

The Minnesota Phosphorus Index

Purpose:

to estimate risk of P loss from field to water

Developed from:

- Literature review of other indices
- Characterization of P relationships for MN soils
- Runoff studies from Minnesota and neighboring states

Available at:

<http://www.mnpi.umn.edu>



Models

Mathematical estimates; not reality

Why use models?

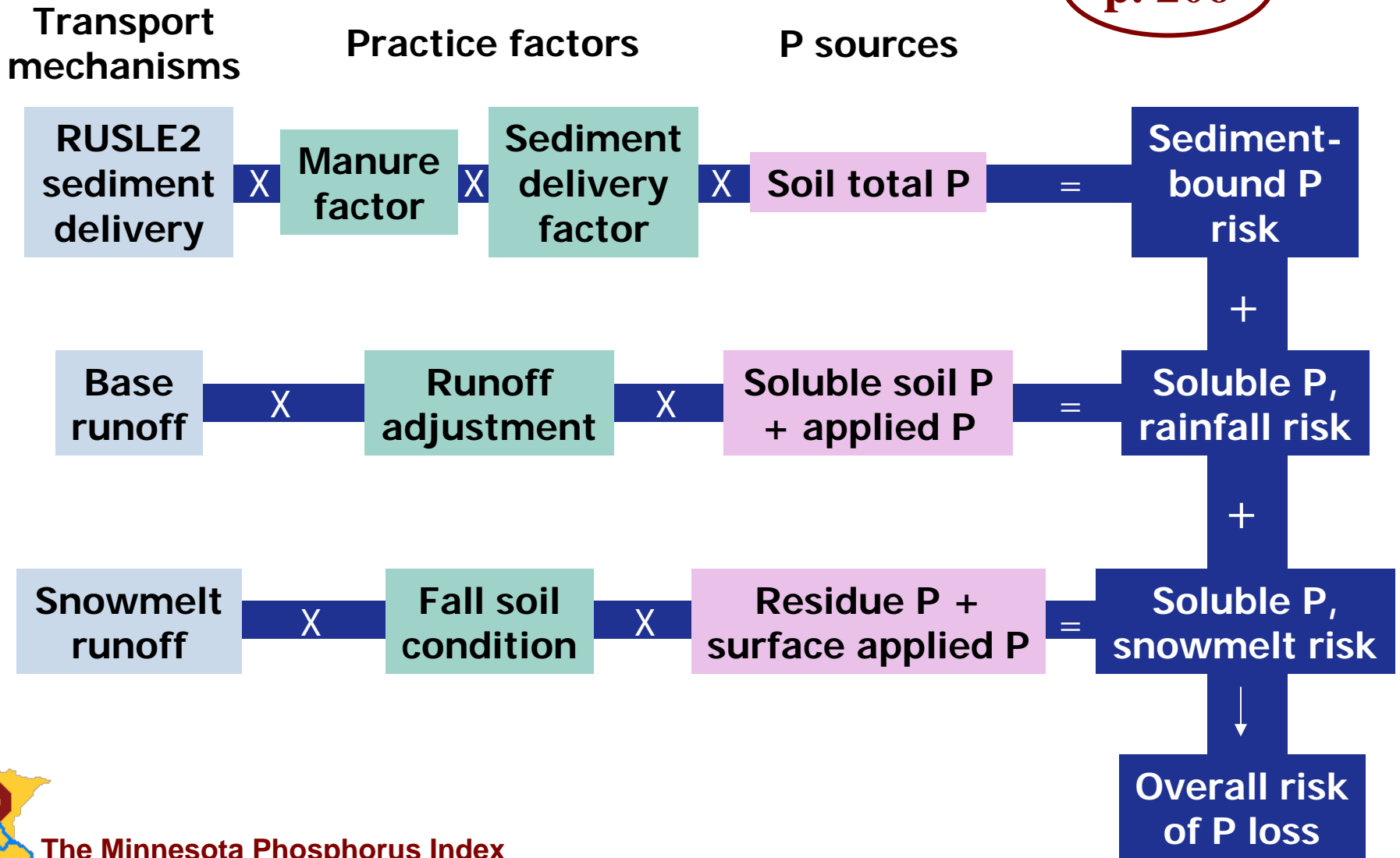
- Cheaper than measuring/monitoring
- Plan for the future

