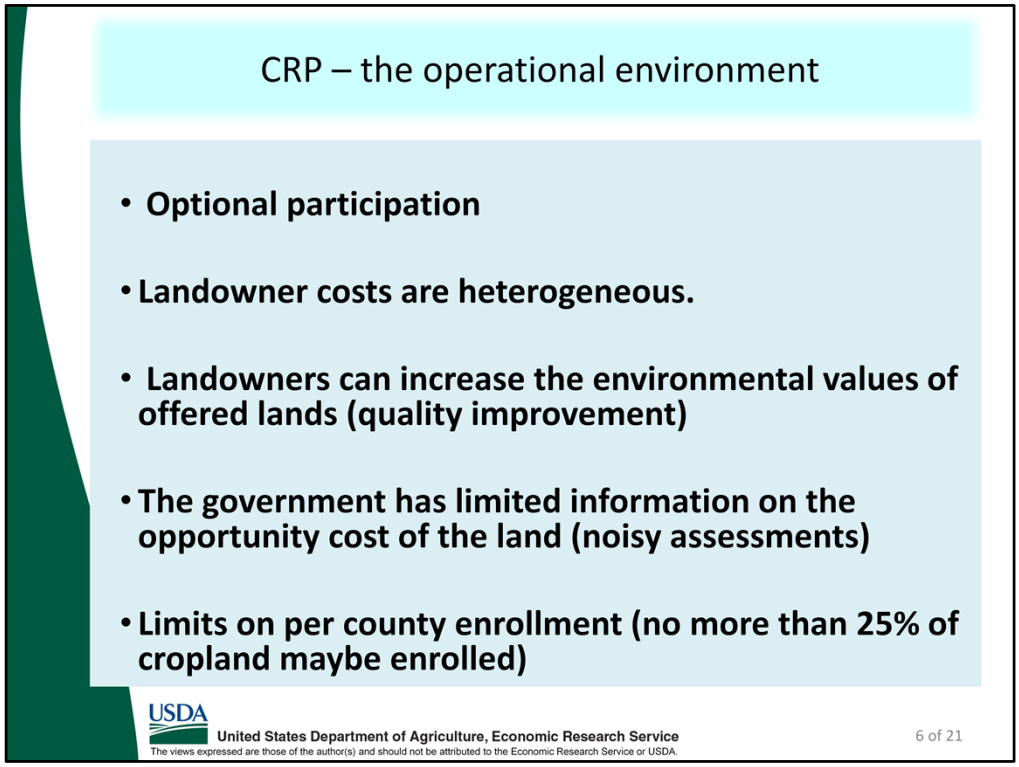
Continuous signups are always open – parcels can be offered to continuous signup at any time. Moreover, offers eligible for continuous signup are automatically
accepted (when offered). Furthermore, payment rates for continuous signup are larger – since a variety of bonuses can be received.
However, continuous signup has more stringent eligibility criteria than general signup.

Roughly speaking, acres eligible for continuous signup (such as acres along streams) are thought to yield high environmental benefits, hence there is no
need to use competition for cost effectivness purposes.

Note that even with shrinking acreage cap, there still is a need for continual signups –

