Costs and Environmental Gains from Conservation Programs

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New Directions in Federal Farm Policy: Issues for the 2007 Farm Bill

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Modeling System to Support Policy

- Economic models to predict land use and conservation decisions in response to policy
  - Working land: costs of conservation practices
  - Land retirement: rental rates
- Environmental models
  - EPIC: Field level changes in erosion, phosphorous, nitrogen, carbon sequestration, etc.
  - SWAT: in stream water quality changes in sediment and nutrients (phosphorous and nitrogen)
- Policy scale (NRI unit of analysis, ~15,000 cropland points in IA)

Design of conservation programs

1. How much will it cost to adopt conservation practices broadly in Iowa? How much improvement in environmental quality might this achieve? (water quality)

2. Should conservation efforts be focused on working land (CSP) or is it better to retire land from active production (CRP)?

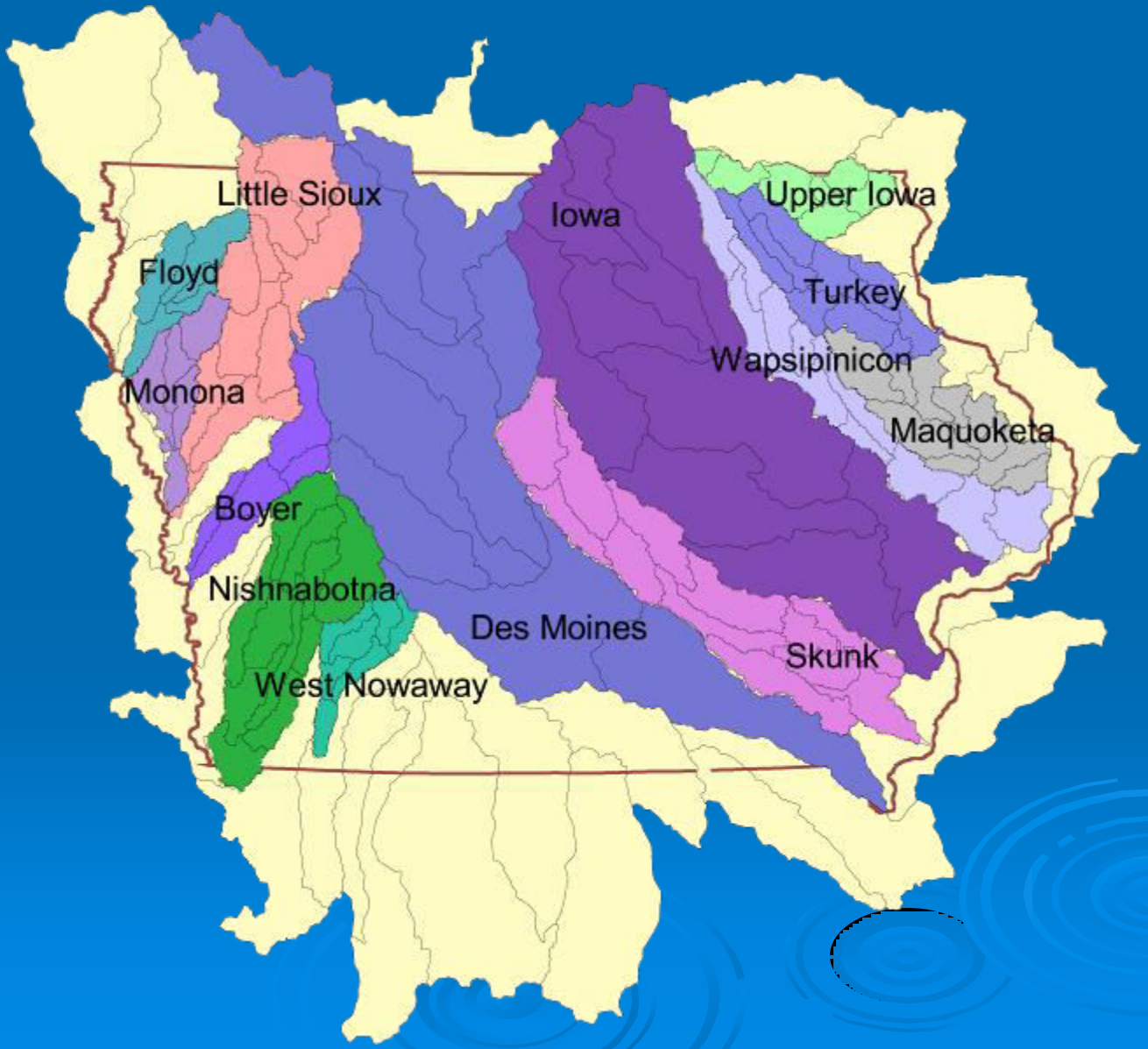
3. How much more cost-effective is it to target land based on its suitability for generating environmental benefits relative to treating all land the same?

