The New York Phosphorus Runoff Index Calculator

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NEW WEBSITE: http://nmsp.css.cornell.edu/

CU-WI Seminar
14 October 2003
Why a PI?

• **NRCS 590:**
  • Agronomic
  • Environmental
  • P index

• **All CNMP’s in NYS**

• Accounts for landscape

• Needed PI calculator to:
  – test
  – teach
Source/Transport Concept

Critical Source Area

High P Source Level

High Transport Risk

(Gburek, et al)
Particulate P results from infiltration excess, short duration and depends on soil erosivity and slope.

Dissolved P moves with saturation excess, long duration, & depends on position in the landscape.

(Steenhuis, Geohring, et al)
NY P Index Structure

Source (value: 0.1-.....) × Transport (multiplier: 0.1-1)

Dissolved
- Drainage class
- Flooding frequency
- Distance to stream

Particulate
- Soil erosion
- Flooding Frequency
- Distance to stream
- Concentrated flow

- Soil test P
- Manure P$_2$O$_5$
  - rate
  - method
  - timing

- Fertilizer P$_2$O$_5$
  - rate
  - method
  - timing
P Index

Rankings: Dissolved and particulate PI should both be <100.

<table>
<thead>
<tr>
<th>P index</th>
<th>Vulnerability</th>
<th>Management recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>Low</td>
<td>N based management</td>
</tr>
<tr>
<td>50-74</td>
<td>Medium</td>
<td>N based management with BMPs</td>
</tr>
<tr>
<td>75-99</td>
<td>High</td>
<td>P applications to crop removal</td>
</tr>
<tr>
<td>≥100</td>
<td>Very High</td>
<td>No fertilizer/manure P application</td>
</tr>
</tbody>
</table>

- Use recommended practices to alter the score.
- Incorporate manure, reduce manure/fertilizer, buffers, timing of manure applications, create management zones, etc.
Challenges:

• No technical software challenges
• Model not field tested
• P saturation level for soil types
• Testing the PI on farm fields
• Tension between managing for N vs P
• Estimating flow path/distance in field
Current Efforts

• Update software if PI is changed
• Collecting PI data from planners to assess score distribution
• Comparing results with neighboring states
• Initiating field calibration studies
• Assessing soil P saturation and storage capacity
• SMR to predict transport risk
Target Audience

- Internal testing
- Students
- Planners
- Extension
- Producers
# Nutrient Management Spear Program (NMSP)

## On-line version:

### NYS P index calculator

The New York P Index was developed by the NYS P Index Working Group.

#### Source Factor

<table>
<thead>
<tr>
<th>Source Factor</th>
<th>Your values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil test P (Morgan P in lbs/acre)</td>
<td>29</td>
</tr>
<tr>
<td>Fertilizer P application rate (lbs P₂O₅/acre)</td>
<td>10</td>
</tr>
<tr>
<td>Fertilizer P application timing</td>
<td>May-August</td>
</tr>
<tr>
<td>Fertilizer P application method</td>
<td>Injected or subsurface bonded</td>
</tr>
<tr>
<td>Organic P application #1 rate (lbs P₂O₅/acre)</td>
<td>30</td>
</tr>
<tr>
<td>Organic P application #1 timing</td>
<td>Sept-Oct</td>
</tr>
<tr>
<td>Organic P application #1 method</td>
<td></td>
</tr>
<tr>
<td>Organic P application #2 rate (lbs P₂O₅/acre)</td>
<td>40</td>
</tr>
<tr>
<td>Organic P application #2 timing</td>
<td>Feb-Mar</td>
</tr>
<tr>
<td>Organic P application #2 method</td>
<td>Broadcast + incorporated in 1-2 days</td>
</tr>
</tbody>
</table>

#### Dissolved P Transport Factor

<table>
<thead>
<tr>
<th>Dissolved P Transport Factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil drainage class</td>
<td>Moderately well drained</td>
</tr>
<tr>
<td>Flooding frequency</td>
<td>Rare (110 years) or never</td>
</tr>
<tr>
<td>Flow distance to blue line stream (feet)</td>
<td>150</td>
</tr>
<tr>
<td>Stream type (blue line on topomap or equivalent)</td>
<td>Perennial - Solid Blue Line</td>
</tr>
</tbody>
</table>

#### Particulate P Transport Factor

<table>
<thead>
<tr>
<th>Particulate P Transport Factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion (RUSLE in tons/acre)</td>
<td>1.9</td>
</tr>
</tbody>
</table>
### Particulate P Transport Factor
- Erosion (RUSLE in tons/acre): 1.9
- Flooding frequency: [value as entered above for Dissolved P]
- Flow distance to blue line stream (feet): [value as entered above for Dissolved P]
- Stream type (blue line on topomap or equivalent): [value as entered above for Dissolved P]
- Concentrated flow?: Yes (present)

