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**REVERSING THE PROPERTY RIGHTS:
A PRACTICE-BASED TRADING APPROACH FOR CONTROLLING
AGRICULTURAL NONPOINT-SOURCE WATER POLLUTION**

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Introduction

THE DESIGN OF the efficient programs to address the nonpoint sources (NPS) water quality from agriculture has been on the environmental economists’ agenda for decades. A large part of this research has focused on these programs within the context of an existing regulatory structure and the voluntary abatement from agriculture. Despite subsidy programs and the development of nascent water quality trading programs targeting nonpoint source agricultural water pollution, poor water quality pervades much of the U.S. and a large amount of the remaining water quality problems are attributable to nonpoint agricultural sources.

In this paper, we study the efficient design of agricultural water pollution when the regulator is allowed to impose regulations and standards on agricultural non point sources. Furthermore, we carefully address the implications of three types of fundamental difficulties facing by regulators: (1) imperfect information on the abatement costs of individual farms, (2) difficulties in observing pollution or abatement activities at farm level , and (3) imperfect information on the water quality production function.

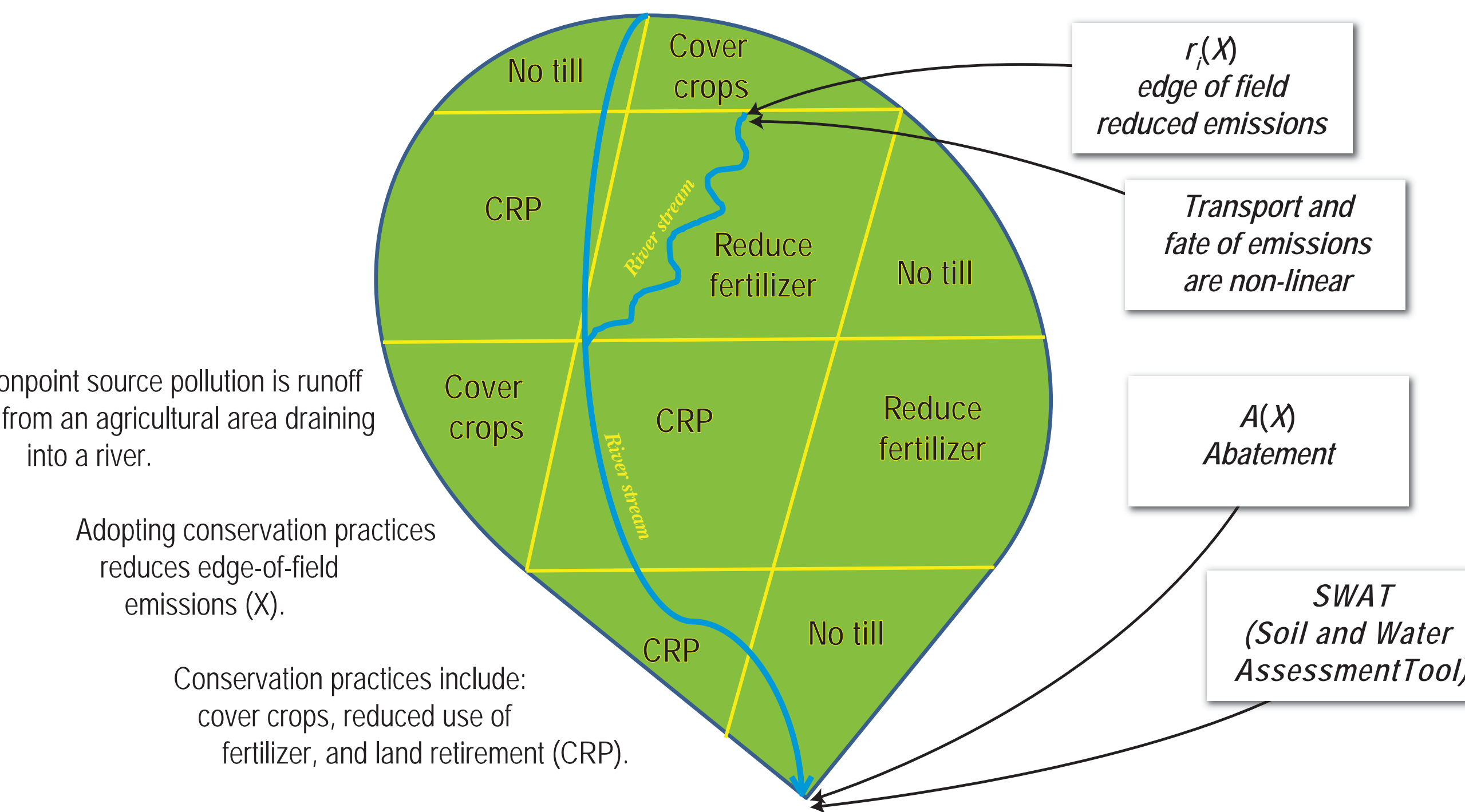


Figure 1

Objective

- Propose a simple approach for regulating emissions from NPS using a point system approach as a proxy for the contribution of each source from the field
 - A regulator is allowed to impose regulations on agricultural NPS;
 - considers abatement actions at the field scale
- Evaluate its ability to achieve water quality goal in a least cost way under different regulatory approaches:
 - A command and control
 - A performance standard
 - A trading setting where initial allocations of abatement actions are assigned just in CAC approach but producers can trade

Method

Use a watershed based water quality model to assign points to each abatement practice

- create a sample of 3,000 watershed configurations by randomly assigning conservation practices to each fields (i.e . Assign each field an abatement practice x_{ij})
- simulate the water quality impact of those assignments ($A(r(X))$
$$A = A(X)$$
- To create the vector of points, a , linearly approximate the abatement function as:
$$A(X) \approx \sum_i a_i \sum_j x_{ij} = X * a$$
- Solve for a , the vector of points
$$\min_a (A - Xa)' (A - Xa)$$

Allocate the points to achieve an abatement goal

- The regulator determines the watershed configuration that achieves \bar{A}

Abatement Action Permit System (AAPS, Kling 2011)

- Assign each abatement practice point values based on their effectiveness in reducing edge-of-field emissions
- Points associated with a abatement practice vary by the location in the watershed
 - each producer would be required to have an average number of points per acre to satisfy his target requirement
 - Allow farmers to buy/sell points among each

- Identifies the total number of points needed to achieve \bar{A}
- Determines the number of points for each field using one of the following methods:
 - the regulator’s least cost placement solution given the cost information available to her
 - random assignment
 - even assignment
 - others

Empirical estimation

- Estimate a set of 9x30 point estimates
- Level of 40 % abatement from the baseline
- Use 1,000 random draws for cost heterogeneity
- Simulate the abatement level and cost outcomes under the three policy scenarios
- SWAT to estimate the nutrient emission levels

