Proceedings of the 10th Annual Nutrient Management Conference

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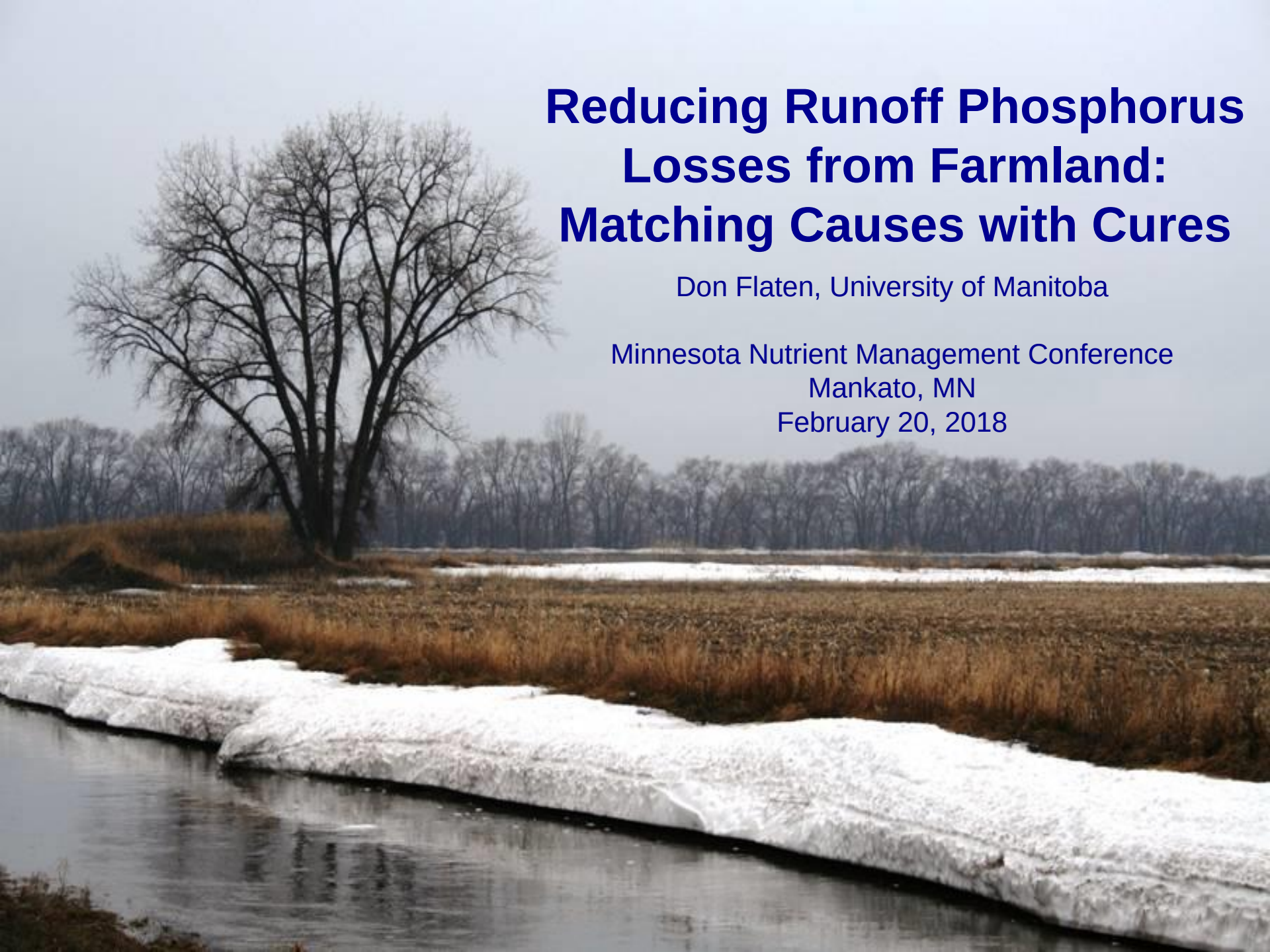


Reducing Runoff Phosphorus Losses from Farmland: Matching Causes with Cures

Don Flaten, University of Manitoba

Minnesota Nutrient Management Conference
Mankato, MN
February 20, 2018

Why is agricultural phosphorus important?

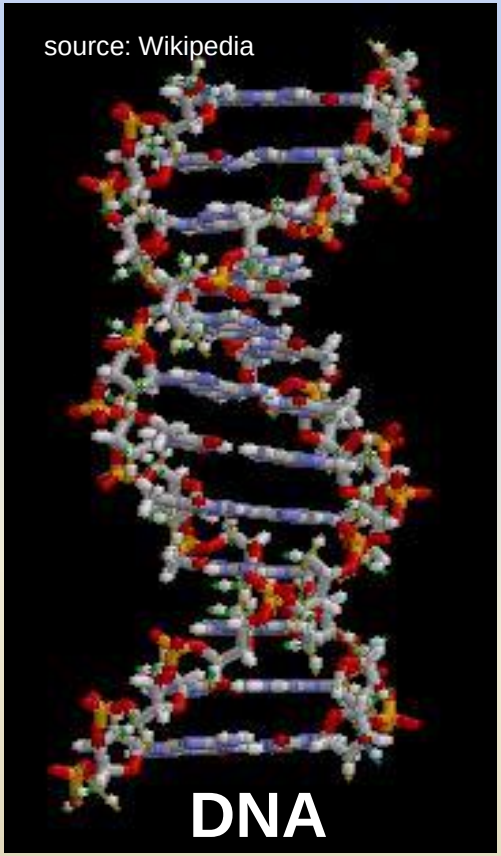
<u>Food</u> - P is a unique element that is essential for almost all life

Source: Christiansen/
Scientific American

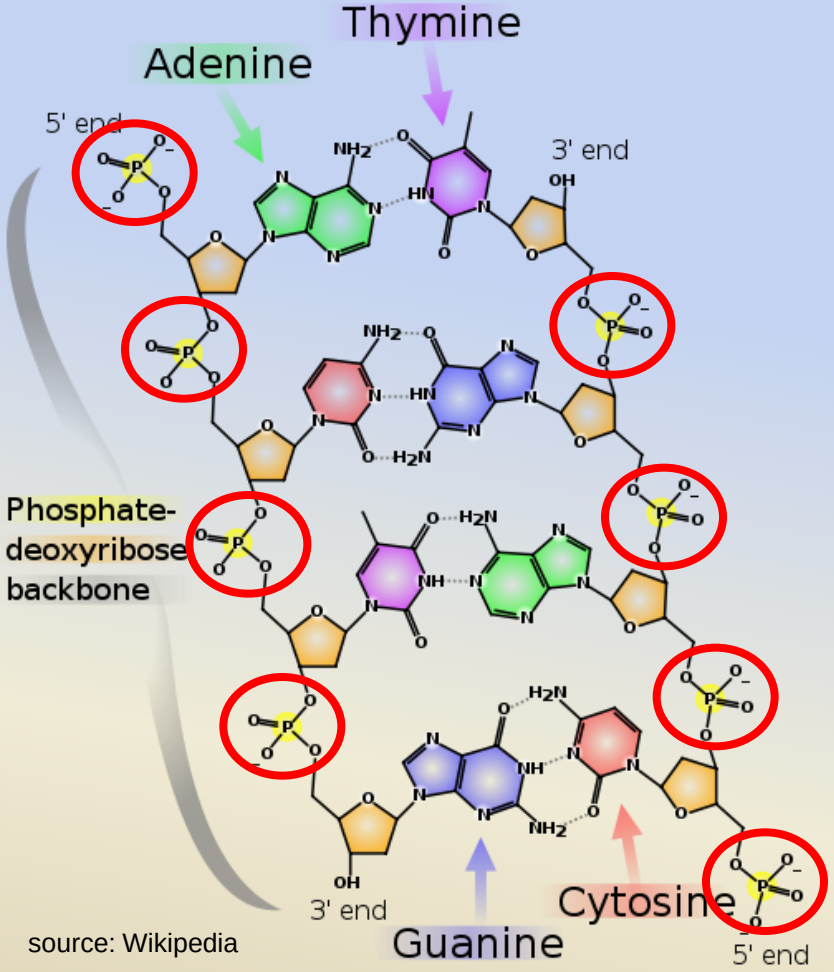
<u>Water</u> - small amounts of excess P cause big problems with water quality

