

# WATER QUALITY TRADING WHAT HAVE WE LEARNED?

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# Outline

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- Brief overview of trading initiatives
  - Implementations and types
  - The goals of trading
  - Determinants of trading outcomes
- Lessons
  - What have we learned about what trading can or cannot do?
  - What have we learned about how to realize the potential of trading?

# WQT Initiatives

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- “Invented” by John Dales in 1968
- 57 experiments, pilot programs, demonstration projects since the early 80s\*
- 26 programs for which trading rules had been established and in which trading *could occur*
- 21 programs that were under consideration or in development
- 10 programs that were completed or inactive
- US leads with all but 6 of the 57 programs
- Significant initiatives in Australia, Canada, and New Zealand

\*Selman et al. 2009 WRI

# Trading Models



# What do policy makers want to accomplish?

- For stand-alone cap-and-trade programs
  - Achieve water quality goals
  - Cost effective control
  - Innovation incentives
- For add-on programs (the norm in the US)
  - Cost savings compared to traditional regulations
  - Facilitate achievement of TMDLs
    - Increased flexibility in pollution control methods
    - Incorporate nonpoint sources
    - Speed compliance
  - Ancillary benefits of green technologies
  - Innovation incentives

# Determinants of trading outcomes

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- Trading rules and procedures established by regulators
- Trading institutions implemented by regulators or the market to facilitate trading within the rules
- The objectives, information, and skill of participant
- Underlying economics

# Determinants of trading outcomes

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- Trading rules and procedures
  - Credit definition, duration, certification, technologies allowed to generate credits, procedures for quantification of water quality impacts of BMP adoption, trade ratios, baseline requirements, double dipping, liability rules, etc.
- Trading Institutions
  - Exchange mechanisms (e.g. clearing houses), auction formats
  - Information and trading services (public education and information programs, private aggregators, consultants)

# Determinants of trading outcomes

- The objectives, information, and skill of participants
  - *Homo economicus* vs real world of people with limited time, resources, skills, and orientation toward markets
  - Complex rules and inadequate institutional design can result in participation and coordination failures
- Underlying economics
  - Cost heterogeneity – the bigger the better
  - Transactions costs (a function of rules and institutions)

# How is it working out?

- *Ex post* assessments are generally negative about the performance of trading programs
  - Most have little or no trading activity = no impact
- Reasons for low or no trade volumes
  - lack of trading partners
  - lack of adequate regulatory drivers (binding caps)
  - uncertainty about trading rules, practice performance
  - excessively high point-nonpoint trade ratios
  - legal and regulatory obstacles to trading
  - high transactions costs
  - programs too new to permit trades
- Better market designs could improve market activity

# How is it working out?

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- Some definite successes
  - Hunter River salinity cap and trade
  - South Nation River phosphorous cap and tax
  - Grassland Farmers selenium cap and trade
  - Connecticut nitrogen cap with compliance incentives
- Some promising/interesting developments
  - Mid-Atlantic nutrient baseline-and-credit trading (especially PA and VA)
  - Minnesota River Basin phosphorous credit trading
  - Greater Miami baseline-and-credit nutrient trading
  - Lake Taupo nutrient cap-and-trade

# Hunter River Salinity Trading

- Developed and administered by the New South Wales water quality management agency
- Caps saline discharges from 22 coal mines and power generators discharging into the Hunter River
- The cap is concentration based and flow dependent (state contingent cap-and-trade)
- Trades organized through an online trading clearinghouse
- Assessments indicate water quality goals achieved
- Lower costs than prior regulations

# California Grassland Farmers

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- Developed and managed by an association of 7 irrigation districts to achieve a cap on selenium discharges from irrigation return flows in the San Joaquin Valley
- Converted a nonpoint problem into a point problem by regulating metered selenium in collected drain water
- Prices and trades arranged at monthly association meetings
- 39 trades in 2 years of operation (1999-2000)
- Trading suspended after installation of selenium recycling facility

# South Nation River

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- Designed to use ag offsets to reduce regulated PS costs of meeting zero discharge limit on new or expanded facilities
- Developed and managed by South Nation Conservancy
  - Long established watershed management agency
  - Provides grants to farmers to install BMPs
  - “Trading” is one of several sources of BMP funding
  - Farmers do not trade!!

