

# **Markets for Water Allocation and Water Quality Opportunities and Challenges**

Jeffrey M. Peterson  
Kansas State University

CSREES National Water Conference

# Introduction

- Water is unique: the only major factor of production without an active market
- Original water laws set rigid rules for water allocation and made exchange difficult
- Nineteenth century policy goals:
  - Agricultural productivity
  - Western settlement
- These goals have been achieved (exceeded?)

# Introduction (con't)

- Current issues are very different!
  - Conflicts across uses
  - Environmental concerns
- Economists have suggested that market mechanisms can be applied to address these concerns
  - Water allocation markets
  - Water quality markets

# Water Allocation Markets

- What is normally traded is the *right to use* water, not water itself
- Statutory law in almost all states specifies water as public property
- Types of markets
  - Permanent transfers of water right (asset markets)
  - Short-term leases of water right (spot markets)
  - Option agreements (options markets)

# Water Market Activity

Trading volume (thousand acre-ft), 1999-2003, by state

State	Lease	Sale	Total
California	3,127	227	3,354
Arizona	1,371	24	1,395
Texas	877	322	1,199
Colorado	74	242	316
10 Other States*	1,762	114	1,876
Total	7,211	929	8,140
Top 4 states' share	76%	88%	77%

\* ID, KS, MT, NM, NV, OK, OR, UT, WA, WY

Source: Howitt, R. and K. Hansen. 2005. "The Evolving Western Water Markets." *Choices* 20(1):59-63

# Water Market Activity

- Trades are concentrated in a few states
- Most common type of trade is from farmer to municipality
  - Markets have redirected some water to new uses
- But traded volume represents only a tiny fraction of total water used
- There remains a large gap between the values of water in agriculture and other uses