Trade-off between desires for
low input detail and high output detail

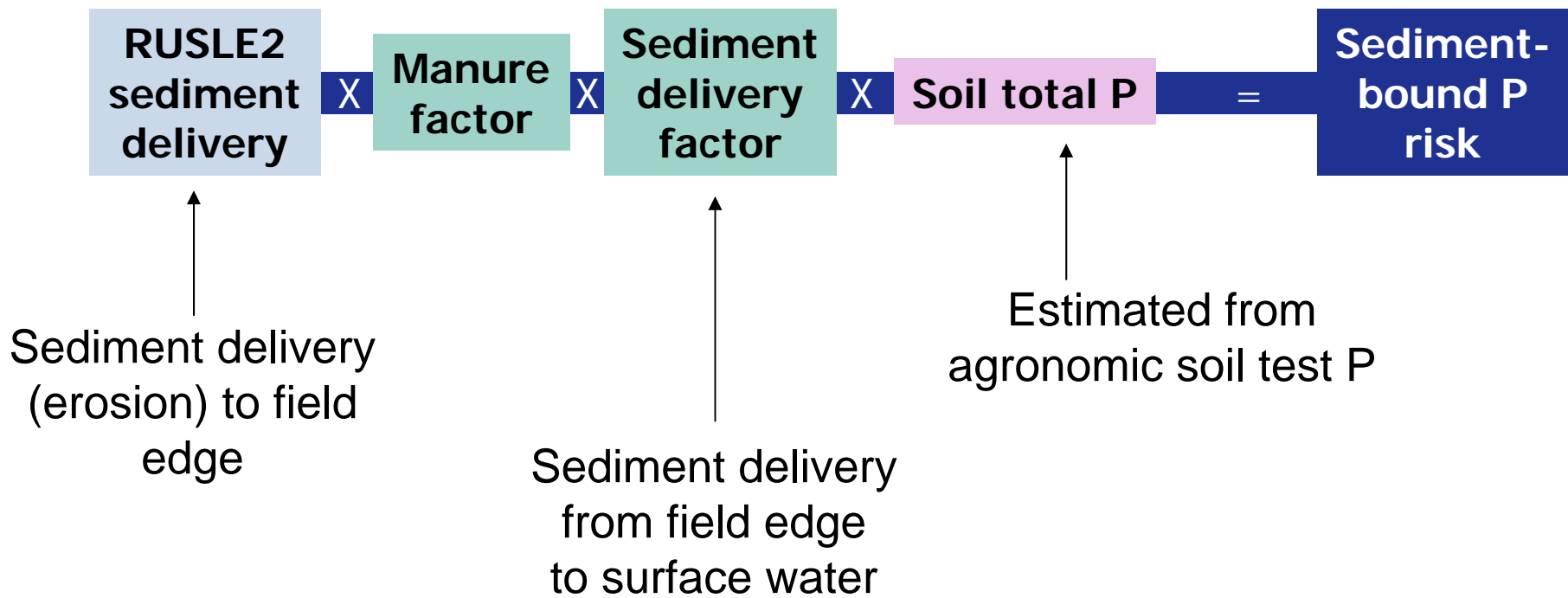


The Minnesota Phosphorus Index

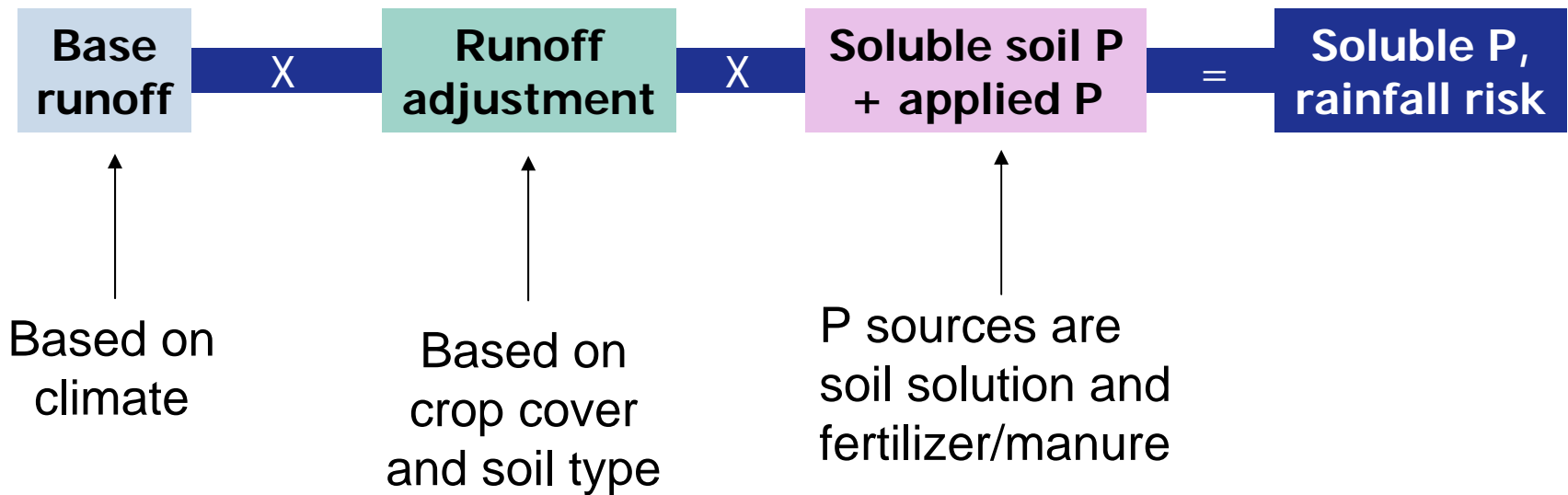
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Sediment-bound P Pathway



