Floodplains of the Illinois River: their use and their economic and environmental value

THE WETLANDS INITIATIVE
The simple logic of floodplain management:

- The state of our floodplains is a matter of land use
- Land use is a matter of economics
- Therefore, economics control the environmental conditions of our floodplains
What problems have been caused by past uses of our floodplains?

- Flood damage
- Degraded water quality
- Reduced wildlife
- Limited biodiversity
Why do these problems occur and why is our environment not more diverse, more functional, more to our liking?

<table>
<thead>
<tr>
<th>Use Category</th>
<th>Unit Value ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation</td>
<td>1,000</td>
</tr>
<tr>
<td>Row-crop</td>
<td>3,000</td>
</tr>
<tr>
<td>Suburban</td>
<td>25,000</td>
</tr>
<tr>
<td>Urban</td>
<td>100,000</td>
</tr>
<tr>
<td>Commercial</td>
<td>2,000,000</td>
</tr>
</tbody>
</table>
And, what of these values?

<table>
<thead>
<tr>
<th>Ecosystem Use</th>
<th>Unit Value ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floodwater Storage</td>
<td>?</td>
</tr>
<tr>
<td>Nutrient Management</td>
<td></td>
</tr>
<tr>
<td>- Nitrogen</td>
<td>?</td>
</tr>
<tr>
<td>- Phosphorous</td>
<td>?</td>
</tr>
<tr>
<td>- Carbon</td>
<td>?</td>
</tr>
<tr>
<td>Sediment Control</td>
<td>?</td>
</tr>
<tr>
<td>Wildlife habitat</td>
<td>?</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>?</td>
</tr>
</tbody>
</table>
Wetland Losses: Mississippi River Basin
Agricultural drainage: pros and cons

Drainage Benefits

- Average Corn Yield (bushel/acre)
  - Undrained
  - Surface Drainage
  - Subsurface Drainage
  - Combination Drainage

Drainage Practice

Area Drained: Mississippi River Basin

- Millions of Acres
- Year

Data shows significant increases in corn yield and area drained over time, highlighting the benefits of drainage practices.
Cumulative flood damage and control costs (1985 dollars)
Nitrogen Fertilizer Use, 1991

Nitrogen Fertilizer Use
1991
Tons/Sq.Mi.

- 0 - 3
- 3 - 10
- 10 - 20
- 20 - 35
Nitrogen benefits and use

- Effect of nitrogen application rate on corn yield

- Annual Nitrogen Fertilizer Usage: Mississippi-Atchafalaya River Basin
Nitrogen in the water

NO$_2^-$ and NO$_3^-$ Concentrations in the Illinois River Near Peoria, 1900 and 1990

2001 Illinois River NO$_3$-N Levels

USEPA Ecoregion Criteria: 2.14 mg TN/L
USEPA Ecoregion Criteria 1.6 mg NO$_3$-N/L
And, what about water quality? Hypoxia in the Gulf of Mexico is a good place to start.
A solution so simple: wetland restoration
Of the nitrogen loads reaching the Gulf of Mexico, the Illinois River contributes more than its fare share.

- **The Illinois River contributes** 3% of the flow **but** 12% (126,000 tons) of the total yearly NO₃-N load.
- **To reach pre-1970’s NO₃-N loads to the Gulf of Mexico** (350,000 tons/year) **requires a load reduction of 700,000 tons/year in the Mississippi River and 100,000 tons/year in the Illinois River.**
- **For the Illinois River, the solution requires** 10% of drained wetlands to be restored, **which would occupy 32% of the FEMA floodplain.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Acres</th>
<th>% Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetlands required</td>
<td>407,000</td>
<td>2.0</td>
</tr>
<tr>
<td>Wetlands drained</td>
<td>4,170,000</td>
<td>20.0</td>
</tr>
<tr>
<td>FEMA Floodplain</td>
<td>1,280,000</td>
<td>6.3</td>
</tr>
</tbody>
</table>
## Potential Restoration Areas in FEMA Floodplain
### Upper Mississippi River Basin