4. How does targeting of different environmental goals affect where payments go?

1. The Costs and Water Quality Effects of Adopting Broad Scale Conservation Practices (funded by DNR)

- Significant water quality change in Iowa may require significant conservation practices and/or land retirement
- What might such changes look like?
- How much might it cost?
- What kind of water quality improvements are possible?

13 Watersheds



Identification of practice locations

Step 1. Retire all land within 100 ft. of a waterway and land with highest erodibility index to reach a total of 10% statewide.

Step 2. Terrace all remaining cropland with slopes above 7% in western Iowa and above 5% for the rest of Iowa.

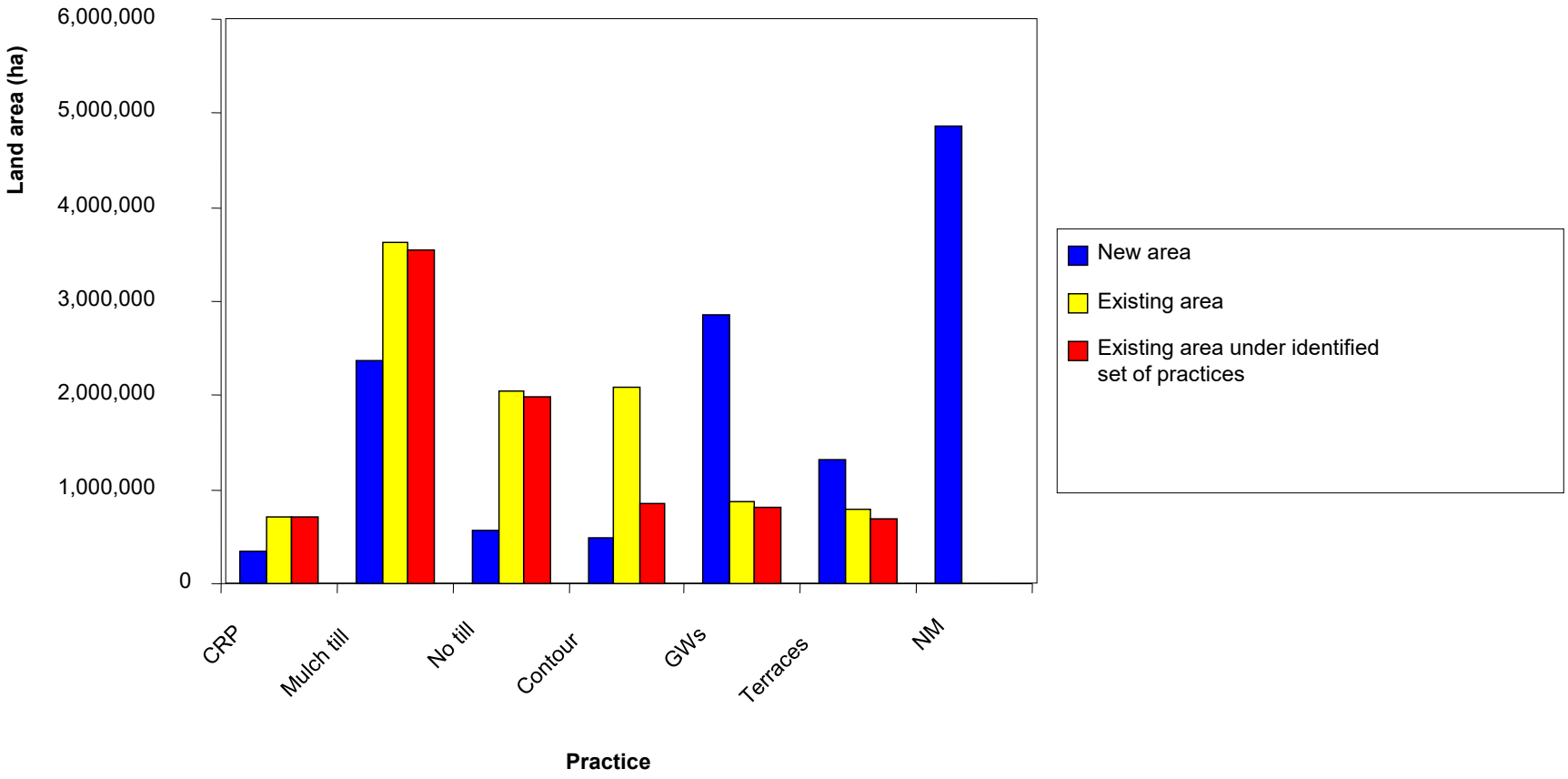
Step 3. Place remaining acreage with slopes above 4% in contours.