Soluble P in Rainfall Runoff Pathway



P in Snowmelt Pathway



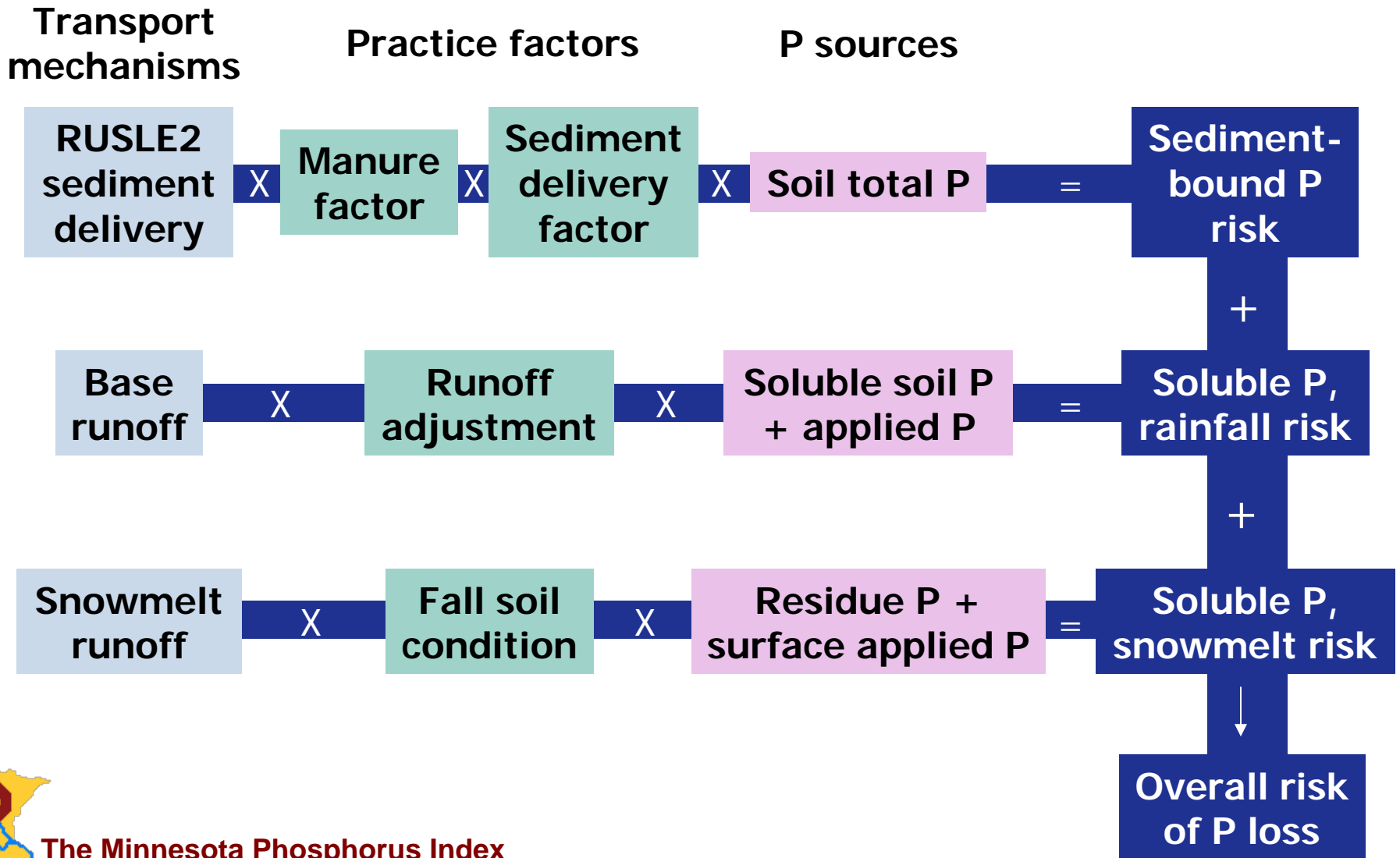
Intense fall tillage

→ rough soil surface and little residue P

→ low snowmelt P losses,
but high erosion and rainfall runoff P losses.



The Minnesota Phosphorus Index



Interpretations

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Total P Loss Risk	Relative Risk	Recommended Changes
0 to 1	Very Low	None
1 to 2	Low	Minor changes in management.