<table>
<thead>
<tr>
<th>State</th>
<th>Watershed* (acres)</th>
<th>Hydric Soils* (acres)</th>
<th>Row Crops on Hydric Soils (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>28,929,000</td>
<td>1,008,000</td>
<td>736,000</td>
</tr>
<tr>
<td>Iowa</td>
<td>36,007,000</td>
<td>2,216,000</td>
<td>937,000</td>
</tr>
<tr>
<td>Minnesota</td>
<td>31,685,000</td>
<td>1,269,000</td>
<td>179,000</td>
</tr>
<tr>
<td>Missouri</td>
<td>32,833,000</td>
<td>1,435,000</td>
<td>832,000</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>24,899,000</td>
<td>916,000</td>
<td>275,000</td>
</tr>
<tr>
<td><strong>Total Area</strong></td>
<td><strong>154,353,000</strong></td>
<td><strong>6,894,000</strong></td>
<td><strong>2,960,000</strong></td>
</tr>
</tbody>
</table>

* Extrapolated data from the report: *Flood Damage Reduction in the Upper Mississippi River Basin (UMR): An Ecological Means*
FINANCING RESTORATION

Water Quality/Nutrient Trading
Nutrient Farming
Cost Comparison
Market Structure
NUTRIENT FARMING

A strategy that:

utilizes created and restored wetlands to naturally remove nitrogen and phosphorous from surface waters and CO$_2$ from the air

is a business enterprise based on the sale of nutrient reduction credits
“Credits” will be sold to dischargers who need to meet water quality standards.
<table>
<thead>
<tr>
<th>Effluent Limit (mg/L)</th>
<th>Wetland Size (acres)</th>
<th>Total Nitrogen</th>
<th>50% split of savings</th>
<th>Net Profit/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Savings*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 TN, 1.0 TP</td>
<td>189,000</td>
<td>74,000,000</td>
<td>37,000,000</td>
<td>196</td>
</tr>
<tr>
<td>2.18 TN, 0.5 TP</td>
<td>322,000</td>
<td>76,000,000</td>
<td>38,000,000</td>
<td>118</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effluent Limit (mg/L)</th>
<th>Wetland Size (acres)</th>
<th>Total Phosphorous</th>
<th>50% split of savings</th>
<th>Net Profit/acre</th>
</tr>
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<tr>
<td></td>
<td></td>
<td>Savings*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 TN, 1.0 TP</td>
<td>189,000</td>
<td>59,400,000</td>
<td>29,700,000</td>
<td>157</td>
</tr>
<tr>
<td>2.18 TN, 0.5 TP</td>
<td>322,000</td>
<td>88,400,000</td>
<td>44,200,000</td>
<td>137</td>
</tr>
</tbody>
</table>

Total annual MWRDGC **cost savings**: $66,700,000-$82,200,000

Total annual Nutrient Farmer **net profit**: $255-$353/acre

* includes sale of extra credits
Total Demand: 2,432 tons TN/month
Hydric soils in IL River Basin: 655,146 acres
TN CREDIT SUPPLY: LOAD

Summer
Total Supply: 6,511 tons TN/month
Winter
Total Supply: 4,339 tons TN/month
Winter Prices
($/ton TN removed)

TN CREDIT COST

- **River**
- **Watershed Boundary**
- **County Boundary**

**Cost in Dollars per Ton**
- 2,500 - 2,750
- 2,751 - 2,900
- 2,901 - 3,000
- 3,001 - 3,500
- 3,501 - 4,000
- 4,001 - 4,500
TRADE SCENARIO: NO RESTRICTION

Summer Demand: 2,423 tons TN/month
Credits Traded: 2,423 tons TN/month
Total Cost: $2,285,000/month
TRADE SCENARIO: 10% ACCRUED

Summer Demand: 2,423 tons TN/month
Credits Traded: 2,993 tons TN/month
Total Cost: $3,005,000/month
• Largely, self-sustaining nutrient management
• Point and non-point nutrient control
• Income generation from bottom lands
• Efficient and fare