Achieving Greater Reliability in Water Quality Trading Programs with Nonpoint Sources:

Using Explicit Safety Requirements and Reliability Graded Trades

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Pollution Trading

- A ***market mechanism*** for ***efficiently allocating*** pollution loads among alternative sources
  - Permits limit emissions; ability to trade creates incentives to find least-cost allocations
  - *Well-designed* trading programs can achieve environmental goals at lower cost than traditional regulatory approaches
- Other possible benefits:
  - more rapid achievement of goals
  - higher levels of environmental protection

The Nonpoint Challenge

- Nonpoint pollution….
  - The leading cause of remaining water quality problems in the US
  - Major target of emerging trading initiatives
- Yet, nonpoint pollution does not fit the “text book” model of a tradable pollutant!

Characteristics of NPS Emissions

- Cannot be measured routinely and accurately at reasonable cost
  - There is no tangible nonpoint “commodity”
  - What should permits be based on?
- Stochastic
  - Driven by environmental events
  - Emissions are only partially under control of “suppliers” of NPS pollution reductions

Meeting the Challenge…

The emerging approach is to….

- Use permits based on “predicted” temporally averaged NPS emissions
  - Prediction replaces measurement
  - Averaging addresses temporal variability
- Use “trading ratios” between point and nonpoint sources
  - To achieve environmental equivalence in trades

Trading Ratios

E.g. a ratio of 3:1 would mean

- A PS must purchase 3 units of NPS reductions to avoid a 1 unit reduction in its own emissions or…
- A NPS would need to purchase only 1/3 unit of a PS reduction to avoid a 1 unit reduction

Factors Affecting Environmental Equivalence….

Trading ratios can adjust for differences in environmental impacts due to differences in the

- Location of emissions
- Timing of emissions
- Chemical form of emissions
- **Relative "risk" of emissions**
  - come back to this later

Trading Ratios

Program Name		Trade Ratio	Pollutant	Trades
Bear Creek	CO	1:1	P	0
Cherry Creek	CO	2:1	P	0
Lake Dillon	CO	2:1	P	0
Lower Boise River	ID		P	0
Piasa Creek Watershed Project	IL	2:1	sediment	0
Kalamazoo WQT Demonstration Project	MI	2:1	P	0
Total Nitrogen Trading in the Neuse River Basin	NC	2:1	N	1
Great Miami Watershed WQ Credit Trading	OH	1:1 - 3:1	P, N	0
Tualatin Thermal Load Trade	OR	2:1	heat	0
Conestoga Watershed Pilot Project	PA	tbd	P, N	0
Fox-Wolf Basin	WI	2:1-10:1	P	0
Tar-Pamlico Basin	WI	2:1	P	0
Trading Framework for AMD - Cheat River	WV	tbd	AMD	0

How good is the approach?

- **NPS emissions models**
  - Essential for trading but…
  - How accurate in predicting NPS reductions?
  - Perfection is not essential but standards of validity and reliability are and should be addressed explicitly in policy design

- **Trading ratios**
  - How should ratios be set?
  - Are trading ratios the best approach for addressing relative risk?

Trading ratios to address relative risk should

- Provide a “margin of safety” in specific point-nonpoint source trades
- Achieve a desired overall level of water quality risk reduction
- Facilitate low-cost achievement of water quality goals

Received Wisdom versus Scientific Results on Trading Ratios

The above factors are commonly assumed to require trading ratios substantially in excess of unity, but…

… scientific research shows that trading ratios close to unity or even less than one can be better for risk management!!

NPS Risk (Mis)Perceptions

- The received wisdom is that trading relatively certain PS controls for relatively uncertain NPS controls is risky
- But failure to control NPS emissions may be a larger, costlier source of risk
  - Ultimate goal is to reduce economic damages from pollution
  - Economic risk, which increases damages, stems from greater variability in environmental outcomes
  - NPS emissions are the chief source of variability and hence risk
  - The fewer NPS controls, the more variability remains – more risk!

NPS Risk and Trade Ratios

- High trade ratios discourage purchasing reductions in NPS pollution by increasing the cost!
- Yet, reducing water quality risk requires reductions in the major and highly variable sources!
- Research indicates that NPS risk is “best addressed” by appropriately “tight caps” on NPS emissions

But, are trade ratios are the right approach?

More fundamentally:

Is “pound for trade-ratio- adjusted, predicted-pound” trading the best approach even when “properly” implemented?

- No, depending on the costs of doing better

Problems with fixed trade ratios

- The current approach treats modeled nonpoint reductions as homogenous commodities
- All NPS trades are treated as equally unreliable
- There are no incentives for greater reliability!

NPS Trades Are Not Equal!

Farm Plan	Predicted NPS Reduction	Probability of Predicted Reduction	Cost
A	20%	50%	$100
B	20%	75%	$175
C	20%	95%	$300

Doing better – Reliability-graded trades with reliability requirements in trading rules

- Define NPS trades as multi-attribute goods
  - A predicted NPS reduction +
  - An assessment of the likelihood (or reliability) that it will be achieved
- Create demands for reliability…
  - Explicit reliability requirements in trades with NPS sources will create demand and incentives for more reliable trades
- The benefits
  - More focused risk-management – simultaneously addresses NPS variability and the producer's ability to control that variability

Challenges to reliability-graded trading…

- **Understanding reliability**
  - We need an explicit understanding of uncertainties in water quality management from field to watershed
- **Implementation Costs**
- **Like models for predicting NPS load reductions, perfection is not the goal**
  - We need to develop scientific protocols to assess reliability just as we assess predicted average responses