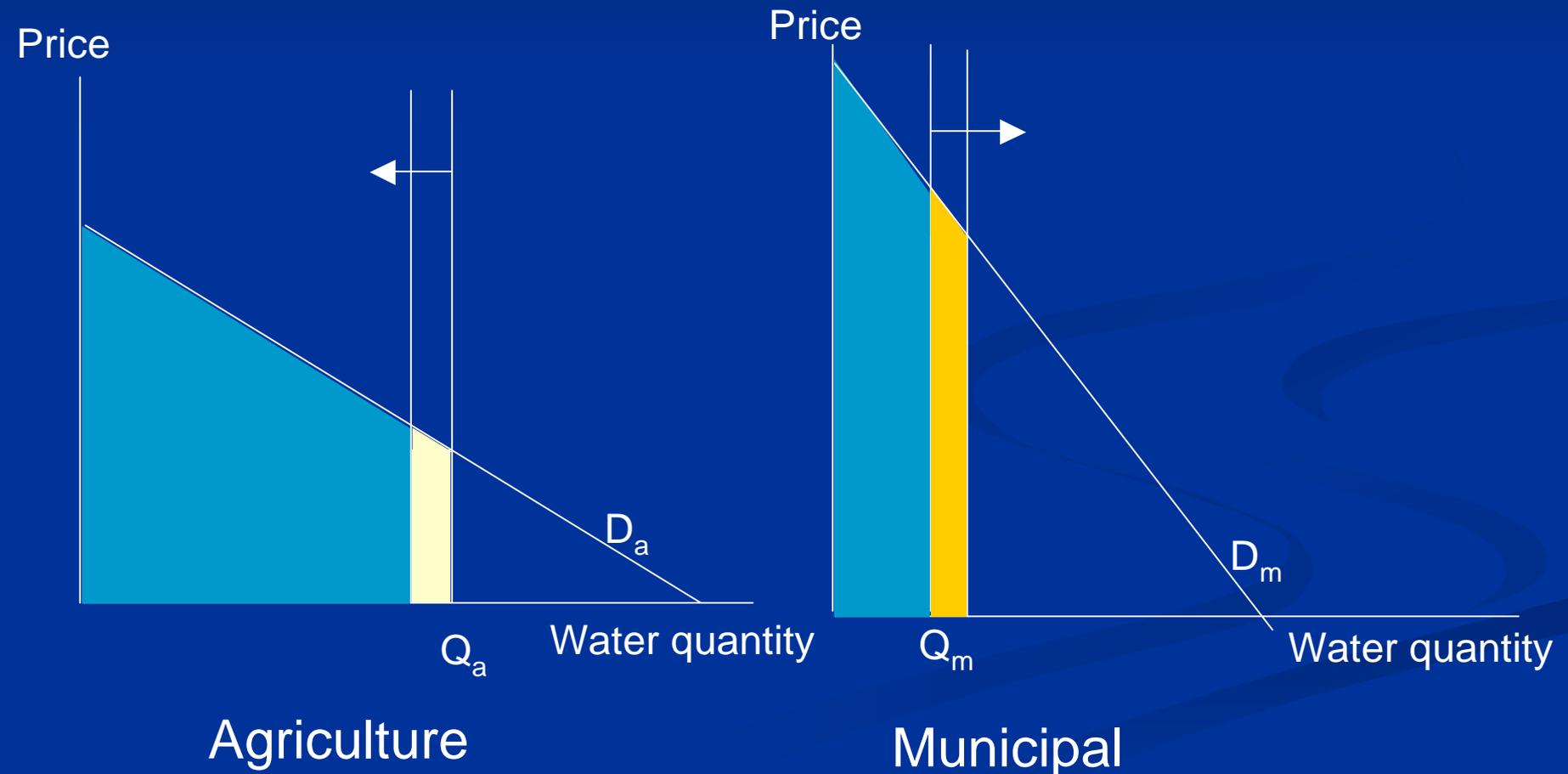
# Water Prices by Use Type

- In the Rio Grande Valley of Texas, the estimated willingness to pay for *permanent transfers* are:<sup>a</sup>
  - **Agriculture:** about \$1,000/acre-foot
  - **Municipal:** about \$13,800/acre-foot
- For the average transaction in the 14 western states, recent *annual* prices paid by different buyers are:<sup>b</sup>
  - **Agriculture:** about \$20/acre-foot/year
  - **Municipal:** about \$90/acre-foot/year

a Griffin, R.C. and C. Chang. 1991. "Seasonality in Community Water Demand." *Western Journal of Agricultural Economics* 16(December):207-17

b Brown, T. and A. Michelsen. 2005. "Western Water Markets: Transactions, Prices, and Diversity" Presentation at the New Mexico Annual Water Conference, Las Cruces, NM.

# Unrealized Gains from Trading



# Barriers to Water Trading

- Heterogeneity of water rights
  - **Riparian:** right to “reasonable use” of water adjacent to land
  - **Prior appropriated:** right to use up to a specified quantity; first in time, first in right
  - **Proportional or correlative:** right to use a share of the total water available

# Barriers to Water Trading

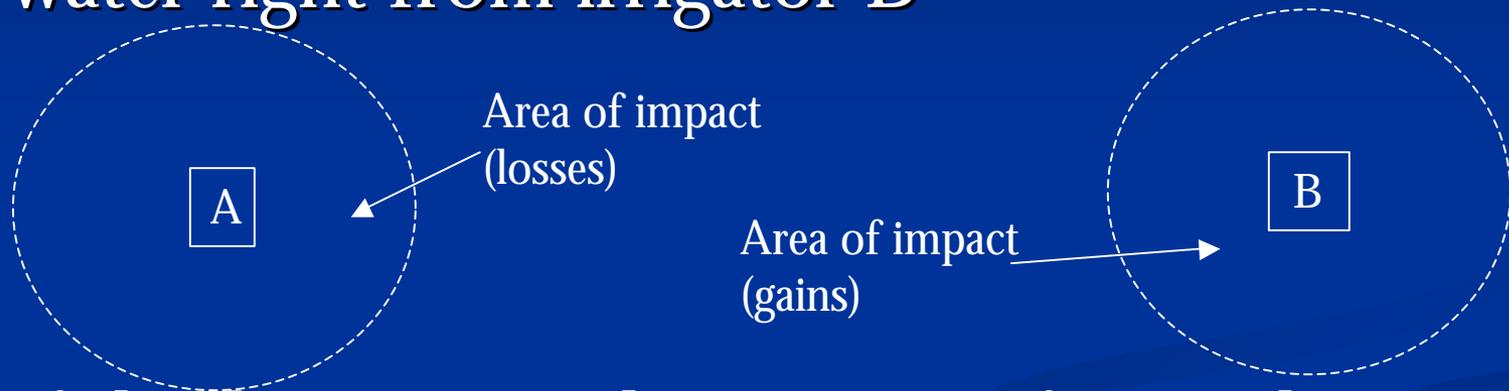
- Heterogeneity of water rights
- Transactions costs
  - **Administratively Induced Costs (AIC):** costs of searching for trading partners and negotiating terms of trade
  - **Policy Induced Costs (PIC):** costs of obtaining approval for trade; most states require “no harm” to third parties