Photo: MB Conservation

Examples of molecules that are vital for life and that require P

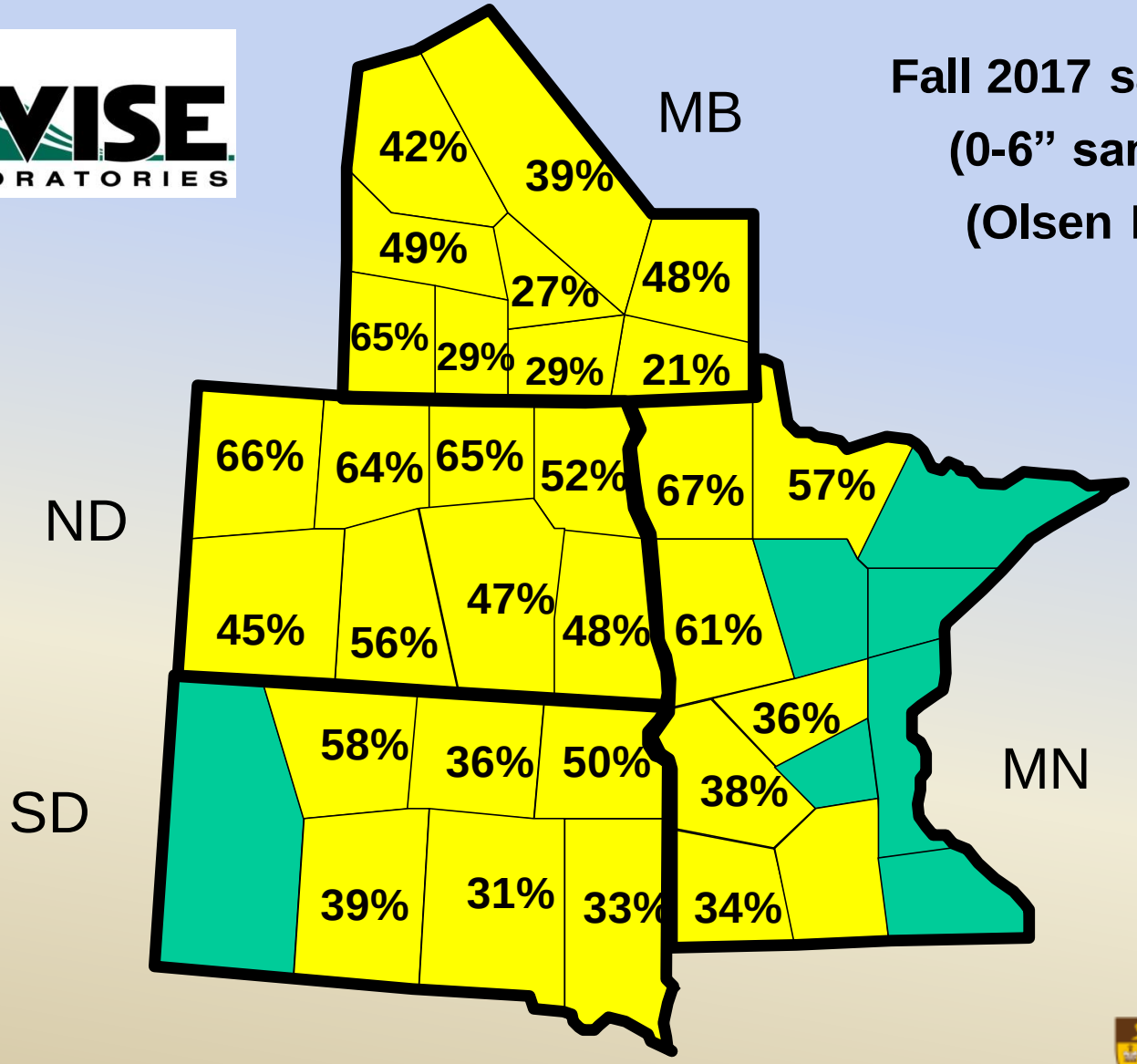


genetic coding & control



source: Wikipedia

% Soil Samples with Phosphorus less than 10 ppm



Fall 2017 samples
(0-6” samples)
(Olsen P test)

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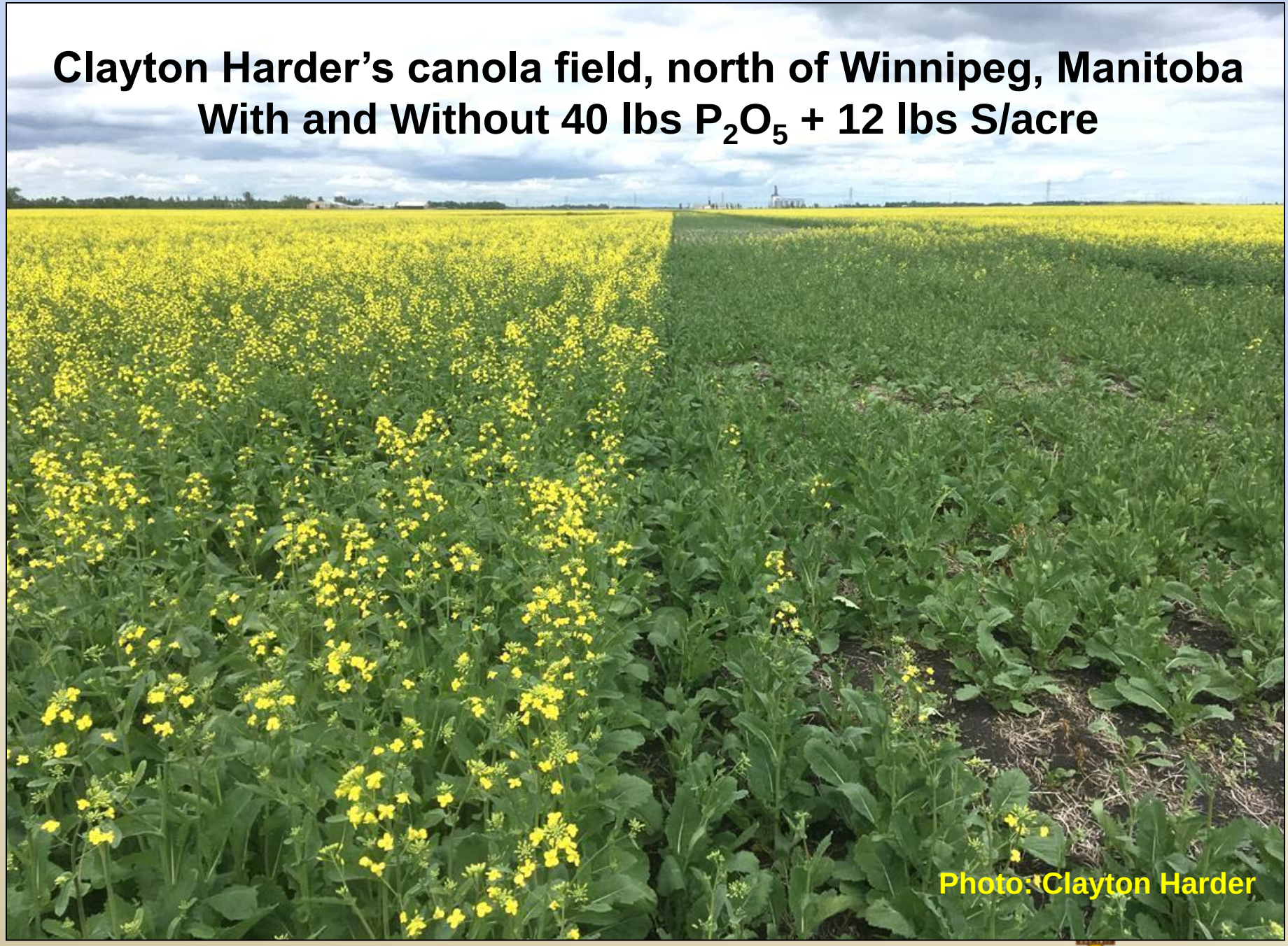
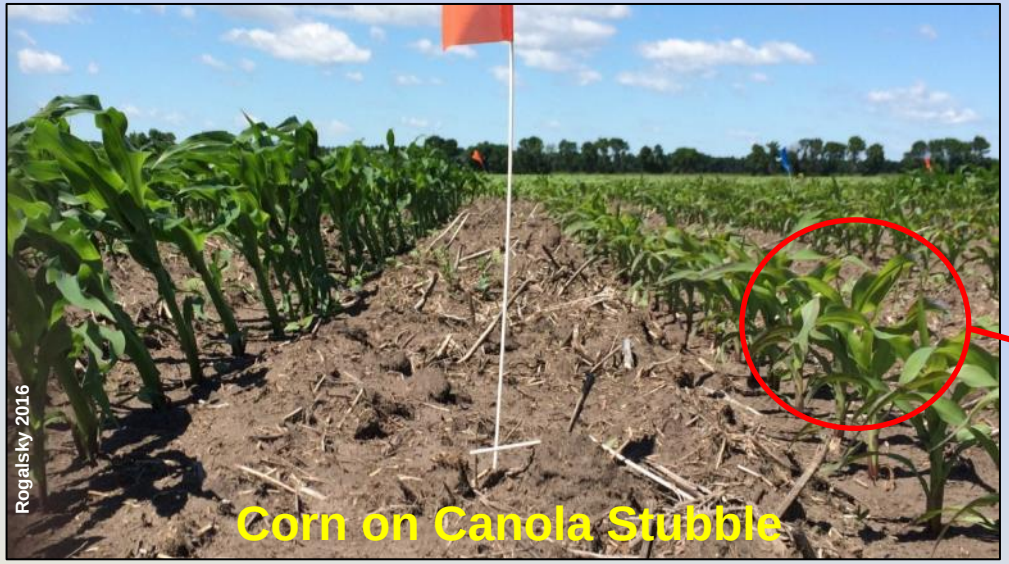
Clayton Harder's canola field, north of Winnipeg, Manitoba With and Without 40 lbs P_2O_5 + 12 lbs S/acre



Corn Response to Starter P in Manitoba



MAP 27 lb P_2O_5/ac

No P Check

P deficiency symptoms at V3

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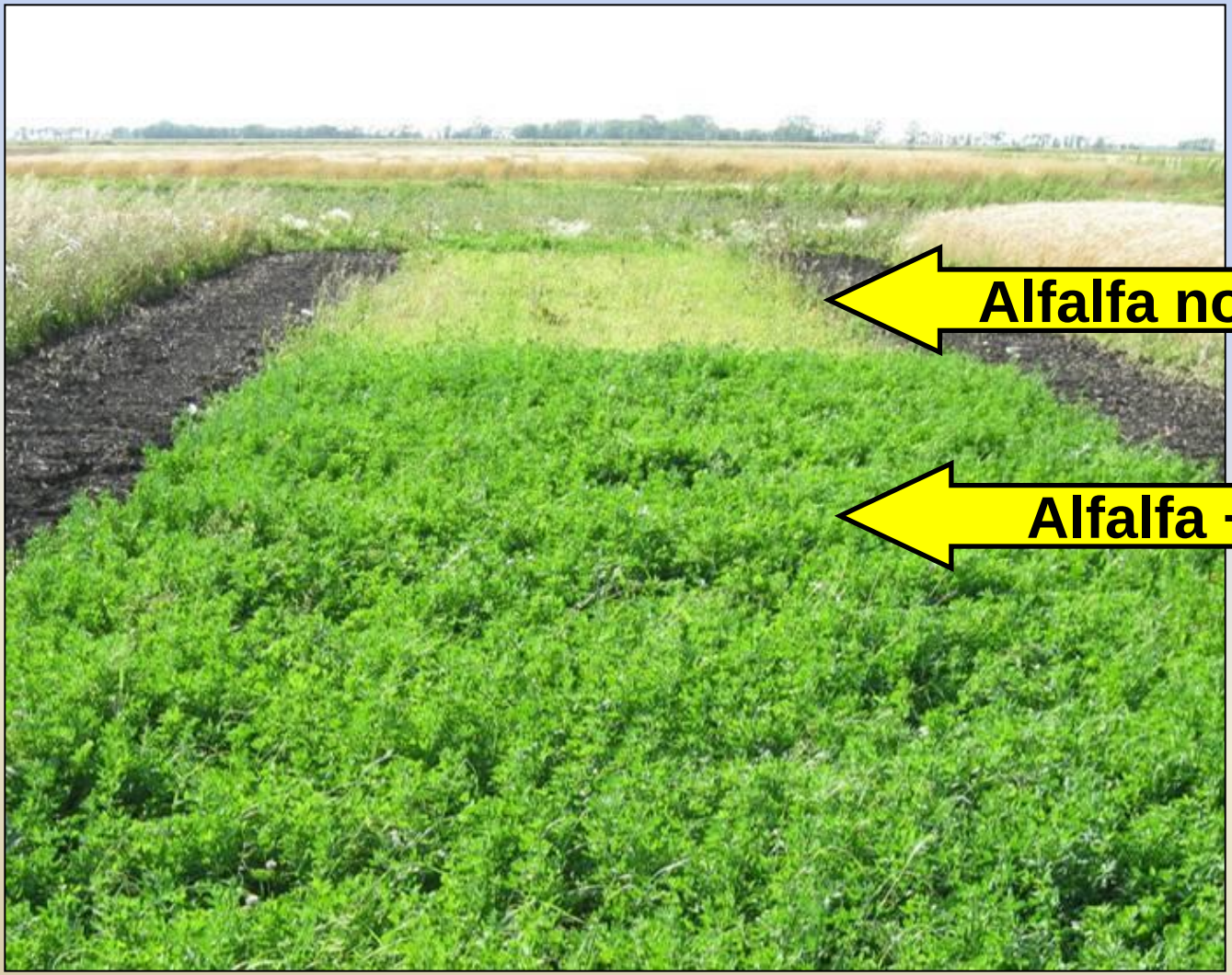
Dr. Martin Entz's long term organic rotation at U of MB demonstrates the importance of P replacement



Why is agricultural phosphorus important?