Results

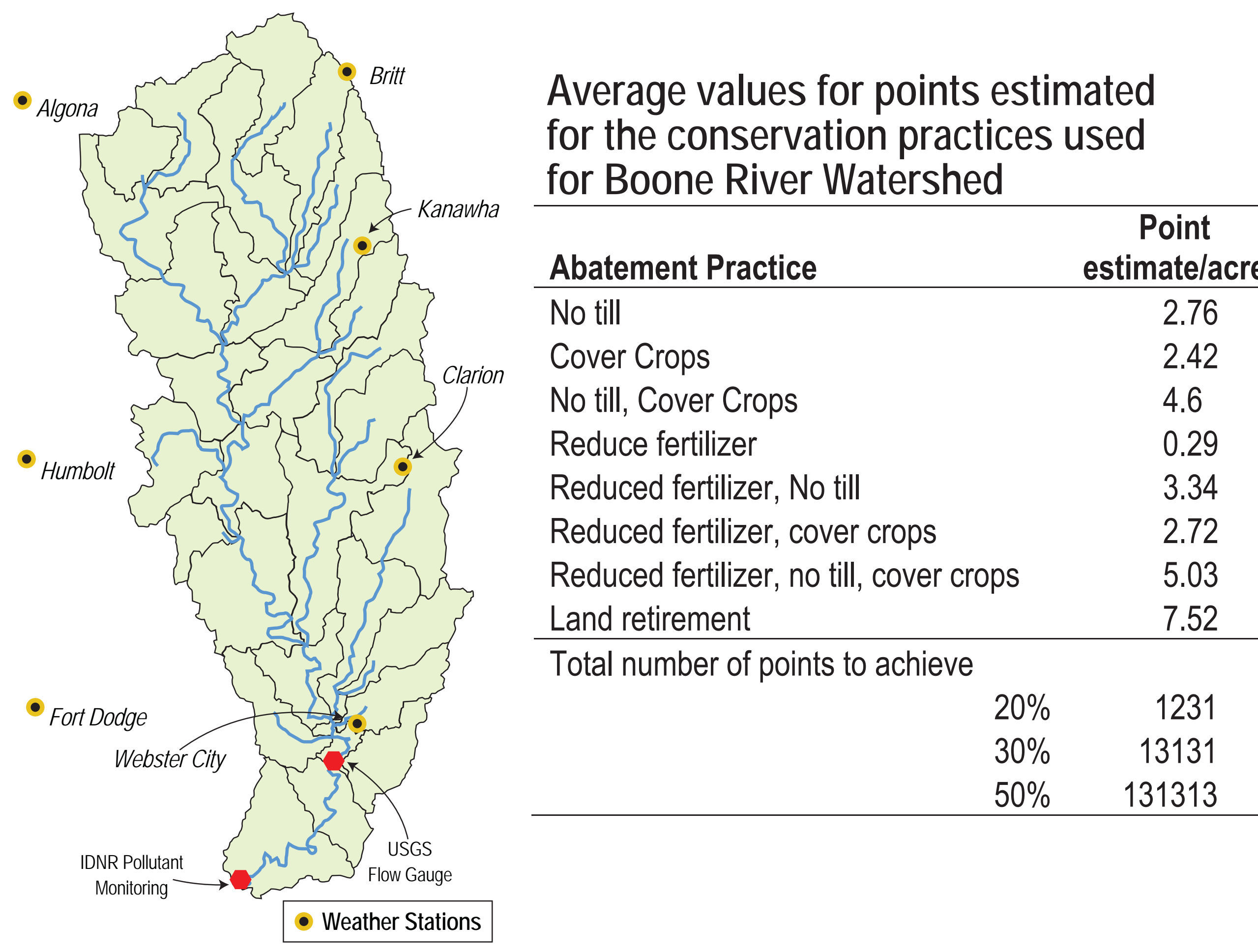
Points estimation and assignment

Agricultural watershed in NW Iowa Land use facts:

- 237,000 ha divided into 30 subbasins and 2,900 homogenous field units
- Corn and soybean cover nearly 90% of the agricultural area

