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Conservation contracts for forest biodiversity. Theory and experience from Finland

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1. Background

- Challenges in maintaining forest biodiversity
  - **No markets**: market cannot sustain biodiversity
  - **Problem of mandatory conservation**: in commercial forests landowners may manage stands to decrease ecological values (political opposition; moral hazard)
  - **Problem of paying for the provision of biodiversity benefits**: landowners know the management costs but authorities do not (adverse selection)

2. Competitive bidding systems

- **Suggested solution**: competitive bidding systems for landowners providing environmental goods and services
  - Creates competition among landowners and reduces costs of conservation
  - Auction theory applied to multi-attribute environmental goods policy
- Literature: Latacz-Lohman & van der Hamsvoort (1998), Latacz-Lohman & Schilizzi (2005), Stoneham et al. (2003), Cattaneo et al. (2007)
- Applications in practice
  - USA: Conservation Reserve Program (CRP)
  - Australia: Bush Tender Trial; Auction for Land Recovery
  - U.K.: Challenge Fund Scheme
  - Germany: Grassland Conservation Pilot

3. The Finnish Pilot Program: Trading in Nature Values (TNV)

- The first application of a bidding system to forestry
  - Ten years' agreements for biodiversity conservation
  - Possible targets for permanent preservation
- **Basic approach of TNV**:
  - **Ecological index**: describes the dimensions of biodiversity benefits of the forest stands the society wishes to promote
  - **Landowners offer**: stands to the program with their bids
  - **Authorities**: choose the supplied stands according to their return, generally benefits/bid
- **Research problem** of the paper
  1. How well does the Pilot program perform?
  2. How do the features of bidding impact the outcomes?
  3. How big are the information rents in the Pilot program?

4. Theory of Green Auctions: indexes

- Environmental performance index

  $b = \alpha_1 n_1 + \ldots + \alpha_k n_k$

- Overall index

  Ecological: $I = b/B$

  Cost save: $I = \omega_1(b/B) + \omega_2(1-(\sigma/R))$

- Acceptance probability

  $P(I > I^c) = \int f(I)dI = F(I)$

5. Theory of Green Auctions: participation

- Let (1 - $F(I)$) denote probability of being accepted to the program with $F'(I) = f(I)$
- The landowner participates if:

$$(\pi_1 + \sigma)(1-F(I)) + \pi_0 F(I) > \pi_0$$

where in forestry case

$\pi_0 = pe^{-r(T^*-A)}Q(b;T-A) + e^{-r(T^*-A)}V^*$ (no participation)

$\pi_1 = pe^{-r\delta}Q(b;A+\delta) + e^{-r\delta}V^*$ (participation)

6. Optimal bid and information rent

- **Optimal bid**: $\sigma^* = \pi_0 - \pi_1 + (1-F(I))/f(I)$

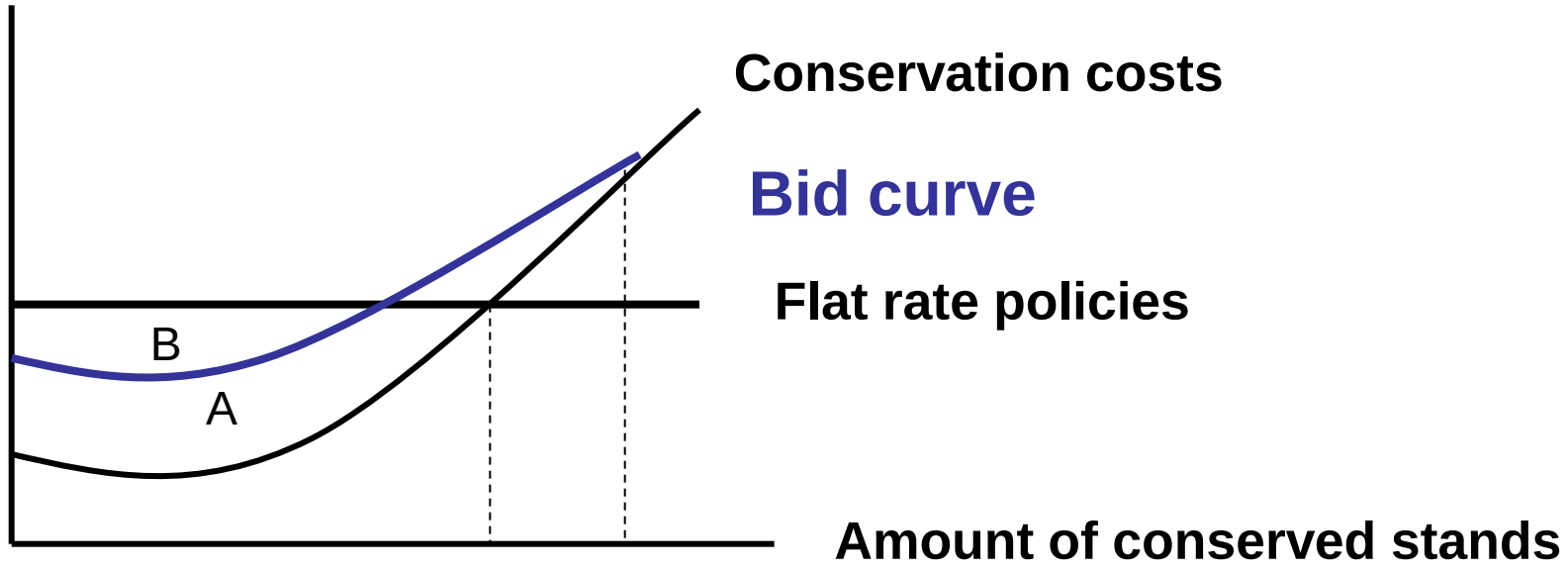
Two components:

$(\pi_0 - \pi_1)$ = conservation costs

$(1-F(I))/f(I)$ = information rent

6. Optimal bid and information rent

- Illustration



7. Biodiversity simulation model

- Actual data from the pilot program 2003-2004 on 150 submitted stands
  - Forest types (herb-rich, mesic, dryish)
  - Ecological index (dimensions of biodiversity)
  - Value of stands (timber assortments and their prices)
  - Actual bids, agreed bids
- Our own calculations:
  - Conservation costs (rental costs of lenghtening the rotation age)
  - Information rents = bid – costs
- **Simulation model**: allows an examination of alternative auction designs and the role of the authorities

8. Selected stands: ecological features, costs and information rents

Forest type (age-class)	Enrolled stands	Stand age	Diversity score	Bids €/ha	Costs €/ha	Rents €/ha
Herb-rich (87-160	17	111	0,48	2125	1893	232
Herb-rich (56-87)	13	68	0,48	1838	937	901
Herb rich (41-56)	5	45	0.53	1620	60	1560
Mesic (102-170)	12	123	0.42	1908	1673	235
Mesic (70-100)	15	83	0.40	1654	943	712
Mesic (50-70)	3	57	0,24	1177	248	929
Dryish (150-178)	4	165	0,42	1355	1039	316
Dryish (98-150)	3	103	0,25	567	611	-44
All	72	95	0,43	1757	1189	568

9. Selected stands: observations

1. Amount of old herb-rich stands is great; they receive very low information rents

   Implication: Landowners have strong conservation motives and the bidding system makes them operative

2. Even young stands may exhibit some structural properties that make them worth conserving

   Implication: chances to save conservation funds, as these stands entail lower conservation costs

3. Authorities conserved stands that would not have been cut during the 10 years period

   Implication: waste of scarce conservation budget

10. Biodiversity simulation model: features of conservation

Forest type (age-class)	Enrolled stands	Diversity score	Bids €/ha	Costs €/ha	Rents €/ha
Herb-rich (87-160)	7	0,80	3183	1629	1554
Herb-rich (56-87)	7	0,73	2914	576	2338
Herb-rich (41-56)	5	0.70	2804	-326	3129
Mesic (102-170)	15	0.76	3027	1501	1526
Mesic (70-100)	17	0.75	3009	440	2569
Mesic (50-70)	7	0,71	2831	-44	2874
Dryish (150-178)	6	0,72	2866	662	2204
Dryish (98-150)	3	0,69	2779	129	2651
All	72	0,74	2964	1189	2250

11. Biodiversity simulation model: observations

1. The share of the stands conserved in the oldest age class in all forest types is much lower than it was actually
2. Both biodiversity index and information rents are higher than they were actually
3. Competitive bidding in forestry differs from that in agriculture in one important aspect
   - The number of stands with high biodiversity values is very limited in areas where commercial forestry has been practiced
   - Conservation costs are high for valuable stands and increasing the size of the conservation budget enrolls more stands in the program but with lower biodiversity values.

12. Conclusions

- The competitive bidding system is a promising means for biodiversity conservation in forestry
  - It really invites those forest landowners to conservation who have real conservation motives
  - As a voluntary means it increases the acceptability of conservation and general knowledge
- Ultimately, size of information rents defines how efficient these systems may become
- Future research topics:
  - determinants of information rents;
  - alternative designs for forestry