<u>Food</u> - P is a unique element that is essential for almost all life

Source: Christiansen/ Scientific American

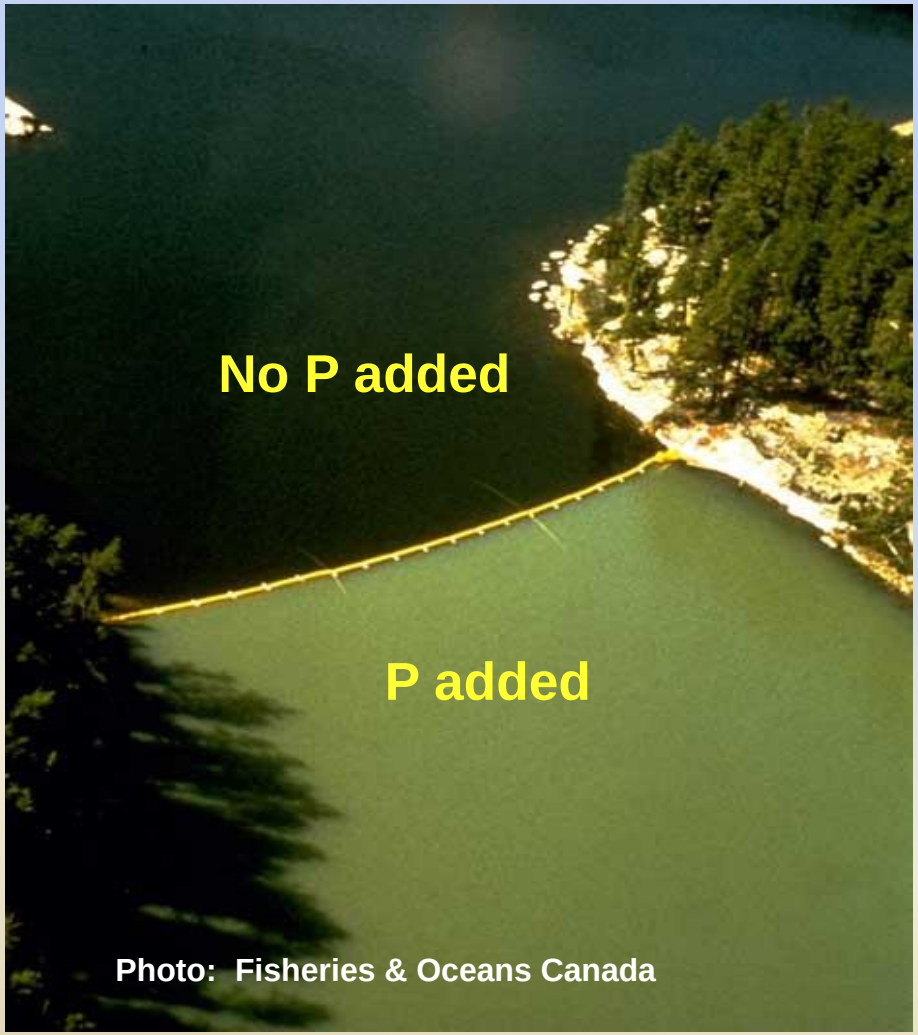
<u>Water</u> - small amounts of excess P cause big problems with water quality

Photo: MB Conservation

Small Amounts of P Cause Big Problems with Water Quality

"Eutrophication" occurs at very low conc'ns of P (20-50 ppb):

- Blue-green "algae" (cyanobacteria)
- Oxygen Depletion
  - Fish kills
- Nerve and Liver Toxins
  - Livestock & wildlife mainly at risk



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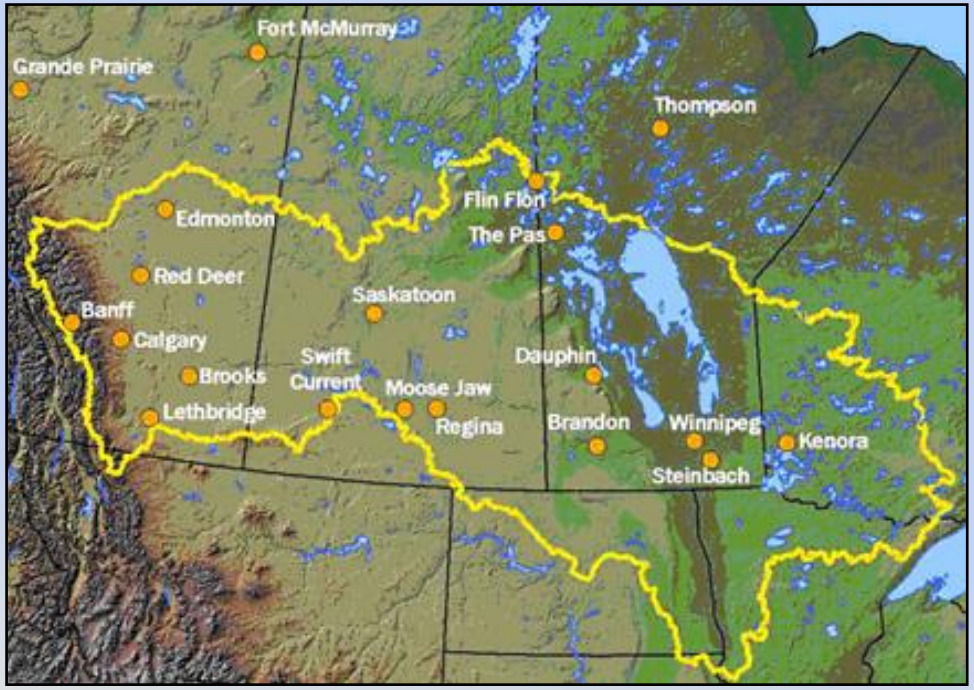
Water Quality is Important Everywhere

Lake Winnipeg Basin

- 2nd largest watershed in Canada (380,000 square miles)
- over 50% of the watershed is used for agriculture
- relatively dry climate, where runoff dominated by snow-melt over relatively level landscape
- home to 6.6 million people in 4 provinces and 4 states



Public Concern About Agricultural Nutrients and Water Quality is Increasing

WINNIPEG FREE PRESS, TUESDAY, DECEMBER 10, 2002 LOCAL A11

Lake Winnipeg pollution blamed on farm runoff

By Helen Fallding

FARM runoff may be the biggest source of pollution in Lake Winnipeg and the province's southern rivers, according to a new study by Manitoba Conservation.

About three-quarters of the phosphorus added to the Assiniboine and Red rivers as they passed through Manitoba from 1994 to 2001 had washed off the land. The figures are almost as bad for nitrogen, which combines with phosphorus to promote the growth of algae blooms.

The blooms are bad for fish and wildlife and can produce dangerous toxins.

University of Winnipeg biologist Eva Pip, who has read the report, said many people assumed municipal sewage was the biggest culprit behind the deteriorating health of Lake Winnipeg.

"There's always been finger-pointing... but now that we have some actual numbers, this gives us a starting point which we can use to start addressing the problem."

In a previous study completed last year, Manitoba Conservation staff concluded that nitrogen and phosphorus loads in Lake Winnipeg increased 13 and 10 per cent respectively over the last three decades as a result of changes in the Red River basin.

"Those are very significant values in a short time," Pip said.

A Lake Winnipeg snail recently declared endangered is an early warning sign that the lake is in trouble, she said.

Lake Winnipeg has had very bad algae blooms for the last five years, including some this summer at Victoria Beach and on the western shore as far north as the Jackhead reserve, Pip said.

She is calling for more regulation of the nutrients farmers apply to their land.

The latest Manitoba Conservation study, led by Alex Bourne, did not separate the effects of chemicals from manure or natural sources.

Manitoba's livestock farmers are required to monitor the amount of nitrogen they apply in manure, but phosphorus is regulated only in Quebec.

Livestock farmers have long complained they are subject to much greater scrutiny than the majority of their neighbours who use chemical fertilizer — soon to be regulated in Ontario after the Walkerton contaminated water scandal.

Keystone Agricultural Producers vice-president David Rolfe said quality assurance programs that require farmers to better manage their fertilizer if they want to be certified might be a better approach than more regulation.

Manitoba's water quality manager Dwight Williamson said a discussion paper should be out within six months on setting water quality objectives in the Assiniboine, Souris and Qu'Appelle rivers.

Manitoba Agriculture staff already have extension programs encouraging farmers to invest in soil testing so they don't waste fertilizer and to use low-till agriculture to keep water on the land. "We do this all the time," John Heard said.

When fertilizer prices are high, farmers have more incentive to keep their fertilizer use to a minimum, he said.

Pip said the move to drain more farmland — supported by increased government dollars — is also contributing to runoff problems.

Manitoba has no control over pollutants in the rivers before they cross the U.S. and Saskatchewan borders.

Winnipeg's wastewater treatment plants and sewers added more than 4,000 tonnes of nitrogen to the Red River a year, according to the Manitoba Conservation study — 11 per cent of the total load in the river at Selkirk.

Pip said the nutrient load will be worse now that the city has added orthophosphate to drinking water to deal with elevated lead levels from old pipes.

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MICHAEL MOORE / ASSOCIATED PRESS ARCHIVES

Over-fertilizing of fields is common in livestock-abundant areas.

Over-fertilizing polluting province's water bodies

By Helen Fallding

FARMERS in livestock-intensive areas of Manitoba are over-fertilizing their land, potentially contributing to water pollution as far away as Lake Winnipeg.

In an $81,000 study for the Manitoba Livestock Manure Management Initiative, DGH Engineering found the nutrients nitrogen and phosphorus building up in soils in the rural municipalities of Hanover and La Broquerie near Steinbach.