Step 4. For remaining land with slopes > 2%, put in grassed waterways.

Step 5. For remaining land with slopes $\geq$ 2% put 20% in no till and 80% in conservation tillage.

Step 6. Assume 10% reduction in N and P from nutrient management on all corn acres

Area of practices



Annualized social costs
(in millions of dollars)

LAND SET ASIDE	CT	CONTOUR	GW	TERRACES	NM	TOTAL
96	97	12-24	11-17	53	33	303-321

Watershed	Baseline loadings and percent reductions due to scenario									
	Sediment		Nitrate		Organic N		Total N		Total P	
	(1,000 t)	(%)	(1,000 t)	(%)	(1,000 t)	(%)	(1,000 t)	(%)	(1,000 t)	(%)
Floyd	244.7	30	7.3	13	1.5	54	8.8	20	.5	52
Monona	192.4	10	5.0	17	.8	41	5.7	20	.3	42
Little Sioux	594.0	6	26.2	11	3.4	51	29.6	15	1.5	49
Boyer	3,231.3	35	15.2	16	6.6	54	21.8	27	2.8	53
Nishnabotna	507.4	43	3.3	20	1.4	53	21.7	30	2.8	52
Nodaway	507.4	45	3.3	11	1.4	47	4.7	22	.5	45
Des Moines	2,202.1	10	38.1	6	25.7	41	63.8	20	7.2	37
Skunk	4,982.5	63	30.0	13	5.0	54	35.1	19	2.5	51
Iowa	3,433.8	13	53.9	6	54.5	51	108.4	29	8.5	48
Wapsipinicon	1,902.0	64	29.9	9	3.2	52	33.1	14	1.3	50
Maquoketa	1,274.6	46	14.8	9	3.6	59	18.4	19	1.1	56
Turkey	1,371.4	65	12.4	10	2.6	62	15.0	19	.9	59
Upper Iowa	880.4	50	3.7	10	1.1	40	4.9	17	.4	28

Key Findings

- Annual cost of implementing the identified set of conservation practices are predicted to be in the neighborhood of a third of a billion dollars
- Reductions in sediment and phosphorous of up to 60% are predicted
- Nitrate reductions are predicted to be up to 20%
- Some context: commodity program payments for Iowa in 2003 (the last year for which the data were available) exceeded half a billion dollars.
- Caveats: Whether this set of conservation practices meets (or exceeds) the goals of water quality is an important question that is not considered here. Also, there may also be better combinations of practices that can achieve the same water quality gains.