# Barriers to Water Trading

- Heterogeneity of water rights
- Transactions costs
- Socio-political costs
  - Large scale water trades may disrupt the local economy and social structure in the region of origin, creating political opposition

# A Closer Look at Third Party Effects

- Suppose groundwater irrigator A wishes to buy a water right from irrigator B



- If third parties in the vicinity of A are harmed, then most states prohibit the transaction
- More economically efficient procedure: compensate losers
- Also appropriate to consider the gains near B

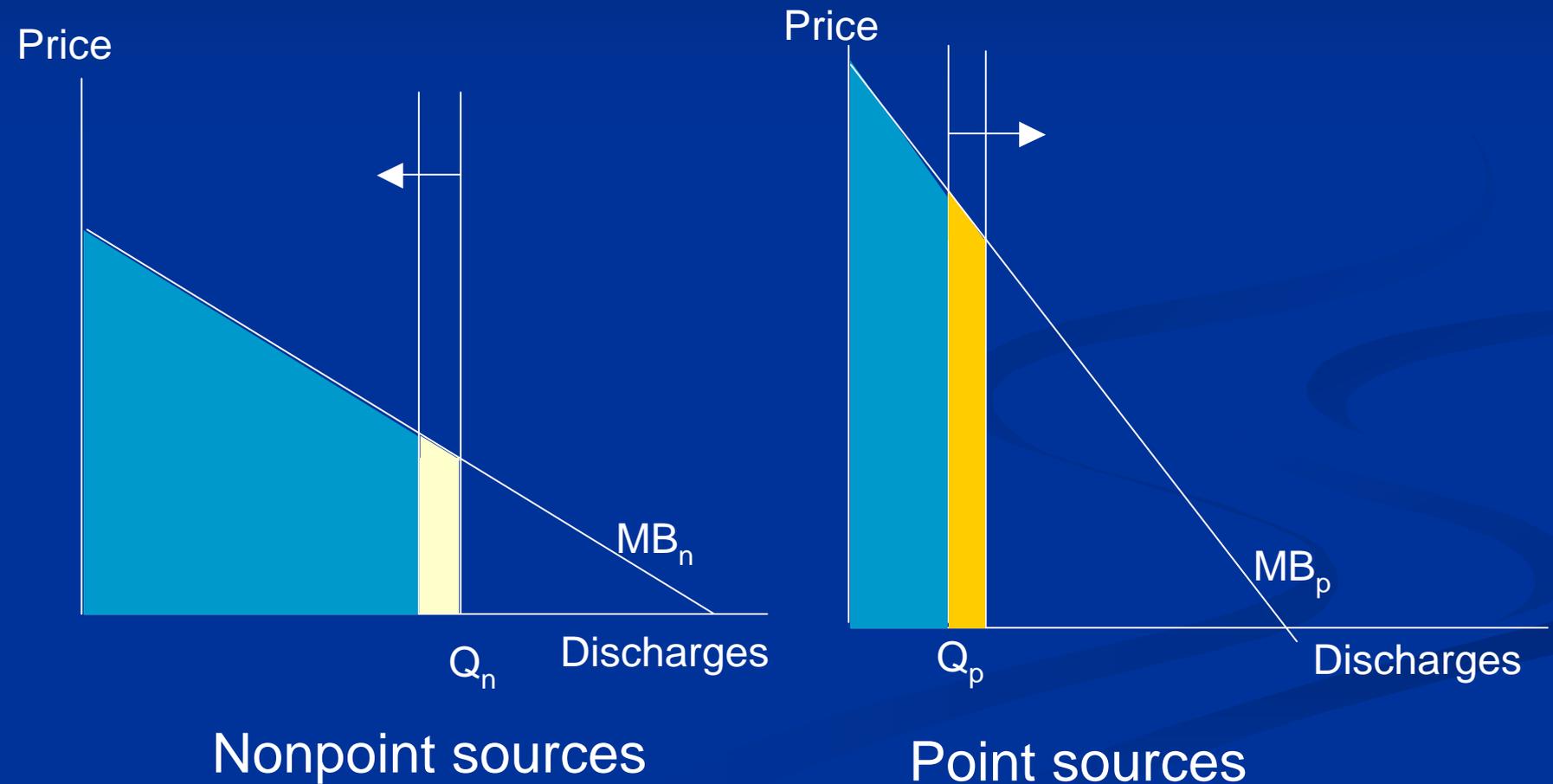
# Case Study: Colorado Big Thompson (CBT) Market