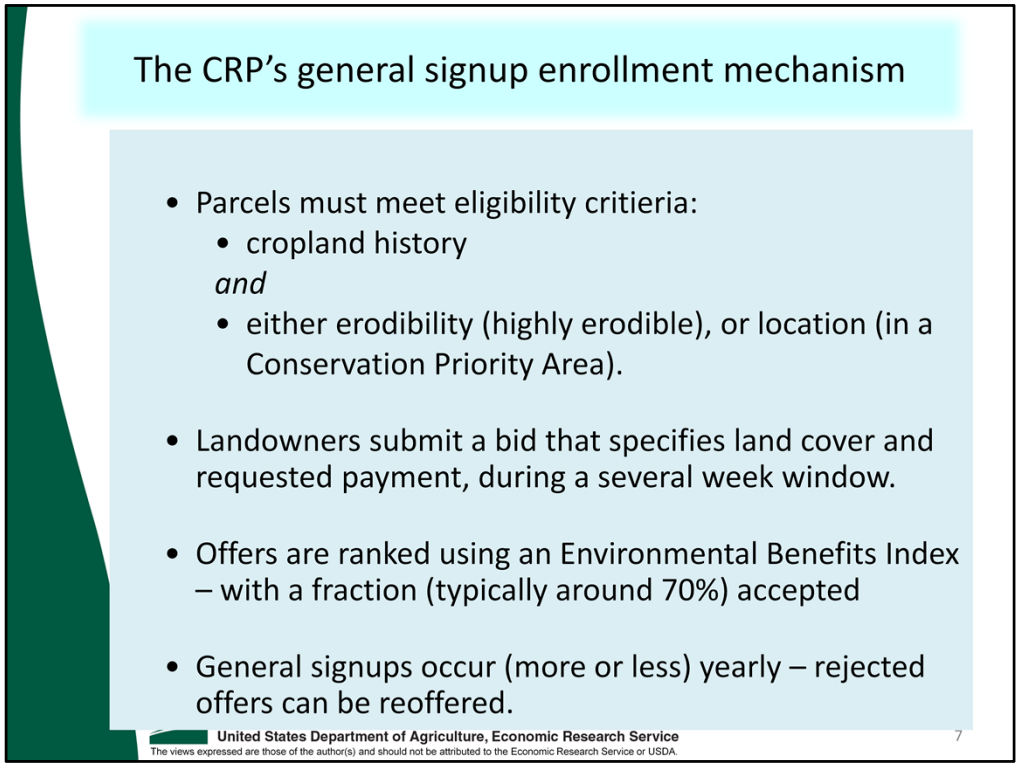
either general or continuous.

Note: as of April 2013, of the 27.00 million acres in CRP, 21.54 were general signup, and 5.49 were continuous. There were in 700k contracts (300 in general, 400 in continuous).



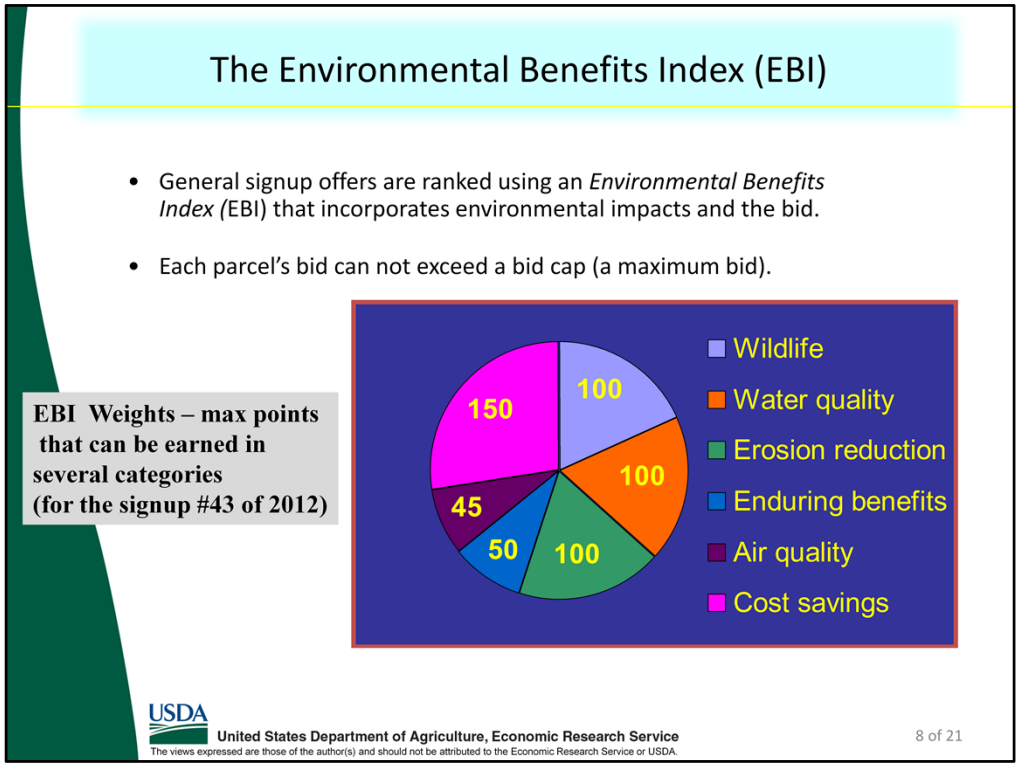
So how does the CRP currently enroll acres.
Most importantly, it is voluntary. So landowners need to be induced to offer their land.
Secondly, a competitive mechanism currently exists for general signups, one that rewards both lower asking prices and better quality.
And one that uses available information (on soil productivity) to suppress over payment.

