“How Can We Help Farmers Comply with Modern Environmental Regulations?”

The Wisconsin Agricultural Stewardship Initiative and the Role of Pioneer Farm

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Pioneer Farm
UW-Platteville
Farmers Today Face Major Challenges

- World Population: 6.3 billion
- Volatile Foreign & Domestic Markets
- Complex Technology
- Animal Health & Ethics
- Food Quality & Safety
- Environmental Regulations
- Farm Policies

- Threats to:
  - Traditional Profitability
  - Quality of Life
  - Ecological Health
WISCONSIN AGRICULTURAL STEWARDSHIP INITIATIVE (WASI)

HISTORY

† Wisconsin 1997 Act 27
† WASI unveiled in 2000
† Stakeholder Research Priorities 2000 & 2002

† 1999 Delegations to the Netherlands
† Funded in 2001-2003 budget
Pioneer Farm

Working farm, located at UW-Platteville, with 430 acres and small dairy, swine, and beef herds

**Mission**

- Conduct, monitor, & evaluate applied systems research on ecology and economy of the whole farm
- Use stakeholder priorities to *guide* research agenda
- Share findings; Advocate science-based public policies; and Maintain and grow core competency of teaching
Stakeholder Research Priority: Erosion & Sedimentation
Stakeholder Research Priority: **Hypoxia**

Nutrient Loading is a Problem

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**Nitrogen delivered (%)**

- 0 to 20
- 20 to 30
- 30 to 50
- 50 to 80
- 80 to 90
- > 90

USGS 2003
Stakeholder Research Priority: Nutrient Management

Pioneer Farm Soil Test Data Trends

Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Phosphorus</th>
<th>Potassium</th>
</tr>
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<tbody>
<tr>
<td>1968</td>
<td>23.4</td>
<td>87.1</td>
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<tr>
<td>1971</td>
<td>39.5</td>
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</tr>
<tr>
<td>1974</td>
<td>40.1</td>
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</tr>
<tr>
<td>1978</td>
<td>75.5</td>
<td></td>
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<tr>
<td>1981</td>
<td>59.7</td>
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</tr>
<tr>
<td>1983</td>
<td>56.2</td>
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</tr>
<tr>
<td>1987</td>
<td>67.9</td>
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</tr>
<tr>
<td>1989</td>
<td>81.2</td>
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</tr>
<tr>
<td>1992</td>
<td>80.9</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>259.6</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>198.5</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>196</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>213</td>
<td>206</td>
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PPM
Stakeholder Research Priority: Sources of Nutrients

<table>
<thead>
<tr>
<th>Nutrient Source</th>
<th>Feed</th>
<th>Fertilizer</th>
<th>Animal</th>
<th>Natural</th>
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<tbody>
<tr>
<td>Nitrogen</td>
<td>53%</td>
<td>71%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>29%</td>
<td>43%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>Potassium</td>
<td>2%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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</table>

Courtesy of Kevin Erb
Stakeholder Research Priority: Systems Mass Balance

Farm and Research staff gather inputs and outputs.

**Inputs** include TMR and other feed rations.

**Outputs** include manure, bedding, meat, and milk.

Time consuming and costly, needed to understand the nutrient/manure system.
Stakeholder Research Priority: Nutrient Management

- **WI Phosphorus Index**
  - Planning tool for farmers
  - Evaluate risk of P losses from fields with varying management practices
  - Part of WI Nutrient Management Standard 590
Stakeholder Research Priority: Nutrient Management

• USING PIONEER FARM DATA TO CALIBRATE THE P INDEX
  • Risk Modeling Approach
  • Calculate average annual P losses in particulate and dissolved form in lb/acre/year for each field based on climate, soil, soil test P, and crop management
  • “Worst-case” loss factors added for unincorporated surface applications of P:
    - non-frozen ground
    - frozen ground
### Pioneer Farm Selected Nonpoint Runoff Basins & Monitoring Sites

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Area Acres</th>
<th>Site Number</th>
<th>Area Acres</th>
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<tr>
<td>1</td>
<td>24.58</td>
<td>6</td>
<td>2.66</td>
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<td>2</td>
<td>22.02</td>
<td>7</td>
<td>39.32</td>
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<td>3</td>
<td>12.31</td>
<td>8</td>
<td>24.35</td>
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<td>4</td>
<td>74.42</td>
<td>9</td>
<td>13.63</td>
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<tr>
<td>5</td>
<td>6.77</td>
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</tr>
</tbody>
</table>

- **Site 1**
- **Site 2**
- **Site 3**
- **Site 4**
- **Site 5**
- **Site 6**
- **Site 7**
- **Site 8**
- **Site 9**

Map showing the locations of the Pioneer Farm Selected Nonpoint Runoff Basins & Monitoring Sites.
Stakeholder Research Priority: Environmental Baseline

NonPoint Runoff Monitoring Station

Precipitation Gage
Radio Telemetry Antenna
Cover w/ solar panels
Peristaltic Pump
Data Logger and radio
Sample Refrigerator
Nitrogen tank
Pressure Transducer
12 V Battery
Sites in Action
including snowmelt

Agricultural Fields
Grassed Waterway
Wingwall
Flume
Rip Rap
Snowmelt 2-18-03

Manure applied to site 3 basin
Preliminary Snowmelt Data: 2003 (all 3 events)
Preliminary Snowmelt Data: 2003 (all 3 events)

Nitrate (NO$_2$+NO$_3$)

Drinking Water Standard

EPA ambient water quality criteria

Site
Composite 2002 Storm Runoff Data from all Sites
Note: does not include snowmelt data

<table>
<thead>
<tr>
<th>Constituent (mg/L)</th>
<th>Max</th>
<th>Min</th>
<th>Average</th>
<th>Background</th>
<th>EPA</th>
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<tbody>
<tr>
<td>NO2+NO3</td>
<td>17</td>
<td>0.10</td>
<td>2</td>
<td>8</td>
<td>2.2</td>
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<tr>
<td>Dissolved P</td>
<td>4</td>
<td>0.01</td>
<td>1</td>
<td>0.02</td>
<td>n/a</td>
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<tr>
<td>Total P</td>
<td>14</td>
<td>0.03</td>
<td>3</td>
<td>0.08</td>
<td>0.076</td>
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<tr>
<td>Susp. Solids</td>
<td>9930</td>
<td>1.00</td>
<td>376</td>
<td>40</td>
<td>n/a</td>
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Background = typical low-flow concentrations in southwest Wisconsin streams (USGS Water Resources Investigations Report 85-4214)

EPA = Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion VI
EPA 822-B-00-017 (2.2 mg/L is the total N criteria)
Take Home Points

- Pioneer Farm is a bridge between science and policy.
- Gathering high quality data is time consuming, complicated and costly.
- Equipment selection is critical for research project flexibility and reliability.
- Collaboration is essential.
- Research must be timely and relevant.
- Serve a broad-based constituency.