- CBT is a federal Bureau of Reclamation project in northeastern Colorado
- The most active water market in the western United States
- Water rights are proportional (homogeneous product)
- Trading partners can be found through postings on CBT website, brokers (low AIC)
- Effects on third parties and return flows are not considered (low PIC)

# Water Quality Markets

- Over 30 markets in operation in the U.S.
- Typical market involves ‘point-nonpoint’ trading
- Point sources can either:
  - a) install technology to reduce discharges, or
  - b) buy water quality credits to offset discharges
- Nonpoint sources generate credits to sell by adopting ‘best management practices’ (BMPs)

# *Déjà vu* : Unrealized Gains From Trading



# The Story So Far: Nothing Happening

- Previous research has found clear evidence of potential gains from trading
- Most programs have little or no activity
- Evidently there are one or more barriers that prevent trading
- Only limited research in this area to date; much yet to learn about the trading barriers

# Possible Barriers to Trading

- Transactions costs
  - **AIC:** Search and negotiation
  - **PIC:** Trades must be approved by facilitating agency; contract obligations must be monitored and enforced

# Possible Barriers to Trading

- Transactions costs
- Intangible costs
  - **Point sources:** public relations risks, default risk
  - **Nonpoint sources:** managerial effort, learning

# Possible Barriers to Trading

- Transactions costs
- Intangible costs
- High trading ratios
  - Typical trading ratio is 2:1; i.e., nonpoint sources must reduce discharges by 2 units to generate 1 saleable credit
  - Trading ratios are equivalent to levying a tax on credits

# NutrientNet

[www.nutrientnet.org](http://www.nutrientnet.org)

- A website designed to minimize AIC and facilitate trading
- Developed by the World Resources Institute
- Implemented in the Kalamazoo watershed phosphorous program in MI, the Chesapeake Bay nitrogen program
- Educational version available for demonstration to stakeholders, classroom use ([edu.nutrientnet.org](http://edu.nutrientnet.org))

WELCOME to **NutrientNet** - first on-line market for improving water quality through nutrient trading

project of the World Resources Institute



## » My account

## » About project

## » Markets

## » Support

Email:

Password:

 sign up - help

Introduction  
Project FAQs  
Related resources  
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Kalamzoo river basin  
View offers/buy credits  
Post offer  
Trading history

Policy issues  
Technical issues  
Worksheets help  
Glossary

## » Get started in 5 easy steps: (why sign up?)



## » What is NutrientNet? Quick guide:

- Water quality & current problems
- Nutrient run-off sources
- Existing policies & regulations
- NutrientNet approach

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Selected Best Management Practices

Summary	Location	Field details
---------	----------	---------------

 Reference Map  Aerial Photos

**Help**

Use the map tools or ZIP code list to find your area.

**Farm Field Tools**

Click the **start** button below to draw a new farm field boundary. Once the field is defined, click the **submit** button to proceed.

**start**

**submit**

**STEPS:****1. Zoom in**

Click on the map to zoom in to your location area, or select a zip code from the scroll down menu.

**2. Define your field**

After zooming in, press the start button, and click the boundary corners of your field. If you make a mistake or want to start drawing again, just press the start button again.

**3. Save location**

Once done click Submit button to continue.

**You may also...**

- Switch between Aerial photos and Reference maps by selecting appropriate radio box (in upper right corner).
- Click on Zoom out icon to zoom out one level.