In two other municipalities where there is less livestock production — Roland, south of Carman, and Sifton in western Manitoba — there was less buildup.

Excess nutrients not taken up by crops wash off fields into streams and rivers, with Red River nutrients eventually working their way to Lake Winnipeg. The lake has been plagued with bad algae blooms in recent years that are toxic to fish and wildlife and interfere with the enjoyment of summer beaches.

DGH senior engineer Doug Small said farmers applying manure to their fields from livestock barns are also applying some chemical fertilizer.

In Roland, fertilizer inputs average 85 kilograms per hectare of nitrogen and 14 kilograms per hectare of phosphorus, but the numbers in Hanover are 98 for nitrogen and 32 for phosphorus.

"We're not saying it's an immediate serious crisis," Small said. "There's an issue here that needs to be addressed for long-term sustainability."

Only about five per cent of Manitoba farmland receives animal manure.

Small said the obvious solution is for farmers using manure to cut back more on expensive chemical fertilizers — something that would save them money and conserve the natural gas used to make fertilizer.

The owners of large livestock operations are required by the province to test the soil where their manure is applied to monitor levels of nitrogen, but phosphorus is not yet regulated.

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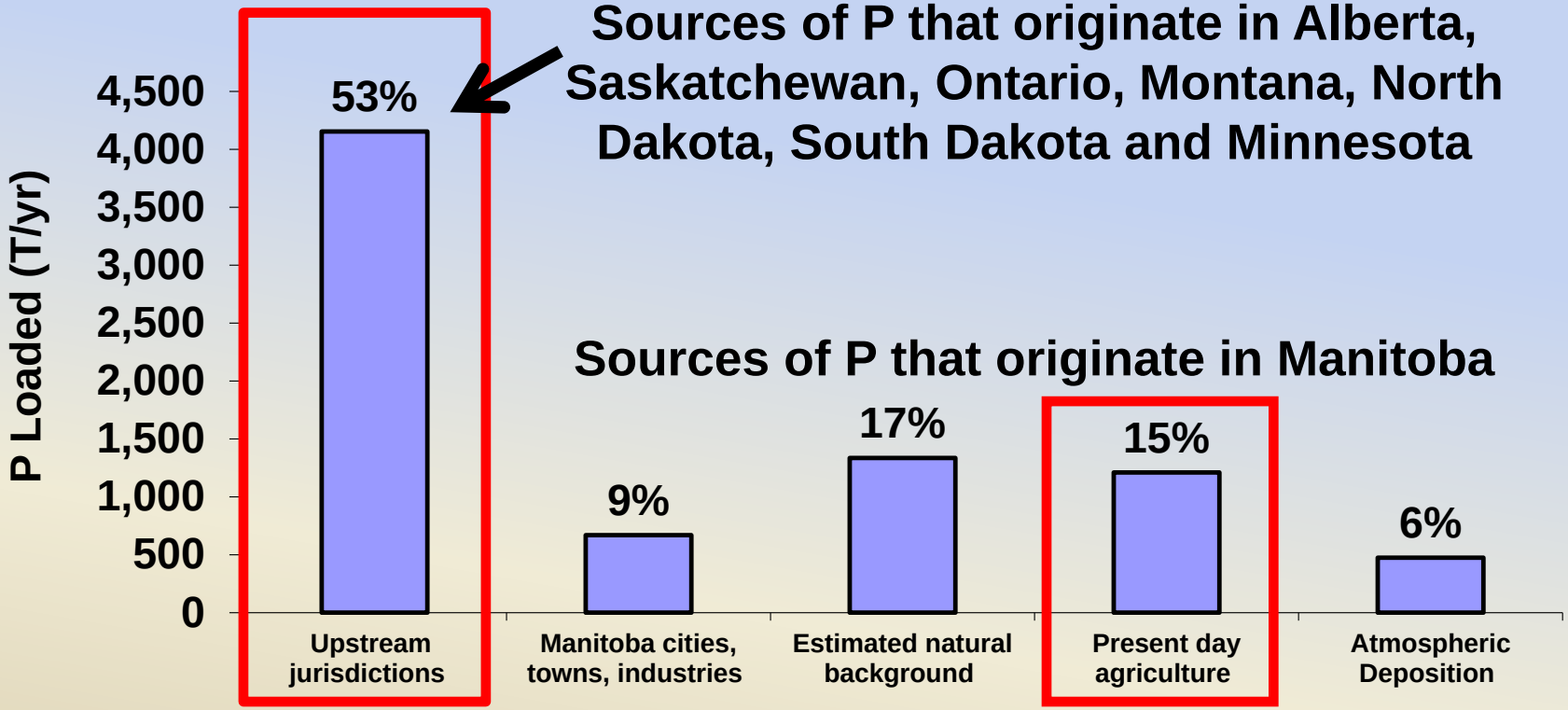
Lake Winnipeg's P comes from many relatively small sources



Manitoba Water Stewardship. 2006. Questions and Answers: Water Quality Management Zones for Nutrients (data are estimated for 1994-2001)

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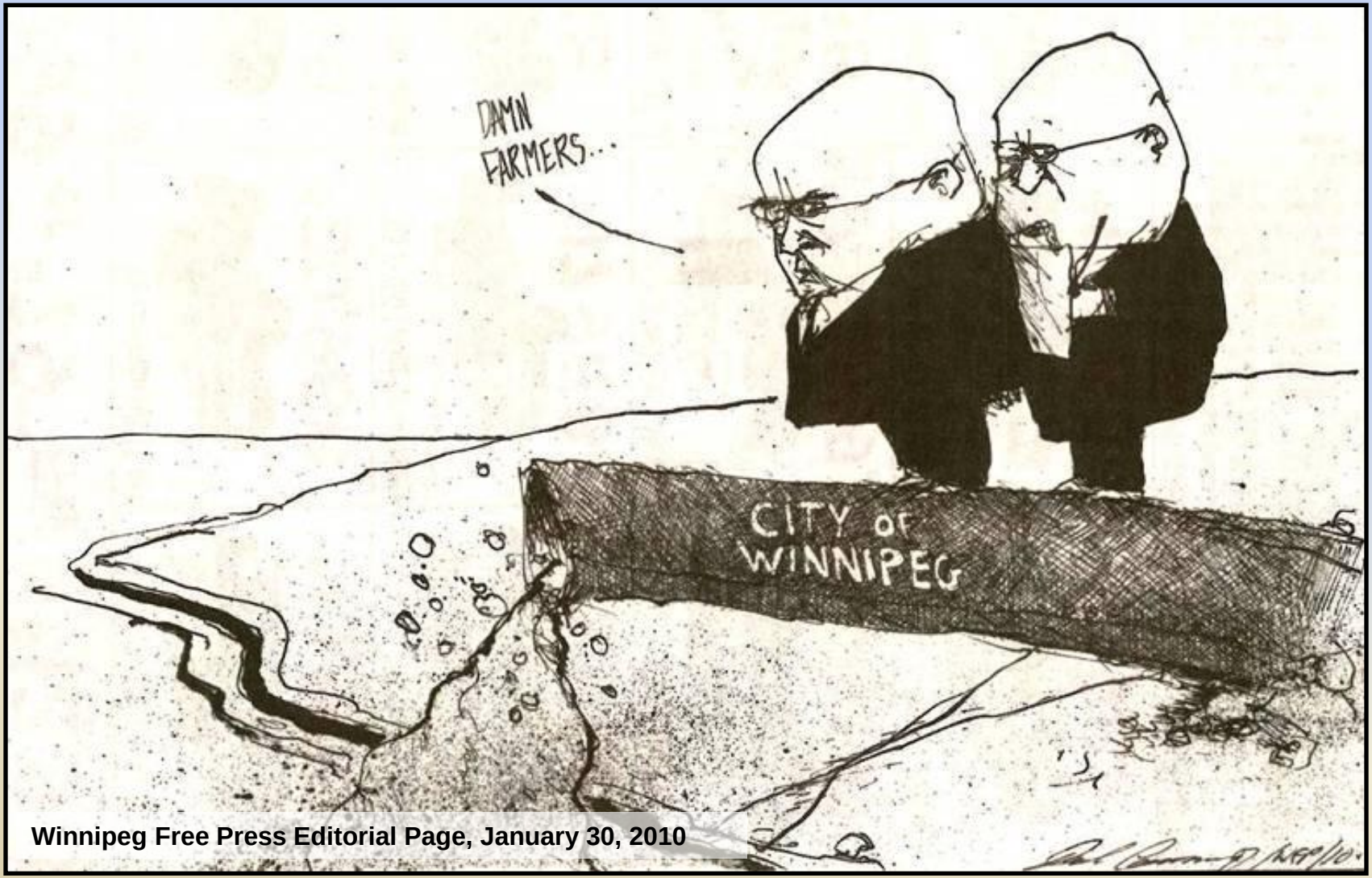
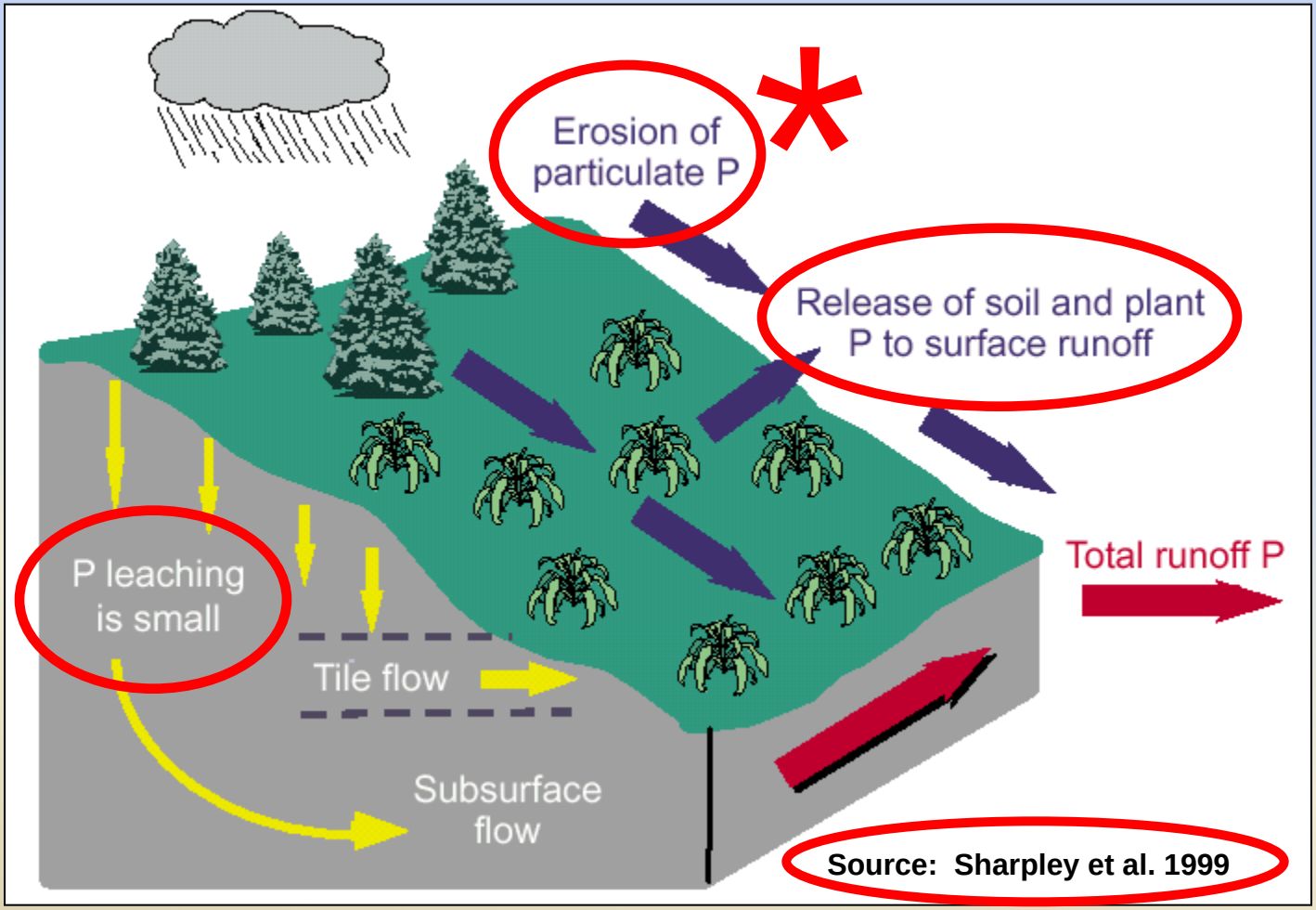
The “Blame Game” …