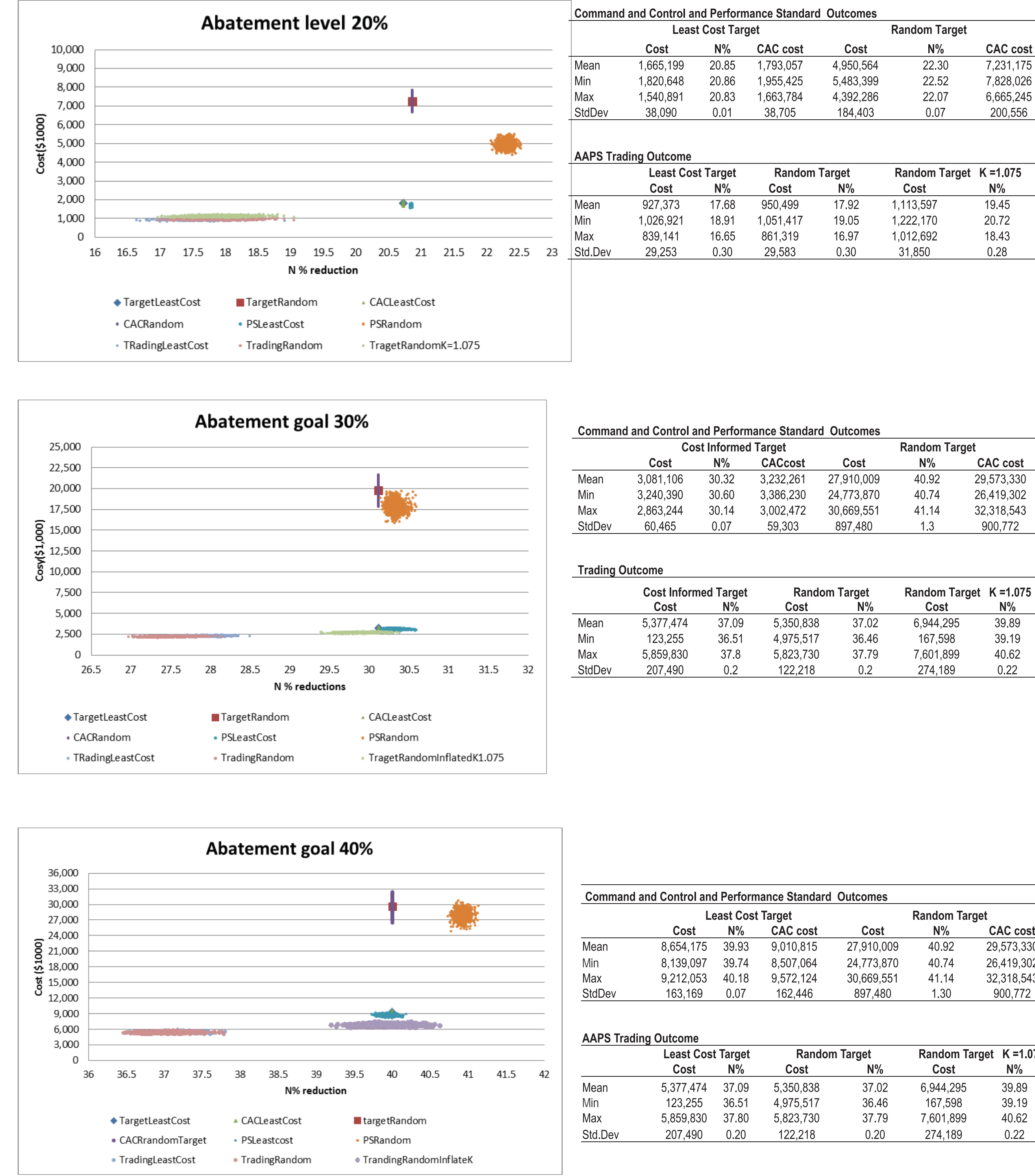
Environmental facts:

- Discharged some of the highest N loads during 2000-2002 amongst analyzed Iowa watersheds
- Use a set of 9 abatement practices



As expected, the conservation practices known to be more aggressive in reduction the agricultural emissions accrue more points.

Empirical Results



Conclusions

OUR FINDINGS SHOW a promising performance of the points-based trading system both in terms of reaching the water quality objectives and in terms of cost-efficiency. Our findings suggest that the inefficiencies of the simple points-based trading system may be outweighed by the appeal of capitalizing on established ambient pollution trading theory in a realistic context of agricultural nonpoint-source pollution.