2 to 4	Medium	Small improvements in management may be necessary to lower the risk of P losses. The producer should avoid management practices that increase the risk of P losses.
4 to 6	High	Moderate improvements in management are recommended to reduce the risk of P losses.
>6	Very High	Multiple and possibly large improvements in management practices are recommended.



Uses of the MN P Index

Watershed

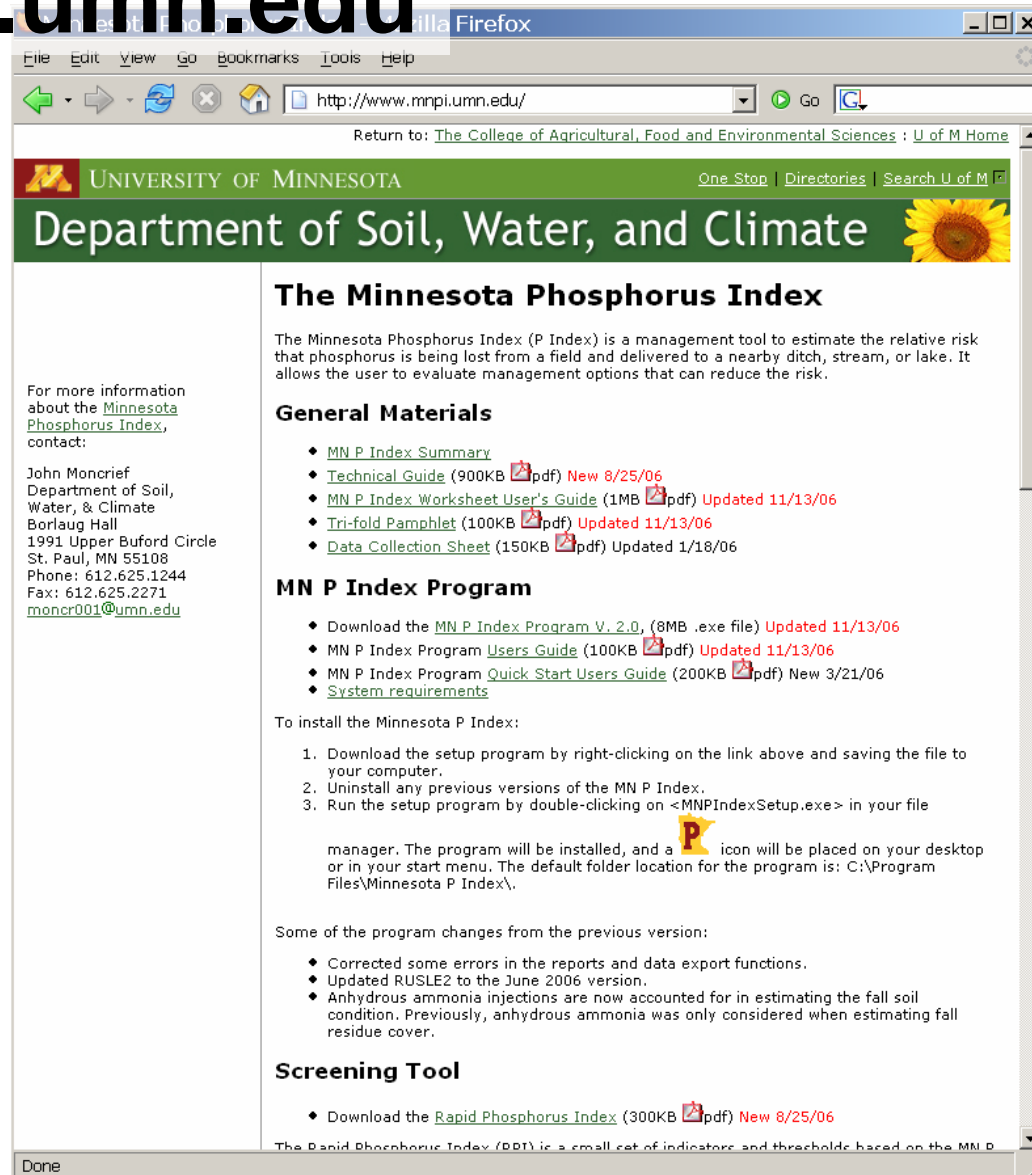
- Identify sources of P going into a lake or stream
- Determine site-specific practices to reduce P loss
- Target programs to improve surface water quality