# South Nation River

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- Credits sold at a “price” set by the program administrator to cover the average cost of installing agricultural BMPs
- 269 projects funded through 2009
- \$708 thousand to farmers/\$173 thousand in program delivery costs (CAD)
- Significant cost savings compared to no trading
- Water quality improving
  - Contributions of ag offsets is positive but not quantified

# Connecticut Nitrogen Credit Exchange

- Established by the Connecticut DEP to facilitate reducing nutrient discharges into the Connecticut River as required by the Long Island Sound TMDL
- 79 waste water treatment are annually assigned individual discharge limits
- Plants generate credits when they over comply
- Plants that under comply must acquire credits to cover the shortfall
- Credit price is set by the Nutrient Credit Advisory Board (NCAB) appointed by the state legislature
- Buyers and sellers do not interact in a market

# Connecticut Nitrogen Exchange

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- Steady progress towards TMDL
- Estimated costs savings of \$300-\$400 million compared to no trading

# Greater Miami River

- Established and administered by the Miami Conservancy District
- Provides municipal WWTPs an option to purchase agricultural credits on favorable terms in advance of an expected tightening of discharge standards
- Ag BMPs selected in bi-annual reverse auctions
  - Farmers submit applications through (and with technical assistance from) participating Soil and Water Conservation Districts
  - SWCDs can add their costs for assistance and annual inspections to farmers' bids
- Funding from participating WWTPs and grants from USEPA and USDA

# Greater Miami

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As of March 2013

- Eleven rounds of project submittals resulted in funding for 397 agricultural projects
- 1.14 million credits over the life of the projects
- \$1.6 million in credit sales to agricultural producers
- Estimated 572 ton reduction in nutrient discharges

# LESSONS



# Water is harder than air

- Complex water pollution processes require complex commodities and trading rules
  - Multiple interacting pollutants (e.g., nitrogen, phosphorous, sediment)
  - Spatial heterogeneity of the impacts of discharges on downstream water quality
  - Unobservable nonpoint emissions
  - Stochastic nonpoint emissions
  - Lags between land use change and water quality impacts (largely ignored)

# Water is harder than air

- Small spatial scales = thin markets
- Pre-existing regulatory environment poses challenges
  - NPDES permit requirements
    - Trading can generally be used only to meet WQBELs – not TBEL, limiting scope of trading and cost savings
    - Trading can open scrutiny of permits
  - Agricultural nonpoint sources largely unregulated
    - Participation voluntary – but they are the main source of potential cost savings
    - In consequence, program developers must address questions about baseline participation requirements, leakages, additionally, double dipping

# Nonpoint pollution is much harder than point pollution

- Measurement and monitoring uncertainty
  - Unobservable nonpoint emissions
- Stochastic processes uncertainty
  - e.g. weather
- BMP performance uncertainty
  - BMP efficiencies individually and in combination
- Lags between land use change and water quality impacts
- Greatly complicate the definition of scientifically sound commodities and trading rules

Well-designed  
point-point trading programs can  
protect/improve water quality and  
lower costs compared to traditional  
effluent standards

- E.g., Grassland Farmers, Hunter River,  
Connecticut Nitrogen Exchange

Trading can get agricultural BMPs  
on the ground given effective  
incentives and institutions

- E.g., South Nation River, Greater Miami

# Various types of institutions can facilitate trading

- Bilateral trading, clearing house markets
- Cap and tax, cap with incentives
- The best forms remain an open question and will vary with context

# Engaging trusted conservation organizations can pay off in agricultural participation

- E.g., South Nation River, Greater Miami

# Nonpoint trades can save point sources money

- E.g., South Nation River, negotiated various offsets

High point-nonpoint trade ratios are a significant barrier to trading and a very crude (and possibly counterproductive) way to address nonpoint uncertainty

- Industrial Economics survey of point sources
- Scientific research on trading design

Baseline participation requirements are a barrier to trading that can diminish participation and cost-savings

- Scientific research on trading design

*Ex Ante* studies of the potential of markets often use the cost savings between conventional regulations and the “least cost solution”

- This is an exaggeration, especially for nonpoint pollution
- Realistic estimates must take into account market institutions and behavior
- Research and experience show rules and institutions matter a lot

We do not yet know  
whether point-nonpoint  
trading programs can deliver  
water quality goals at  
low cost on time

- BMP performance uncertainty
- Spatial uncertainty
- Temporal uncertainty (lags)
  - The instantaneous steady state response underlying trading programs is false

# Realizing the potential

- Trading is a good idea in principle and well worth continued exploration and development
  - Implementation should be context specific:
    - Is water science adequate to define trading rules consistent with quality protection goals?
    - Are the public and private transactions costs worth the expected benefits?
    - Spatial, temporal, and other uncertainties must be confronted in goals and rules
  - We need to develop and advance the science of trading through applied research and experimentation

# Realizing the potential

- Trading rules should not be developed without consideration of their effects on market performance
  - Rules should serve both economic and ecological functions
  - Economic analysis as well as water science and law must be integrated in rules development

# Realizing the potential

- Public sector development cannot end with environmental agency rules development, implementation, and enforcement
  - Investments in the market place are needed to get people to participate and achieve gains from trade (exchanges, consultants, contract design, education)
  - Integrating agencies that participants know and trust can pay off
  - Information about what to expect is crucial
    - Uncertainty is a barrier to entry
    - Exaggerated returns from “promoters” can lead to costly mistakes
  - Research the market, information programs and services