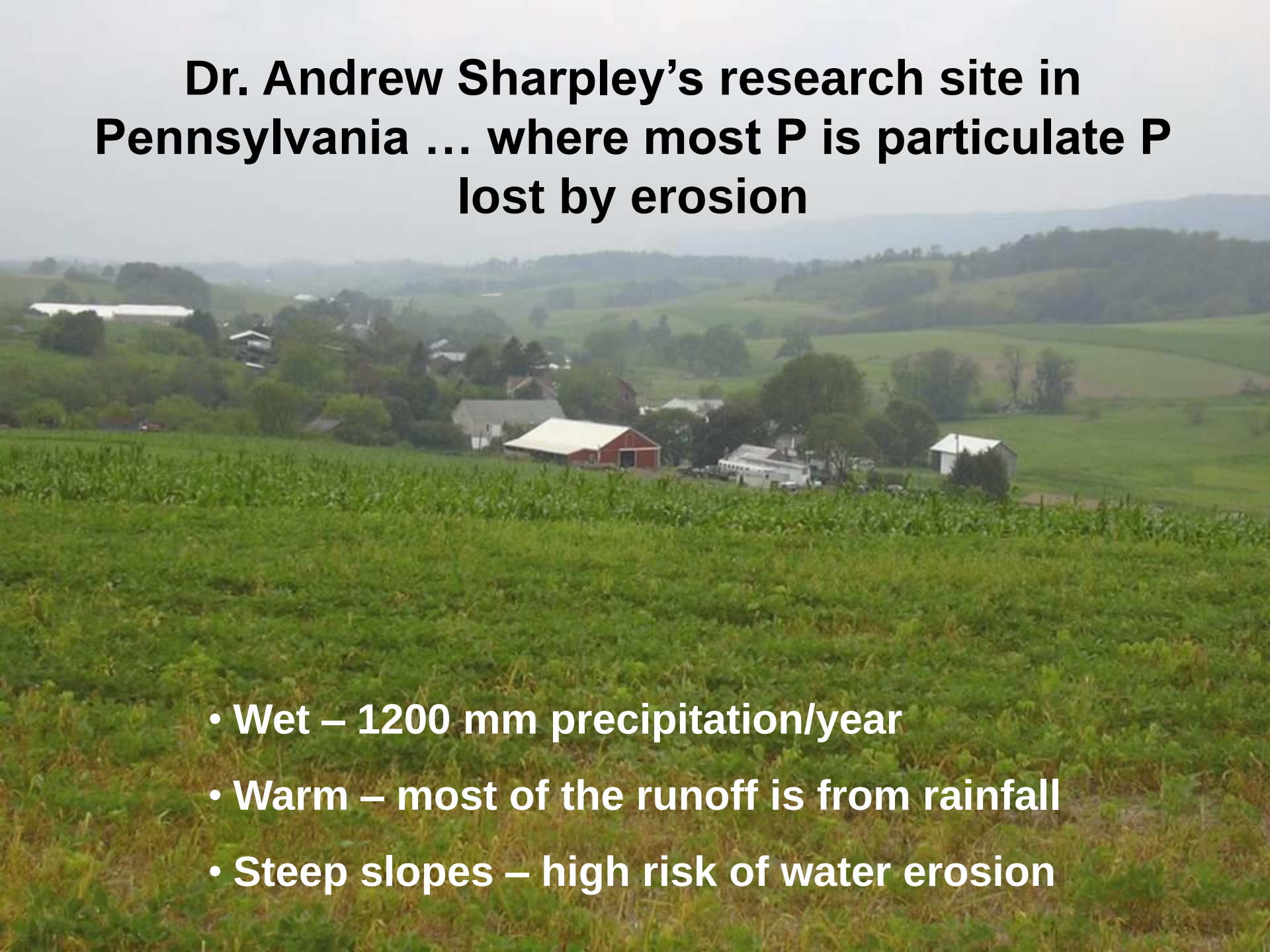
Winnipeg Free Press Editorial Page, January 30, 2010

How can agriculture reduce its share of P loading to surface water?

Processes that Transport P to Water

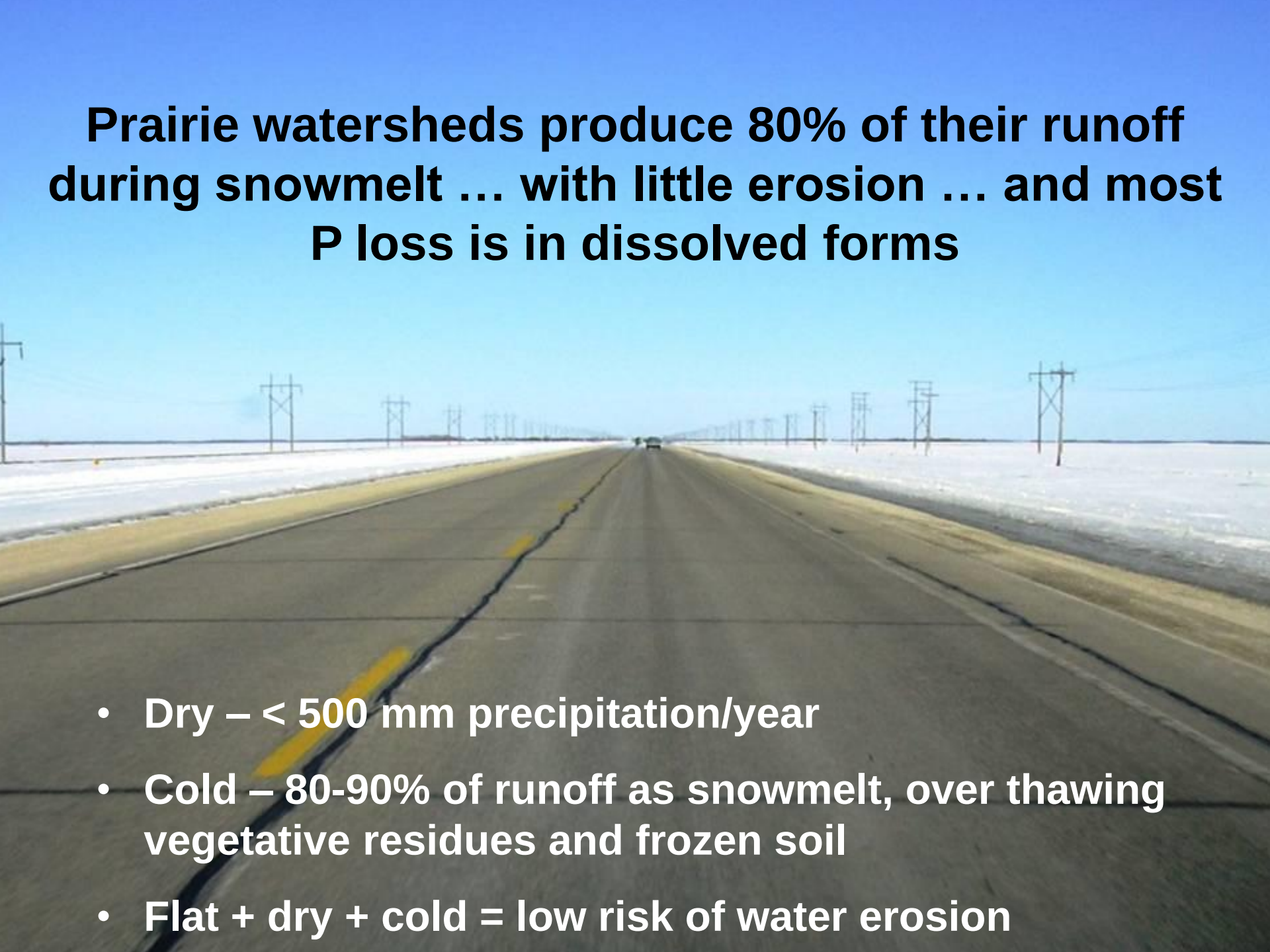


Dr. Andrew Sharpley's research site in Pennsylvania … where most P is particulate P lost by erosion