Field or farm

- Plan nutrient management
- Compare alternative management scenarios
- Determine how and how much manure can be applied




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Department of Soil, Water, and Climate





The Minnesota Phosphorus Index

The Minnesota Phosphorus Index (P Index) is a management tool to estimate the relative risk that phosphorus is being lost from a field and delivered to a nearby ditch, stream, or lake. It allows the user to evaluate management options that can reduce the risk.


General Materials

- ◆ [MN P Index Summary](#)
- ◆ [Technical Guide](#) (900KB  pdf) **New 8/25/06**
- ◆ [MN P Index Worksheet User's Guide](#) (1MB  pdf) **Updated 11/13/06**
- ◆ [Tri-fold Pamphlet](#) (100KB  pdf) **Updated 11/13/06**
- ◆ [Data Collection Sheet](#) (150KB  pdf) **Updated 1/18/06**

MN P Index Program

- ◆ Download the [MN P Index Program V. 2.0](#), (8MB .exe file) **Updated 11/13/06**
- ◆ MN P Index Program [Users Guide](#) (100KB  pdf) **Updated 11/13/06**
- ◆ MN P Index Program [Quick Start Users Guide](#) (200KB  pdf) **New 3/21/06**
- ◆ [System requirements](#)


To install the Minnesota P Index:

1. Download the setup program by right-clicking on the link above and saving the file to your computer.
2. Uninstall any previous versions of the MN P Index.
3. Run the setup program by double-clicking on <MNPIndexSetup.exe> in your file manager. The program will be installed, and a  icon will be placed on your desktop or in your start menu. The default folder location for the program is: C:\Program Files\Minnesota P Index\.

Some of the program changes from the previous version:

- ◆ Corrected some errors in the reports and data export functions.
- ◆ Updated RUSLE2 to the June 2006 version.
- ◆ Anhydrous ammonia injections are now accounted for in estimating the fall soil condition. Previously, anhydrous ammonia was only considered when estimating fall residue cover.

Screening Tool

- ◆ Download the [Rapid Phosphorus Index](#) (300KB  pdf) **New 8/25/06**

The Rapid Phosphorus Index (RPI) is a small set of indicators and thresholds based on the MN P

Base Scenario

Erosion = 2 t/ac/yr

Blue Earth County

Soil:

Silt loam

SHG = B

4% OM

Olsen-P = 20 ppm

100 feet from field to water

Cropping system:

corn, 180 bu (following soybeans)