Other factors do influence the current mechanism, such as a mandated limit on per county acreage (that seeks to prevent too much disruption to a local agricultural economy).
Also, the administrative agency (USDA/FSA) is traditionally collegial with farmers, hence may be reluctant to aggressively pursue policies that maximize bang for the buck.



Along with the EBI and the bid cap; cost share incentives and county enrollment caps can be thought of as forming the CRP enrollment mechanism.

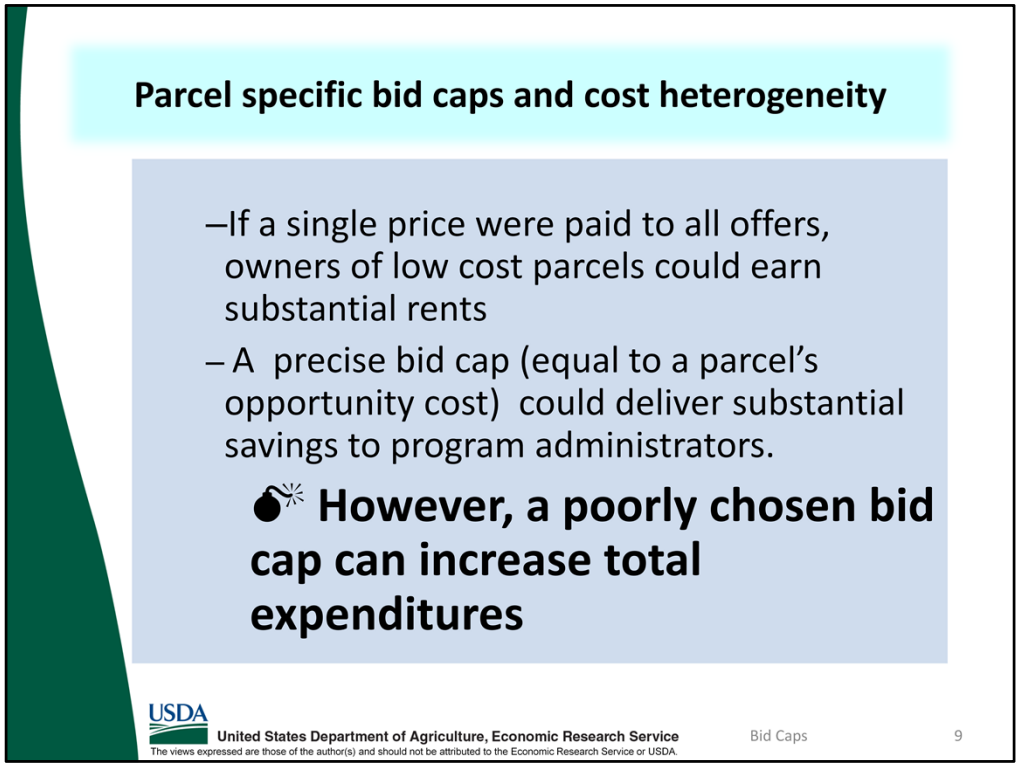
The EBI contains several environmental components: wildlife, water quality, soil erosion, enduring benefits (largely, tree cover), and air quality. The EBI is computed using weights that measure the contribution of numerous sub-factors; such as soil type, distance to water bodies, the conservation practices to be installed, and location in air/water/wildlife protection zones. The weights are derived from a "delphic process" incorporating expert input, and have been mostly stable for over a decade.