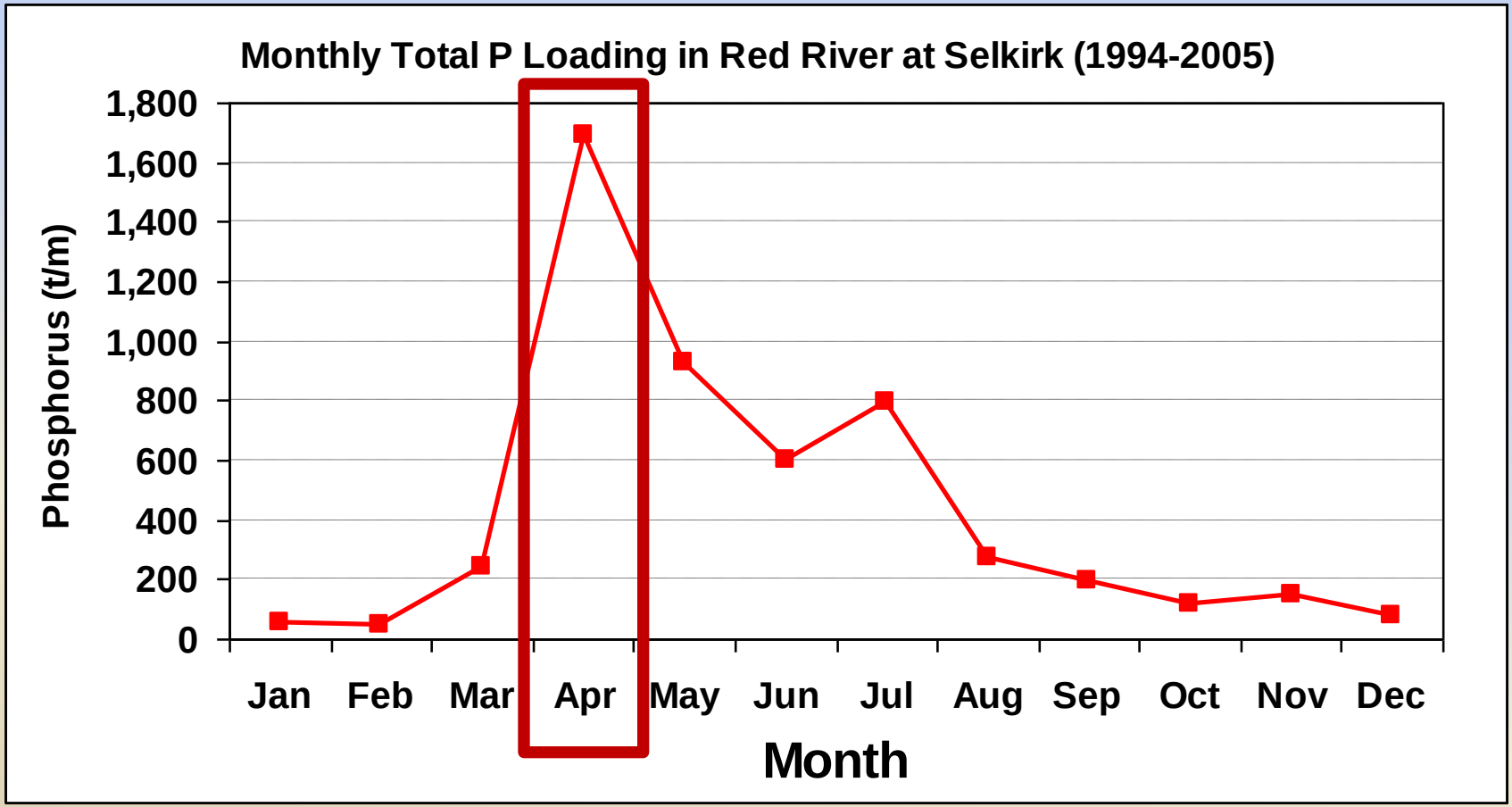
- Wet – 1200 mm precipitation/year
- Warm – most of the runoff is from rainfall
- Steep slopes – high risk of water erosion

Prairie watersheds produce 80% of their runoff during snowmelt … with little erosion … and most P loss is in dissolved forms



- Dry – < 500 mm precipitation/year
- Cold – 80-90% of runoff as snowmelt, over thawing vegetative residues and frozen soil
- Flat + dry + cold = low risk of water erosion

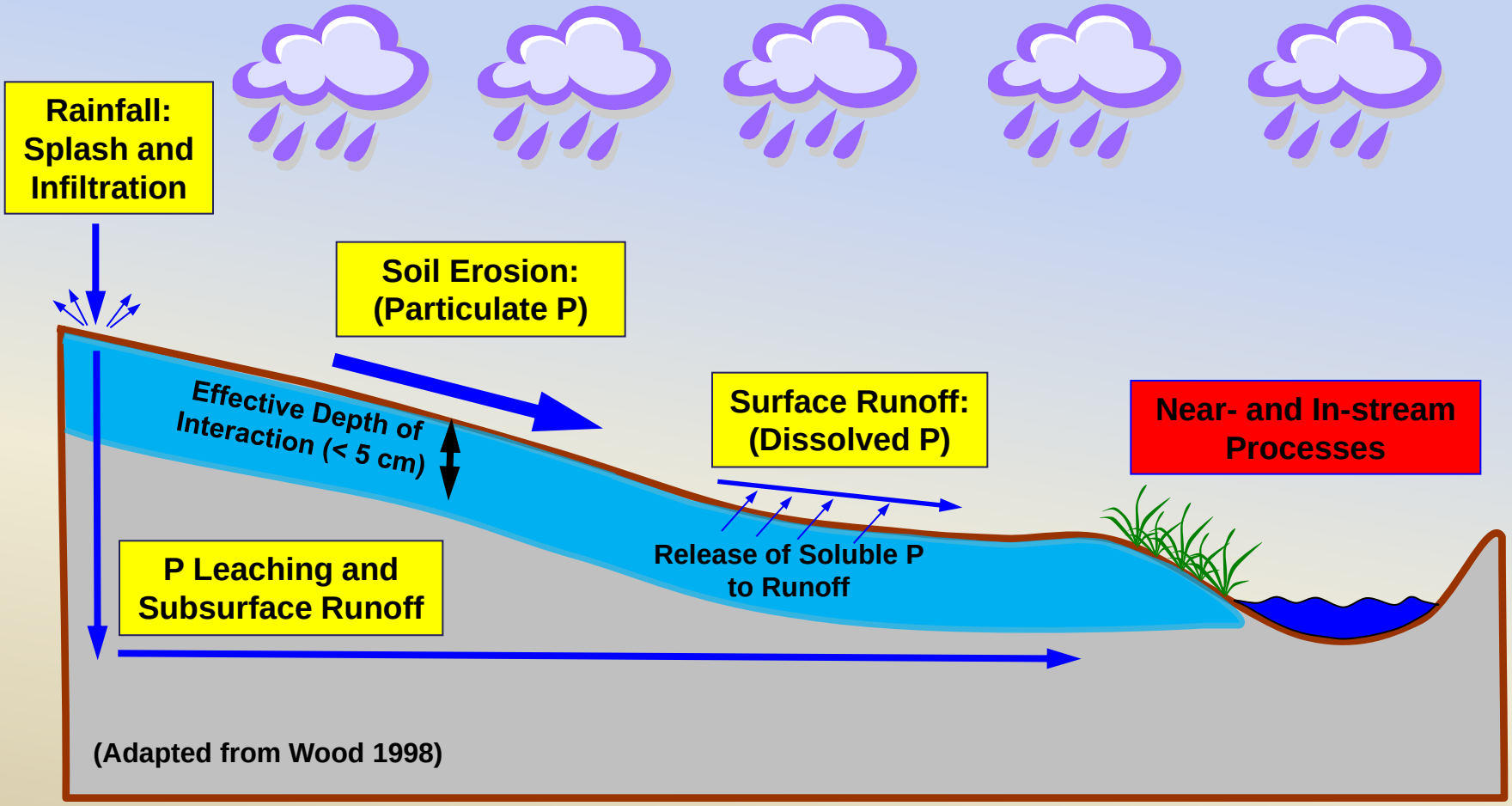
Runoff and nutrient transport: Most P loading to Lake Winnipeg occurs during snowmelt



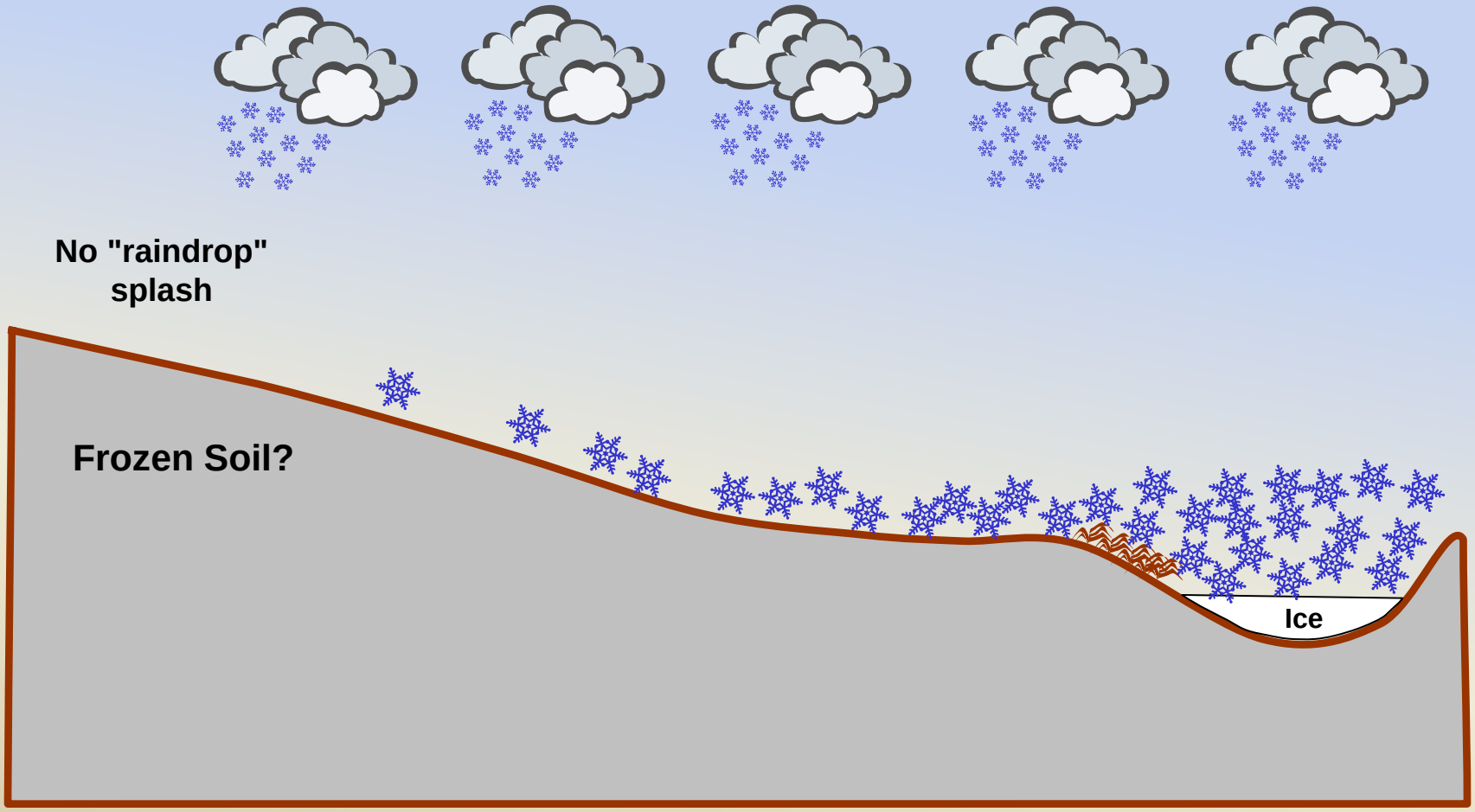
Lake Winnipeg Stewardship Board Report, December 2006

What are the differences between rainfall runoff and snowmelt runoff processes for P loss in the Prairies?