fall chisel

no contouring

no P fertilizer or manure

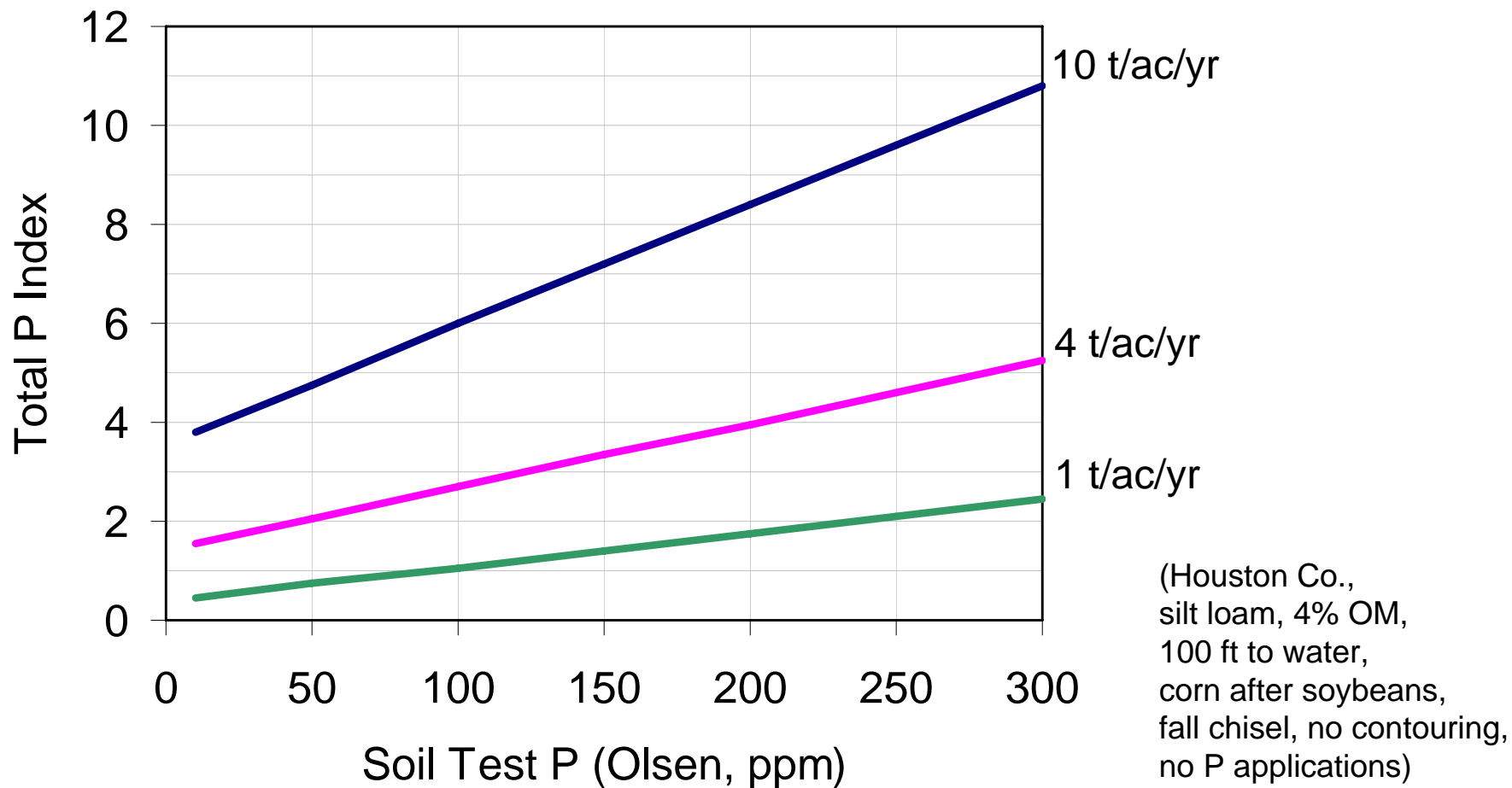


MN P Index Sensitivity Analysis

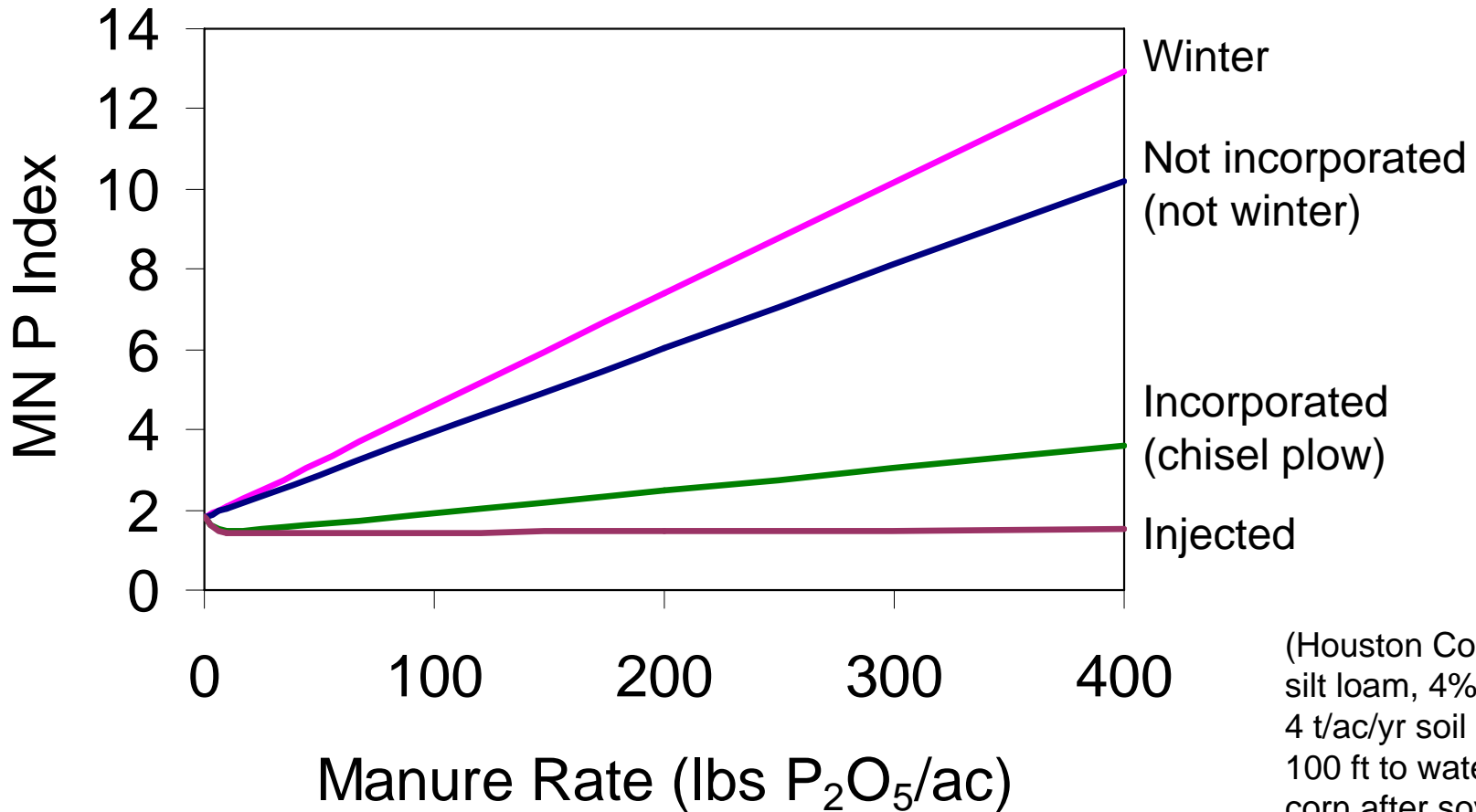
Total (Path 1 + Path 2 + Path 3)

Management alternatives	Low input value	High input value	Low MN PI result	High MN PI result
Base scenario			1.2 (0.8 + 0.1 + 0.3)	
1. Manure amount (non-winter, not incorporated)	50 lbs P ₂ O ₅	300 lbs P ₂ O ₅	2.1 (0.8 + 1.0 + 0.3)	6.7 (0.8 + 5.6 + 0.3)
2. Manure amount (winter)	50 lbs P ₂ O ₅	300 lbs P ₂ O ₅	2.4 (0.8 + 0.1 + 1.5)	8.3 (0.8 + 0.1 + 7.4)
3. Manure method and timing (100 lbs P ₂ O ₅)	<ul style="list-style-type: none"> - fall no incorporation - fall chisel - fall injected - winter 		3.0 (0.8 + 1.9 + 0.3)	
			1.8 (0.8 + 0.7 + 0.3)	
			1.2 (0.8 + 0.1 + 0.3)	
			3.5 (0.8 + 0.1 + 2.7)	
4. Soil test P	10 ppm Olsen-P	150 ppm Olsen-P	1.1 (0.7 + 0.0 + 0.3)	2.2 (1.3 + 0.7 + 0.3)
5. Climate (100 lbs P ₂ O ₅ , no incorporation)	Swift Co. (1.3 runoff)	Fillmore (2.3 runoff)	2.5 (0.8 + 1.3 + 0.3)	1.2 (0.8 + 0.1 + 0.3)
6. Tillage/erosion (50 lbs P ₂ O ₅ in fall and 50 lbs P ₂ O ₅ in winter)	Fall no tillage, 0.5 t/ac/yr	Fall moldboard plow, 4 t/ac/yr	4.3 (0.1 + 1.0 + 3.1)	2.8 (1.2 + 1.0 + 0.6)
7. Distance to water	10 feet	1000 feet	1.6 (1.3 + 0.1 + 0.3)	0.9 (0.5 + 0.1 + 0.3)