2. Land Retirement vs. Working Land Conservation

- Land retirement
  Expensive, but many environmental benefits
- Working land
  Cheaper, but often fewer environmental benefits

- If have a fixed conservation budget, could more carbon be sequestered paying subsidies for conservation tillage (WL) or for retiring land from production?

Budget = $100 million/yr

Budget allocation	Carbon, MMT/yr	Average cost, $/MT/yr
10% WL, 90% LR	1.9	53.7
50% WL, 50% LR	2.5	39.8
99.6% WL, .04 LR	2.8	35.6

3. Targeting Benefits and Concerns

- **Benefits: greater environmental gains for given expenditures**

- Concerns:
  - Distributional
  - Correct target

- Examples: CRP

Total acres and annual changes from land retirement in the UMRB

Policy scenarios	Carbon Sequestration (tons)	Erosion reduction (tons)	N Runoff reduction (pounds)	Acres Enrolled (acres)
Actual CRP	1,054,000	15,293,000	4,654,000	3,122,000
Targeting carbon	4,141,000	4,699,000	6,365,000	3,926,000
Targeting erosion	988,000	43,744,000	9,399,000	3,972,000

4. Implications of targeting for distribution of payments

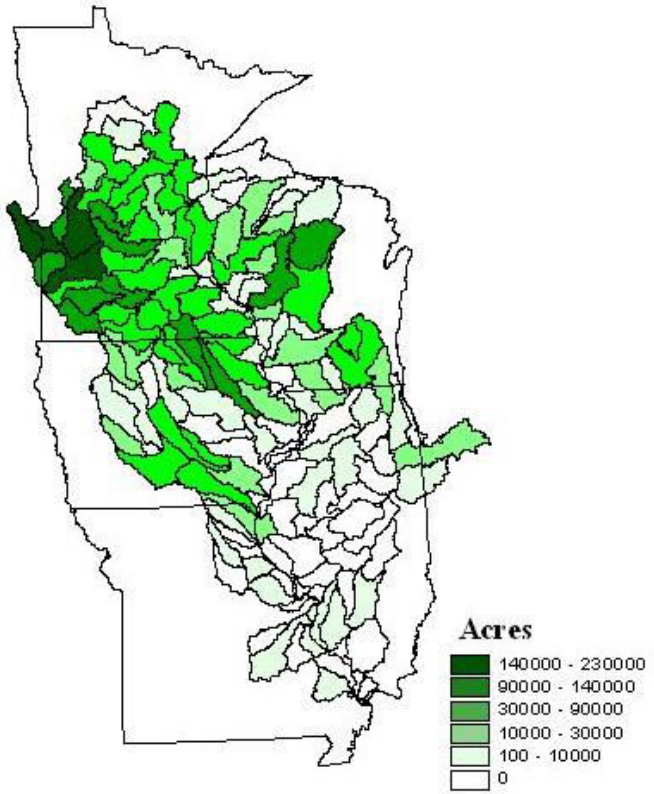


Figure 2. Area selected--target carbon

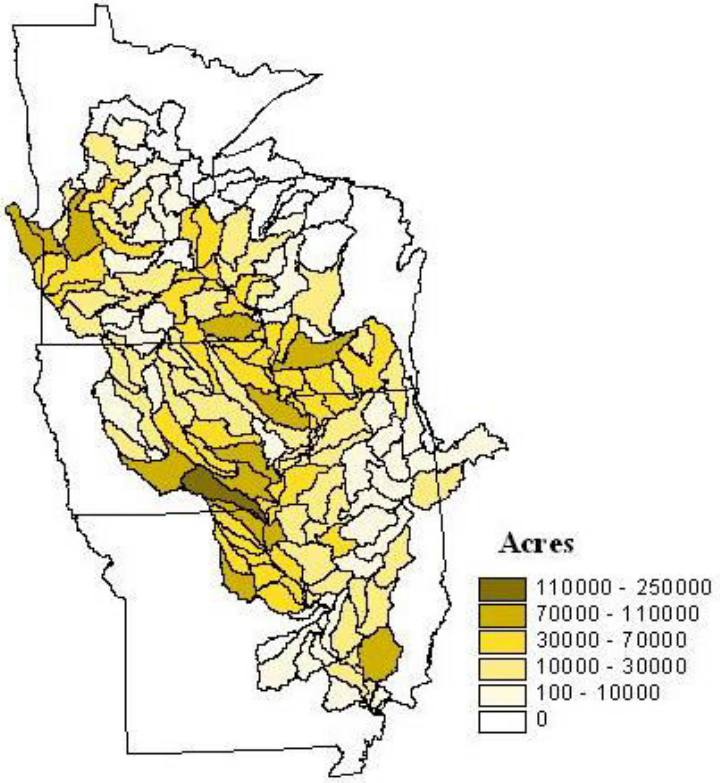
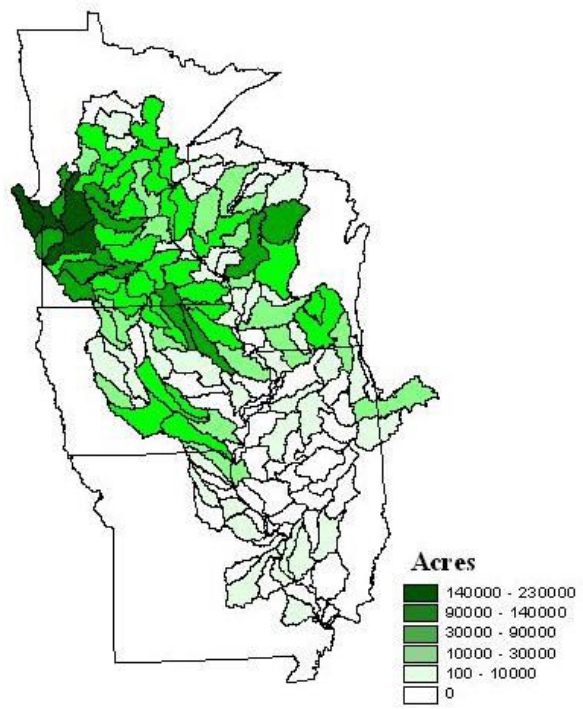


Figure 1. Area selected--the actual CRP program

Distribution of selected CRP under carbon vs. erosion targeting



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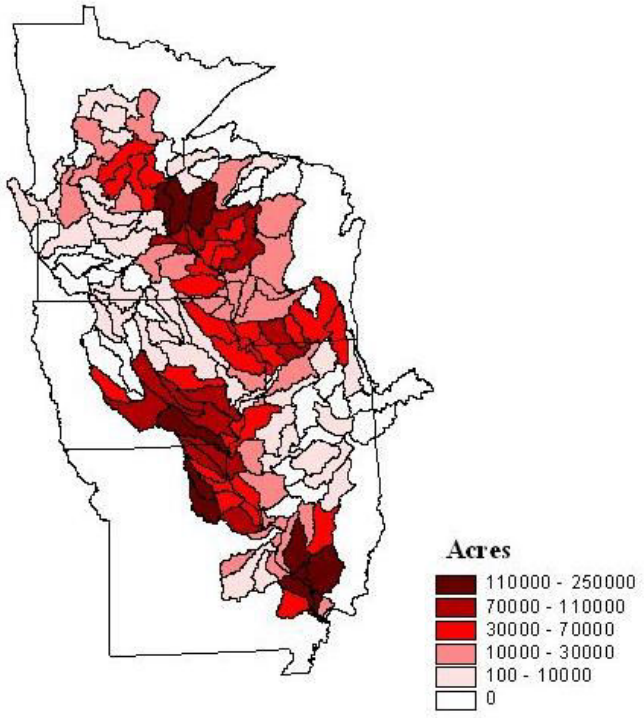

Figure 3. Area selected---target erosion