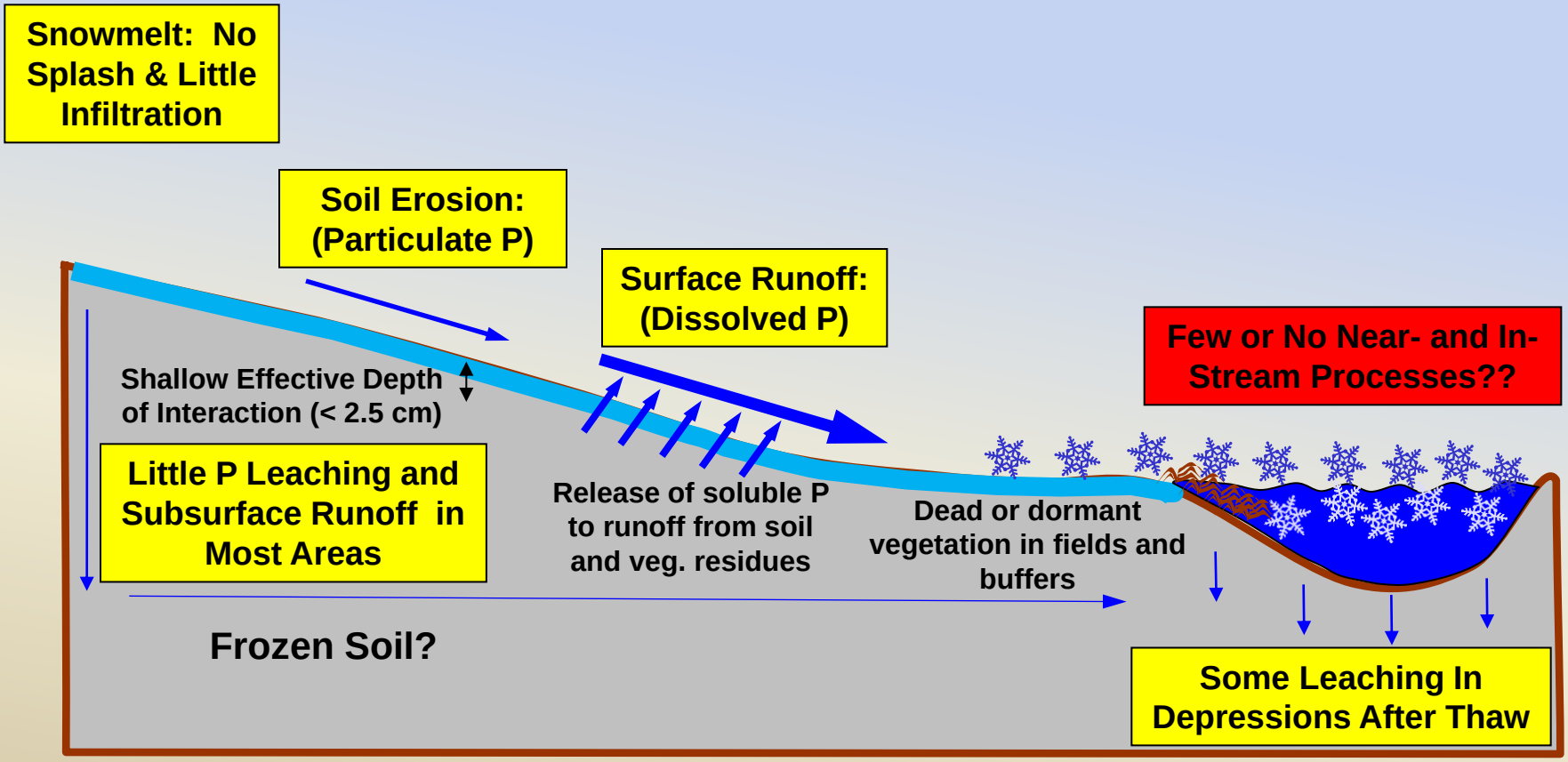
Rainfall Runoff System for Nutrient Loss



Snowmelt Runoff System for Nutrient Loss
Phase 1: Snow Accumulation & Redistribution



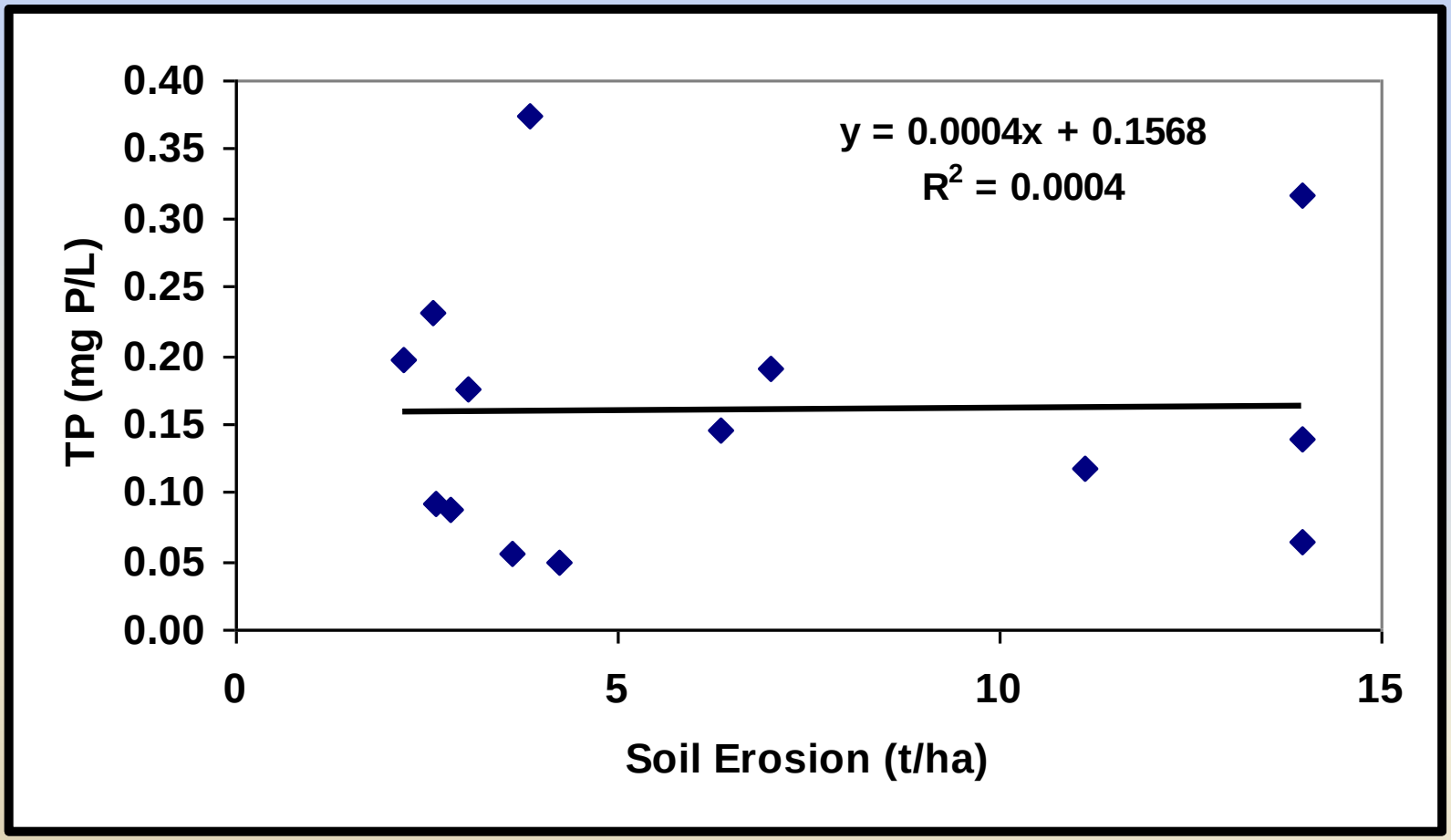
Snowmelt Runoff System for Nutrient Loss
Phase 2: Snowmelt



Depth of interaction between runoff and soil is shallow during snowmelt over frozen soil

Photos: David Lobb

Erosion risk is not related to river P concentrations in 14 regional Manitoba watersheds



Salvano et al. JEQ 2009

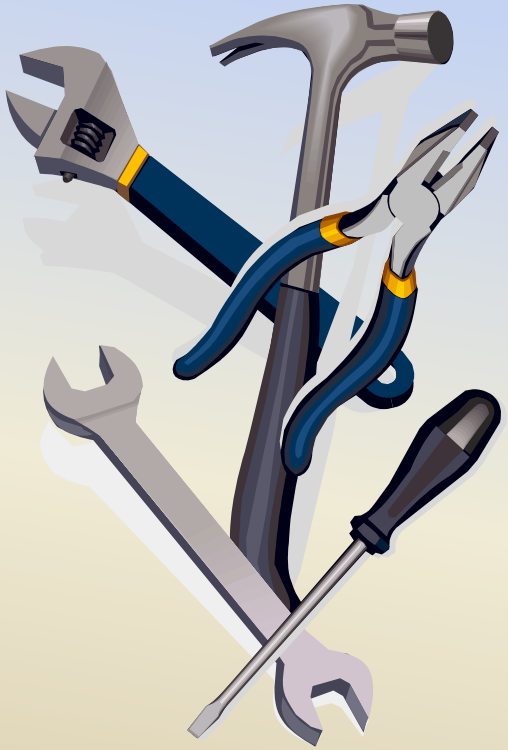
Eastern Manitoba landscape in late spring: Red River Valley's closed basins show little erosion

Prairie "pothole" landscape in spring also reveals low rates of erosion in Western Manitoba