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Selected Best Management Practices

Summary	Location	Field details
---------	----------	---------------



Zoom to a ZIP Code Area

 Reference Map  Aerial Photos

**Help**

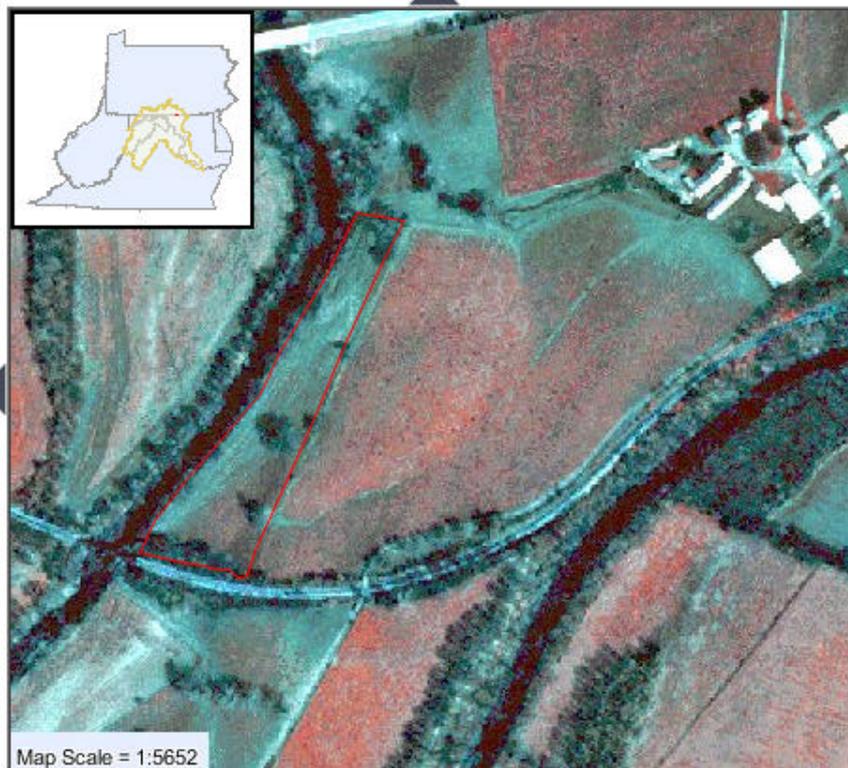
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**About NutrientNet****Markets****Support****Field details**

Use this form to view and update your farming field details.

Selected Best Management Practices

Summary    Location    **Field details**

Save

Reset

**Field:**

Field name:

Field area (ac):

Current crop:

Crop yield (bu/ac):  (average - 155.00)

Are you required to use conservation tillage:  check for yes

**Fertilizer:**

Fertilizer:

Application rate (lbs/ac):  (average - 682.05)

**Irrigation:**

Do you irrigate your field?  check for yes

Water applied (inches):

Nitrogen content (ppm):

**STEPS:****1. Enter field details**

If you are not sure about a certain value, leave a default one.

**2. Save values**

Once done click Save button to continue.

**You may also...**

» Click Reset button to restore values you started with.

» Click on question mark icon for more information about a certain field (where available).



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## Selected BMPs



Use this form to select best management practices/mitigations.

Selected Best Management Practices

Summary	Location	Field details
<input type="button" value="Update BMPs"/> <input type="button" value="Go to Summary"/>		

**Field name:** Joe's Field

---

Field area: 4.02 acres  
 Nitrogen out: 497 lbs  
 Nitrogen in: 619 lbs

---

Nitrogen baseline loading: 88 lbs

**Selected best management practices**

Cover crop What are these?

Land conversion

Conservation tillage

Filter strip

**STEPS:**

**1. Select BMP**  
Click on a checkbox next to the best management practice title to select/deselect appropriate BMP for this field.

**2. View BMP effects**  
Once done with BMP selection click the update BMPs button to fill out BMP details.

**You may also...**

» Go to the summary by clicking on the Go to Summary button.

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## Grass filter strip



Use this form to view and update your farming field grass filter strip details.

Selected Best Management Practices

Summary	Location	Field details	Filter strip: grass
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Save

Reset

## Filter strip:

Strip width:  ?

Strip length (ft):

Project duration (yrs):

Interest rate (%):

## Costs:

Maintainance (\$/ac/yr):

Opportunity cost (\$/ac/yr):  ?