The EBI weights have been fairly stable over time, with some changes (such as adding points for "pollinator cover" in the latest signup).

The weight of Cost Savings factor is not announced during a signup – it is chosen after all offers are received. However, it has not varied much over time.

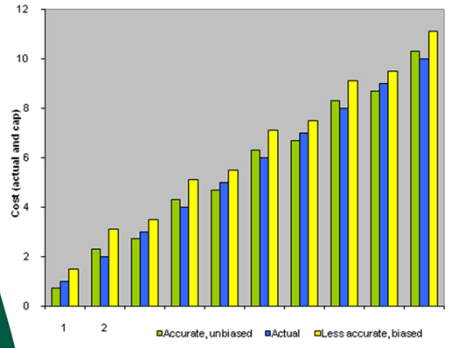
Note that cost enters linearly: the EBI is NOT a cost/benefit ratio metric. One could call it a cost-effectiveness metric



Consider the case of the CRP: a national program with an acreage target. This implies that expensive landowners (Iowa) are competing with inexpensive landowners (Texas). Thus, in a completely open auction process, inexpensive landowners can achieve large windfall earnings – since they are competing with expensive lands. The CRP's bid cap (known as a parcel's Soil Rental Rate), is set using county and parcel specific information; it can be seen as an attempt to limit these economic rents. However, short of applying expensive appraisals to every offered parcel, these bid caps will only be an approximate measure of the ag value of a parcel.

Toy Example: bid cap issues

Assume a population of 10 parcels with heterogeneous values (but otherwise the same)



Actual value

Accurate and unbiased assessment

Less accurate/upwardly biased assessment

Goal: accept 5 of the 10 parcels, by making parcel specific offers

Type of offer	Total cost
Actual value	15
Single price (6th highest value)	30
Using less accurate assessment (*upwardly biased +2 to +5%)*	18.7
Using accurate & unbiased assessment *(+/- 2%)*	31.5

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This is a simple toy example that demonstrates the importance of non-participation. Basically, assuming risk neutrality and profit maximizing farmers, an unbiased and very accurate assessment could lead 50% of potential participants to opt out – since their "cap" would be below their "value". This leads to high program costs – since expensive parcels (with a bid cap above its value) are chosen instead of cheaper parcels (with a bid cap below its value).

Lab results -- Impacts of different bid caps

4 "types" of tickets; tickets of the same type have the same bid cap

Variable	Coefficient	T-Stat
Intercept	4.6	9.4
90% *Bid cap 90% of "type" maximum*	-0.13	-29.3
100%	-0.25 ☺	-2.9
120%	-0.064	-1.4
200% *Bid cap 200% of "type" maximum*	0.0019	0.03
Q10	0.08	1.2
Q20	-0.065	-1.4
Q40	-0.17	-2.9
200% x Q40	-0.13	-1.6
Several other parameters are not displayed …		
N	183 (all treatments)	
F-stat	44.5 (prob<0.0001)	
Rsquare	0.88	

Y = aggregate efficiency =
(observed quality adjusted cost) / (full information cost for same quality)
Lower values mean greater cost effectiveness. Coefficients on dummies can be interpreted as fractional changes (i.e.; 0.10 = 10%)