Effect of Erosion and Soil Test P



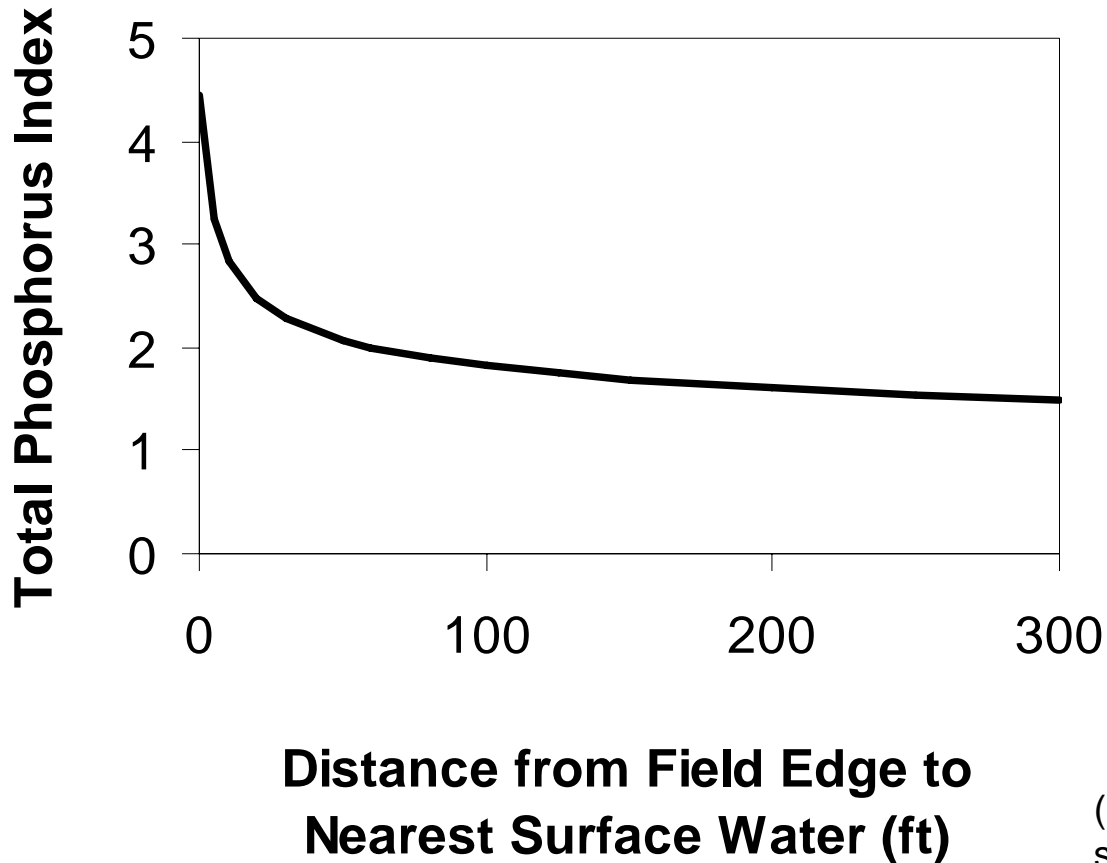
Effect of Manure Rate and Application



(Houston Co.,
silt loam, 4% OM,
4 t/ac/yr soil loss,
100 ft to water,
corn after soybeans,
fall chisel, no contouring)



Effect of Distance to Water



(Houston Co.,
silt loam, 4% OM,
4 t/ac/yr soil loss,
100 ft to water,
corn after soybeans,
fall chisel, no contouring)



Take home assignment

Calculate MN P Index for field

Explain input values

Is result low or high? If low, name a practice that should be avoided on this site to prevent P loss. If high, what could be done to reduce P loss risk?