Land rent (\$/ac/yr):

## Cost sharing:

Do you participate in cost sharing?  check for yes

Contract length (yr):  ?

Sign-up bonus (\$/ac):

Establishment subsidy (\$/ac):

Land rent subsidy (\$/ac/yr):

## STEPS:

## 1. Enter BMP details

If you are not sure about a certain value, leave a default one.

## 2. Save values

Once done click Save button to continue.

## You may also...

» Click Reset button to restore values you started with.

» Click on question mark icon for more information about a certain field (where available).

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## Field summary



Use this form to evaluate best management practices effects and place generated credits for sale.

Selected Best Management Practices

Summary	Location	Field details	Filter strip: grass
---------	----------	---------------	---------------------

**Field name:** Joe's Field

Field area: 4 acres

Nitrogen out: 497 lbs

Nitrogen in: 619 lbs

Nitrogen baseline loading: 88 lbs

**Selected best management practices**

- Cover crop What are these?
- Land conversion
- Conservation tillage
- Filter strip

**Trade generated credits**

Amount:  Starting price:

**Credits & costs**

Selected BMP	Credits	Credit cost	Annual BMP cost	Cost per pound of reduction
Filter strip: grass	27	\$1.18	\$32.45	\$0.59

**Loading data**

Loading	Reductions	Loading (lbs/yr)
Current	--	88
After upgrade	38%	34

**STEPS:****1. Evaluate BMPs**

Review BMPs impact on nutrient run-off, generated reductions/credits and cost data.

**2. Sell credits**

Click Sell button to place market order to sell credits generated by BMPs. Note that you may adjust credit amount and starting price. (Available only if BMPs generate any credits).

**You may also...**

» Click on appropriate tab to review/update farming field Location, Details and BMP data.

» Switch between Basic/Detailed BMP summary view modes.

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## Sell credits

Use this form to review and confirm your offer to sell credits details.

**Offer details :**

Credit amount:  Market: Potomac river basin  
Starting price:  Nutrient: Nitrogen  
Offer closes:     
Reserve:  (blank for none)  
Buy now price:  (blank for none)

**Notes:**

1. **Starting price** - minimum price you want the bidding to start at.
2. **Reserve price** - minimum price you want to sell the credits for.
3. **Buy now price** - price you agree to sell credits for right away, without waiting for the offer to expire.
4. **Offer closes** - date and time when offer expires.

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## Nitrogen market: Potomac river basin

Welcome to the Nitrogen marketplace. Offers to sell credits are listed below.

	Credits	Price	Buy now	Bids	Time left	Reserve
<a href="#">Bid</a>	100	\$10.00		-	17h 10m	-
<a href="#">Bid</a>	1,000	\$25.00		-	17h 10m	-
<a href="#">Bid / Buy now</a>	27	\$5.00	<a href="#">\$7.00</a>	-	08d 17h 10m	-
<a href="#">Bid / Buy now</a>	30	\$10.00	<a href="#">\$20.00</a>	-	13d 17h 10m	not met
<a href="#">Bid</a>	102	\$13.10		3	81d 17h 10m	met

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## Buy credits

Use this form to place a bid for an offer.

**Offer information :**

Credit amount: 27

Seller: mr\_smith [e-mail seller](#)

Nutrient: Nitrogen

Starting price: \$5.00

Market: Potomac river basin

Highest bidder:

Bids so far: 0

Current price: \$5.00

Offer closes: 03/20/04 8:03 In: 08d 17h 09m

**Your maximum bid:**  Enter **\$5.00** or more. Buy now price/bid: **\$7.00**

NutrientNet automatically bids on your behalf up to your maximum bid. [Learn about bidding](#)

# Conclusions

- Despite clear differences, the markets for water availability and water quality have similar challenges
  - Limited trading activity
  - Unrealized gains from exchange
  - Inherent spatial heterogeneity
  - Subject to state/local laws
- In both markets, agriculture is the low-cost provider

# Conclusions

- Based on theory and evidence from active markets, trading will be facilitated by
  - Defining a standardized product to be traded
  - Reducing administrative transactions costs through centralized exchanges (e.g., websites)
  - Rules that trade off absolute efficiency for every trade against market simplicity
- Additional research is needed: trading barriers are still not well understood