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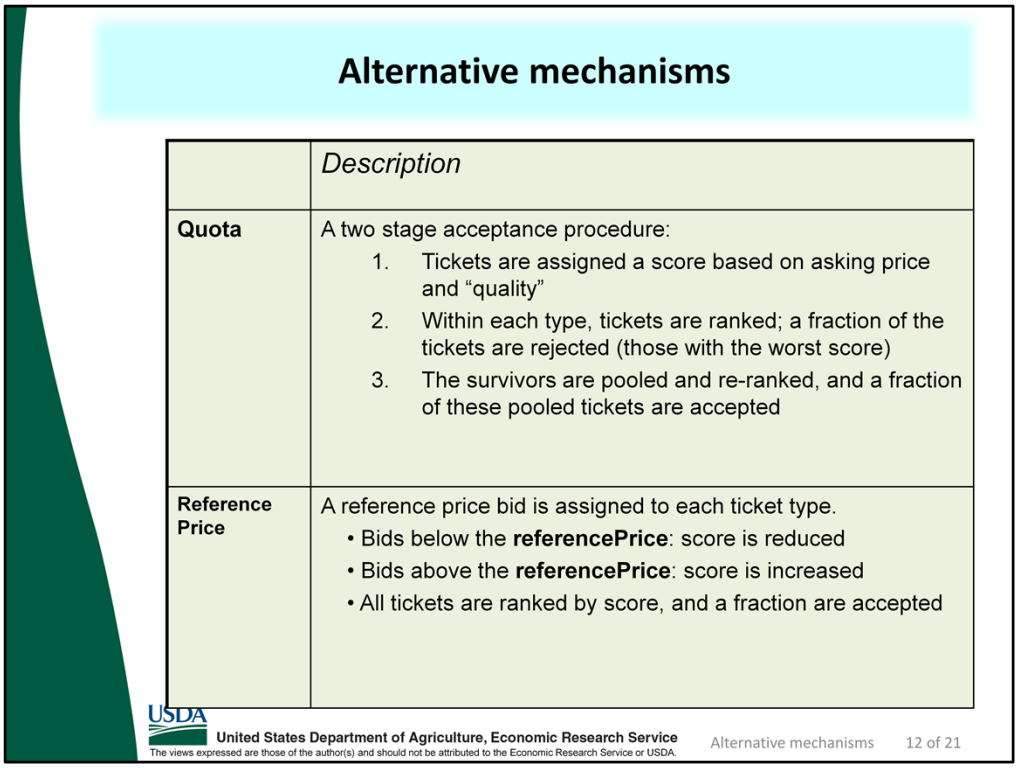
Lab experiments conducted by UMD researchers considered the effects of bid caps. Not unexpectedly, stringent bid caps increase overall costs. Things get a bit interesting when "quality" can be improved (simulating the ability of CRP offers to include more beneficial land covers). This capability lowers the *score rent ratio* (the quality adjusted acquisition costs*)*, especially when bid caps are high and large quality improvements are permitted.

The point: an additional problem with stringent bid caps is that "almost certain to be accepted" parcels (such as highly erodible and low ag productivity) have no incentive to improve their quality.

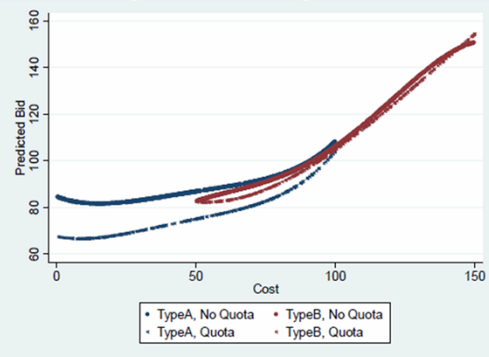


So what can be done? We have considered several modifications to the discriminative ("receive what you bid") auctions that leverage available information in different ways. The key is to somehow enable competition across the board: so that "low cost" providers are not certain of acceptance. The trick is how to do this credibly, and how do this without incurring costs elsewhere (such as by enrolling expensive parcels when low cost parcels fail to make offers).