### Dissolved P Index
- Value: 57
- Category: Medium

### Particulate P Index
- Value: 63
- Category: Medium

### Management Category
- Based on management with BMPs

### Total Source Score
- Value: 63

### Soil test P contribution
- Value: 36

### Fertilizer P contribution
- Value: 1

### Organic P contribution
- Value: 26

### Total Dissolved Transport Score
- Value: 0.9

### Flow Distance Contribution
- Value: 0.6

### Total Particulate Transport Score
- Value: 1

### Erosion contribution
- Value: 0.2

### Flow distance contribution
- Value: 0.6

### Concentrated flow contribution
- Value: 0.2

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### NYS P INDEX CALCULATOR Version 2 (May 1, 2003)

The NY P index was developed by the NY P Index Working Group.

This Excel spreadsheet was developed by Q.M. Ketterings, G. Albrecht, K. Ganoe and K. Czymmek.

#### SOURCE FACTOR

| Field 3 |  
| --- | --- |
| Soil test P (Morgan P in lbs P/acre) | undefined |
| Fertilizer P application rate (lbs P<sub>2</sub>O<sub>5</sub>/acre) | 20 |
| Fertilizer P application timing | May-August |
| Fertilizer P application method | Injected or subsurface banded |
| Organic P application #1 rate (lbs P<sub>2</sub>O<sub>5</sub>/acre) | 0 |
| Organic P application #1 timing | February-April |
| Organic P application #1 method | Surface applied on frozen or snow covered or saturated ground |
| Organic P application #2 rate (lbs P<sub>2</sub>O<sub>5</sub>/acre) | 0 |
| Organic P application #2 timing | None applied |
| Organic P application #2 method | None applied |

#### DISSOLVED P TRANSPORT FACTOR

|  
| --- |
| Soil drainage class | Well/excessively well drained |
| Flooding frequency | Rare (>100 years) or never |
| Flow distance to blue line stream or equivalent (feet) | 200 |
| Stream type (blue line on toposmap or equivalent) | Perennial - Solid Blue Line |

#### PARTICULATE P TRANSPORT FACTOR

|  
| --- |
| Erosion (RUSLE in tons/acre) | 2 |
| Flooding frequency | Rare (>100 years) or never |
| Flow distance to blue line stream or equivalent (feet) | 200 |
| Stream type (blue line on toposmap or equivalent) | Perennial - Solid Blue Line |
| Concentrated flow? | No (not present) |

#### DISSOLVED P INDEX

|  
| --- |
| 50 | Medium |

#### PARTICULATE P INDEX

|  
| --- |
| 59 | Medium |

#### Management Recommendation

N based management with BMP’s
## NYS P INDEX CALCULATOR Version 2 (May 1, 2003)

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### SOURCE FACTOR

<table>
<thead>
<tr>
<th>FIELD 3</th>
<th>PARTICULATE P TRANSPORT FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion (RUSLE in tons/acre)</td>
<td>2</td>
</tr>
<tr>
<td>Flooding frequency</td>
<td>Rare (&gt;100 years) or never</td>
</tr>
<tr>
<td>Flow distance to blue line stream or equivalent (feet)</td>
<td>200</td>
</tr>
<tr>
<td>Stream type (blue line on topomap or equivalent)</td>
<td>Perennial - Solid Blue Line</td>
</tr>
<tr>
<td>Concentrated flow?</td>
<td>No (not present)</td>
</tr>
</tbody>
</table>

### DISSOLVED P INDEX

| 50 | Medium |

### PARTICULATE P INDEX

| 59 | Medium |

### Management Recommendation

<table>
<thead>
<tr>
<th>N based management with BMP’s</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL SOURCE SCORE</td>
<td>99</td>
</tr>
<tr>
<td>Soil test P contribution</td>
<td>98</td>
</tr>
<tr>
<td>Fertilizer P contribution</td>
<td>2</td>
</tr>
<tr>
<td>Organic P contribution</td>
<td>0</td>
</tr>
</tbody>
</table>