Lab results
Quota auctions can reduce acquisition costs

Two “types”, no quality adjustment:

- Imposing a quota reduced acquisition costs by an average of 8%.
- Cost reduction due to reduced bids by “low costs” tickets was greater than cost increases due to accepting higher cost tickets



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ERS researchers have delved into quota auctions – including creating a simulation modeling framework and iterating thousands of times,
and in lab experiments conducted by UMD researchers. The gist is as displayed above: a quota auction reduces acquisition costs, and may do so more in practice than in theory. Look at the “dashed lines” – they represent the bid as a function of the “cost” of a “ticket” – in quota treatments, they tend to be lower for “low cost” tickets

Increase the number of groups and allowed for "quality" improvements

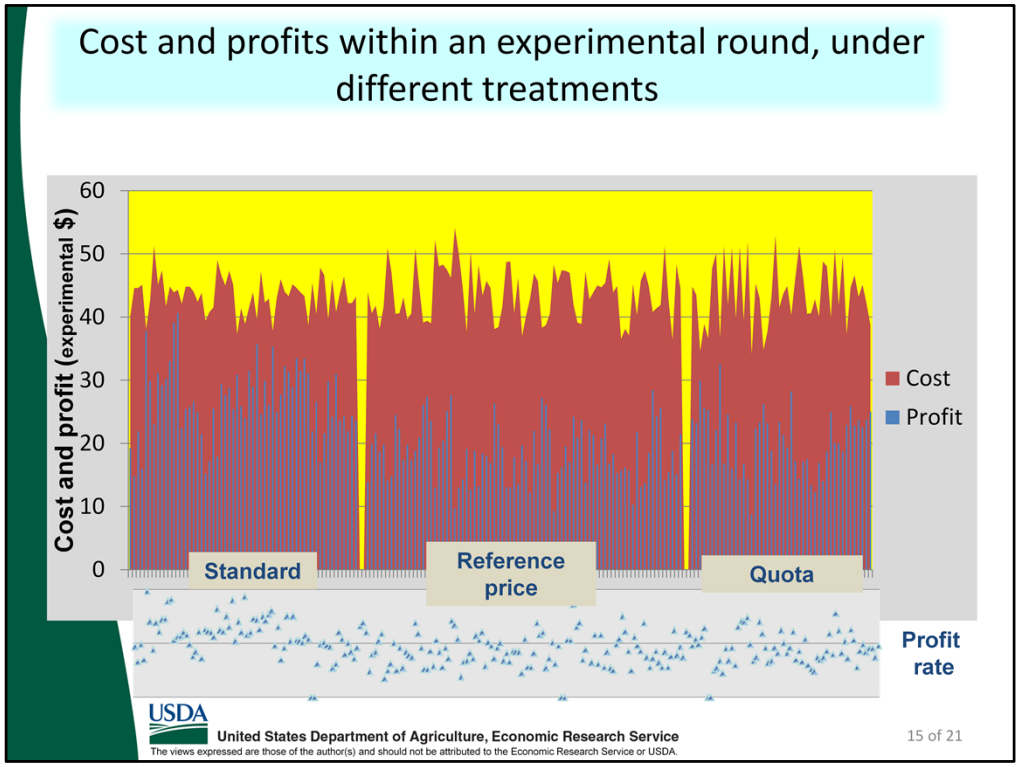
Tickets belong to one of 4 **types**

Description of type	*Cost range*	*Bid cap*	*Reference price*
(a) **Low cost with low variance**	*30 -45*	*90*	*39*
(b) **Low cost with medium variance**	*20-65*	*130*	*45*
(c) **Medium cost with medium variance**	*35 – 95*	*190*	*71*
(d) **High cost with high variance**	*40- 150*	*300*	*94*

Each participant receives:

1. an *(a)* or a *(b)* ticket, and
2. a *(c)* or a *(d)* ticket

We followed up on this work by allowing for quality improvements (so as to capture the ability of CRP parcels to improve their EBI via use of more beneficial land covers); increasing the number of "types" of parcels (that is, increasing heterogeneity); and by considering both a "quota" and a "reference price" mechanism.



Collaborators at UMD conducted a series of lab experiments.
Each bar represents one round. The "cost" is the average cost of a ticket, the profit is the average earnings of a ticket, in this round.
The profit rate is simply the averageProfit/averageCost.

This graph provides some hints that quota and reference price treatments may be more cost effective – with profit rates that are less than observed in the standard auctions
I can't tell for sure just by looking, so we consider regression analysis….

Regression results

	Dependent variable	
Variable	**Aggregate efficiency**	**Average Profit per accepted ticket**
Reference Price dummy	**-0.18 (-8.9)**	**-10.5 (-12.9)**
Quota dummy	**-0.14 (-5.81)**	**-7.7 (- 8.3)**
maxPrior	0.0054 (6.8)	0.21 (7.1)
R-square [f-stat]	0.66 [< 0.001]	0.58 [< 0.001]

For both dependent variables, lower values mean greater cost effectiveness

Each round is an observation, dummies are used (reference price and quota) to discern the influences of each treatment. Only one of these will have a non-zero value.
These fancy mechanisms have statistically significant impacts on the cost of acquisition (average efficiency, and avgProfit) – with cost reductions as high as 18% reduction.

This comes at some social cost – to reduce acquisition costs by scaring low cost producers, you might have to enroll some high cost producers.
However, these are small (proportionally smaller than the improvement in acquisition costs)

Note: the maxPrior is the max accepted score in the prior auction (which seems to have an impact on bid levels, hence acquisition costs).

Other variables, that measure comprehension of the instrument, and cost dispersion, are not displayed

More regression results … using a difference estimator

	Y= average profit per accepted ticket	Coefficient (t-stat)
intercept		1.43 (109)
Reference Price	**Change to reference price treatment**	**-9.7 (-37.2)** ☺
Quota	**Change to quota treatment**	**-7.08 (-23.0)** ☺
maxPrior	Max accepted bid prior round	0.093 (8.1)
vickCost	Total cost in a vickrey auction cost	-0.39 (-25.7)
vickRatio	vickCost/ fullInformationCost	15.8 (14.1)
qSmart	1 if optimal use of quality Improvement options	3.3 (3.1)
R-square [f-stat]		0.54 [< 0.001]
N		1822

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Given the replicative structure of the experiment, difference and difference models are readily estimated. Their findings are qualitatively similar to the simpler “dummy” models.

Comparing reference landowner and students (using difference estimator)

2012 Data	Y= Aggregate efficiency	CRP contract holders	College students
intercept		2.99 (8.1)	3.58 (2.5)
Reference Price	reference price treatment	**0.01 (0.16)** ☹	**0.13 (0.98)** ☹
Quota	quota treatment	**0.29 (4.4)** ☹	**0.49 (4.4)** ☹
maxPrior	Max accepted bid prior round	0.000563 (2.5)	0.001 (1.7)
Compre-hension	Average number of debriefer questions correctly answered	-1.18 (2.5)	-3.7 (-2.4)
R-square & F-stat pval		0.54 <0.001	0.76 (**) <0.001
N		44	24

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Are lab students representative of the real world? UMD collaborators implemented a web based experiment, using CRP contract holders.
They also used the same web based instrument with students.

Somewhat disturbingly, the "advanced" mechanisms do NOT improve performance. Also somewhat interestingly, this failure is not unique to the "field" (to CRP contract holders). It seems the web instrument (that was spread out over a week with no human interaction) elucidated a different response than the more immersive lab experiment.

More work is called for!