### TOTAL DISSOLVED TRANSPORT SCORE

| 0.5 | |

### TOTAL PARTICULATE TRANSPORT SCORE

<p>| 0.6 | |
| Erosion contribution | 0.2 |
| Flow distance contribution | 0.4 |
| Concentrated flow contribution | 0.0 |</p>
<table>
<thead>
<tr>
<th>SOURCE FACTOR</th>
<th>Field 3</th>
<th>Field 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil test P</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Fertilizer P application rate</td>
<td>May-August</td>
<td>May-August</td>
</tr>
<tr>
<td>Fertilizer P application timing</td>
<td>Injected or subsurface banded</td>
<td>Injected or subsurface banded</td>
</tr>
<tr>
<td>Fertilizer P application method</td>
<td>November-January</td>
<td>None applied</td>
</tr>
<tr>
<td>Organic P application #1 rate</td>
<td>Surface applied on frozen or snow covered or saturated ground</td>
<td>None applied</td>
</tr>
<tr>
<td>Organic P application #1 timing</td>
<td>February-April</td>
<td>None applied</td>
</tr>
<tr>
<td>Organic P application #1 method</td>
<td>Surface applied or broadcast/incorporated after 5 days</td>
<td>None applied</td>
</tr>
<tr>
<td>Organic P application #2 rate</td>
<td>None applied</td>
<td>None applied</td>
</tr>
<tr>
<td>Organic P application #2 timing</td>
<td>None applied</td>
<td>None applied</td>
</tr>
<tr>
<td>Organic P application #2 method</td>
<td>None applied</td>
<td>None applied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISSOLVED P TRANSPORT FACTOR</th>
<th>Well excessively well drained</th>
<th>Somewhat poorly drained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil drainage class</td>
<td>Rare (&gt;100 years) or never</td>
<td>Rare (&gt;100 years) or never</td>
</tr>
<tr>
<td>Flooding frequency</td>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>Flow distance to blue line stream or equivalent (feet)</td>
<td>Perennial - Solid Blue Line</td>
<td>Perennial - Solid Blue Line</td>
</tr>
<tr>
<td>Stream type (blue line on topomap or equivalent)</td>
<td>No (not present)</td>
<td>No (not present)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARTICULATE P TRANSPORT FACTOR</th>
<th>2</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion (RUSLE in tons/acre)</td>
<td>Rare (&gt;100 years) or never</td>
<td>Rare (&gt;100 years) or never</td>
</tr>
<tr>
<td>Flooding frequency</td>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>Flow distance to blue line stream or equivalent (feet)</td>
<td>Perennial - Solid Blue Line</td>
<td>Perennial - Solid Blue Line</td>
</tr>
<tr>
<td>Stream type (blue line on topomap or equivalent)</td>
<td>No (not present)</td>
<td>No (not present)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISSOLVED P INDEX</th>
<th>50</th>
<th>81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Medium</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARTICULATE P INDEX</th>
<th>50</th>
<th>81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Medium</td>
<td></td>
</tr>
</tbody>
</table>

**Management Recommendation:**
- N based management with BMPs
- P application not to exceed crop removal

**TOTAL SOURCE SCORE:** 81

**TOTAL DISSOLVED TRANSPORT SCORE:** 0.5

**TOTAL PARTICULATE TRANSPORT SCORE:** 0.6
## NYS P INDEX CALCULATOR Version 2 (May 1, 2003)

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### Table 1: Fertilizer/Organic P application timing.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>February - April</td>
<td>1.0</td>
</tr>
<tr>
<td>May - August</td>
<td>0.4</td>
</tr>
<tr>
<td>None applied</td>
<td>0.0</td>
</tr>
<tr>
<td>November - January</td>
<td>0.9</td>
</tr>
<tr>
<td>September - October</td>
<td>0.7</td>
</tr>
</tbody>
</table>

### Table 2: Fertilizer and Organic P application method.

<table>
<thead>
<tr>
<th>Method</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcast + incorporated in 1-2 days</td>
<td>0.4</td>
</tr>
<tr>
<td>Broadcast + incorporated in 3-5 days</td>
<td>0.6</td>
</tr>
<tr>
<td>Injected or subsurface banded</td>
<td>0.2</td>
</tr>
<tr>
<td>None applied</td>
<td>0.0</td>
</tr>
<tr>
<td>Surface applied on frozen or snow covered or saturated ground</td>
<td>1.0</td>
</tr>
<tr>
<td>Surface applied or broadcast/incorporated after 5 days</td>
<td>0.8</td>
</tr>
</tbody>
</table>

### Table 3: Soil Drainage Class.

<table>
<thead>
<tr>
<th>Class</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderately well drained</td>
<td>0.3</td>
</tr>
<tr>
<td>Poorly or very poorly drained</td>
<td>1.0</td>
</tr>
<tr>
<td>Somewhat poorly drained</td>
<td>0.7</td>
</tr>
<tr>
<td>Well excessively well drained</td>
<td>0.1</td>
</tr>
</tbody>
</table>

### Table 4: Flooding Frequency.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent (&lt;10 years frequency)</td>
<td>1.0</td>
</tr>
<tr>
<td>Occasional (once in 10-100 years)</td>
<td>0.2</td>
</tr>
<tr>
<td>Rare (&gt;100 years) or never</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Table 5: Topomap Blue Line Stream Type.

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent - Dashed Blue Line</td>
<td>1.0</td>
</tr>
<tr>
<td>Perennial - Solid Blue Line</td>
<td>2.0</td>
</tr>
</tbody>
</table>

### Table 6: Concentrated Flow?

<table>
<thead>
<tr>
<th>Yes/No</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>0.2</td>
</tr>
<tr>
<td>No</td>
<td>0.0</td>
</tr>
</tbody>
</table>