Summary

The CRP has evolved over time,

- from a primarily erosion focus to considering multiple environmental amenities
- from near open enrollment, to competitive enrollment, and now a mixture of competitive enrollment (general signup) and locationally targeted (continuous signup)

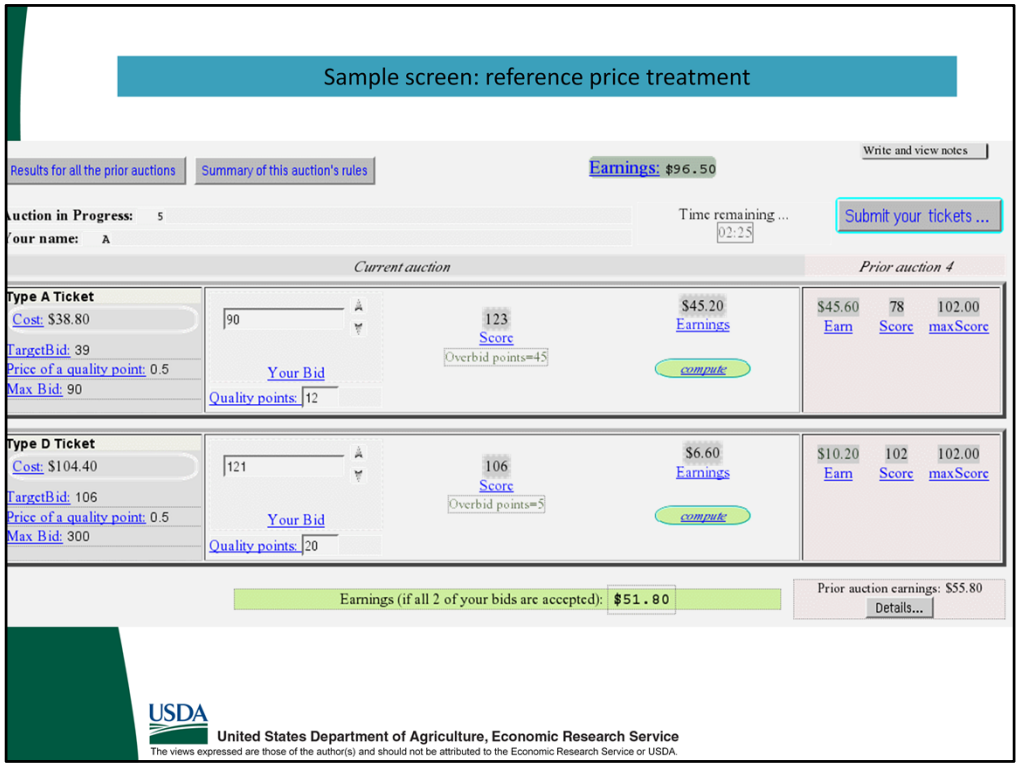
The CRP's "general signup" enrollment mechanism uses a competitive ranking scheme, combined with a bid cap

- Is the bid cap (the SRR) effective? Does it moderate excess payment effectively, or does it suppress interest ?
  - Experimental evidence, and recent history, suggest a rethinking of the bid cap
  - Using alternative auction mechanisms (such as quotas) may provide a more flexible alternative to bid caps

With acreage likely to decrease, and with tight budgets, changes in the CRP are likely.

- Growing interest throughout the government in “evidence based” policy, which could lead to changes in program design, and to willingness to test new mechanisms using experimental methods
- Improved data and models on environmental performance could mean better targeting – with a goal of “landscape impacts” rather than parcel specific metrics.

Miscellaneous


Sample screen: reference price treatment
Write and view notes
Results for all the prior auctions
Summary of this auction's rules
Earnings: $96.50
Auction in Progress: 5
Your name: A
Time remaining ...
02:25
Submit your tickets ...
Current auction
Prior auction 4
Type A Ticket
Cost: $38.80
TargetBid: 39
Price of a quality point: 0.5
Max Bid: 90
90
Your Bid
Quality points: 12
123
Score
Overbid points=45
$45.20
Earnings
compute
$45.60 Earn
78 Score
102.00 maxScore
Type D Ticket
Cost: $104.40
TargetBid: 106
Price of a quality point: 0.5
Max Bid: 300
121
Your Bid
Quality points: 20
106
Score
Overbid points=5
$6.60
Earnings
compute
$10.20 Earn
102 Score
102.00 maxScore
Earnings (if all 2 of your bids are accepted): $51.80
Prior auction earnings: $55.80
Details...
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