Photo: M. Conly, National Water Research Insitute

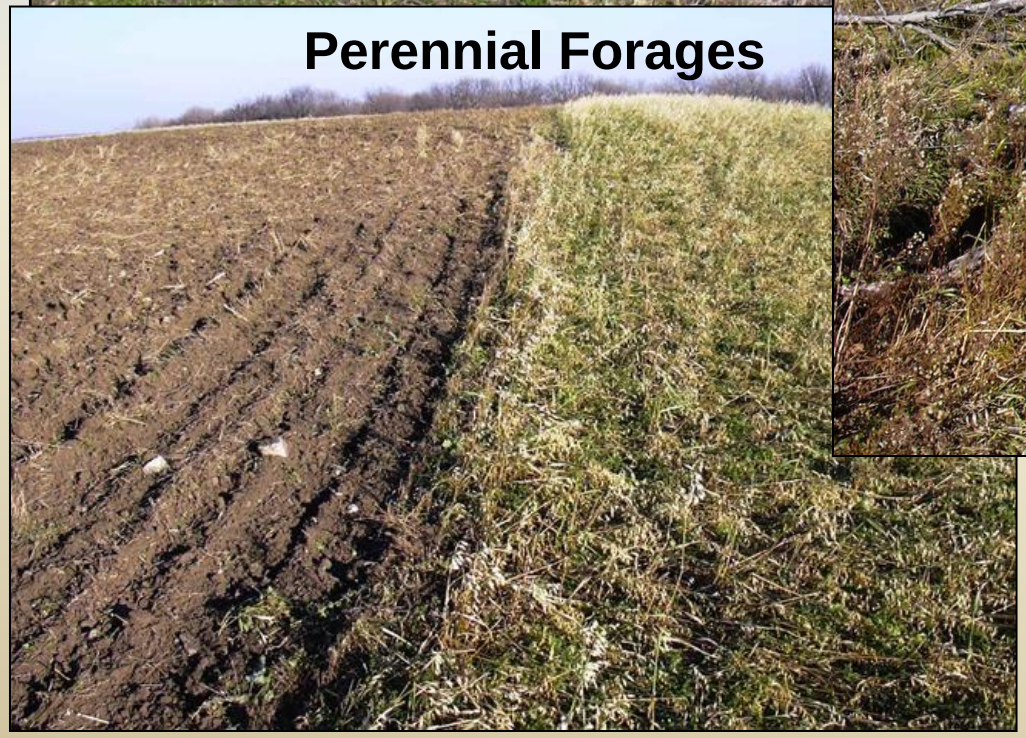
How does the dominance of <u>snowmelt</u> runoff affect the performance of beneficial management practices (BMPs) that we generally use for controlling P loss in <u>rainfall</u> dominated runoff?

What beneficial management practices (BMPs) do we expect farmers to use?



- Source BMPs (in field)
  - Rate, placement, timing of manure and synthetic fertilizer application
- Transport BMPs (field to stream)
  - Conservation tillage
  - Vegetated buffers
  - Cover crops and perennial forage
  - Constructed wetlands and small reservoirs … to manage <u>water</u>

Evaluation of traditional soil and water conservation BMPs ... South Tobacco Creek Model Watershed



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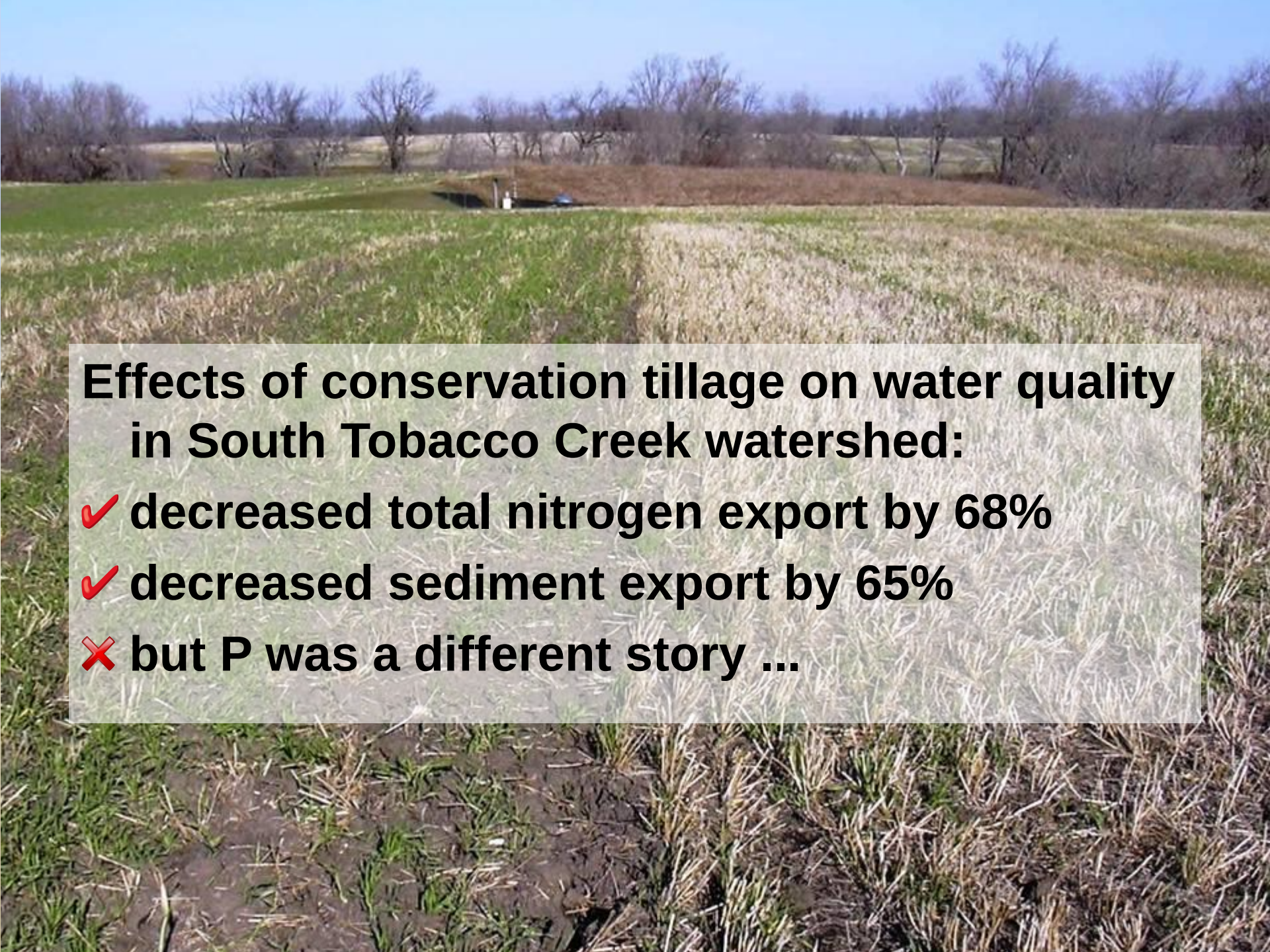
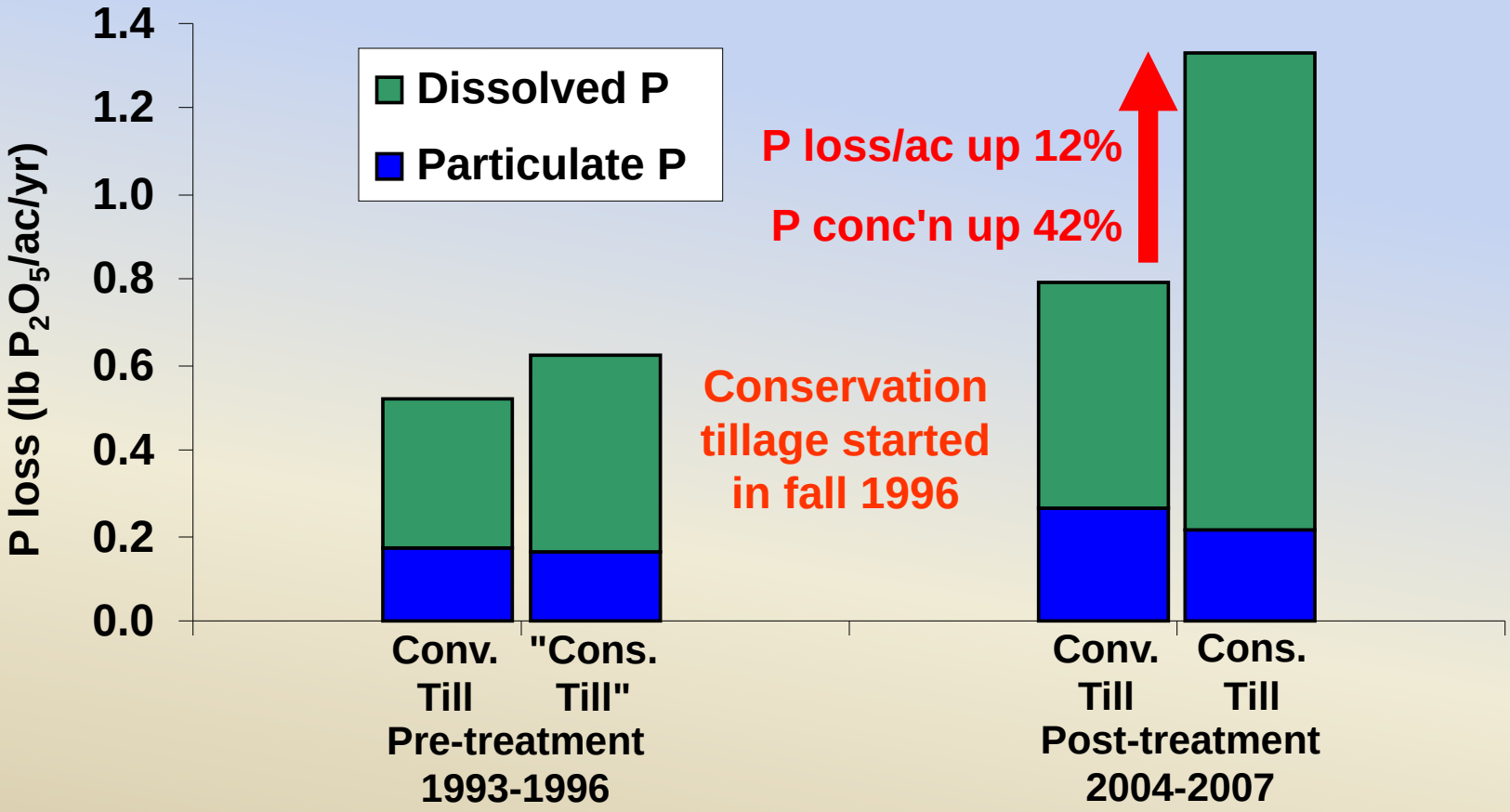


Effects of conservation tillage on water quality in South Tobacco Creek watershed:

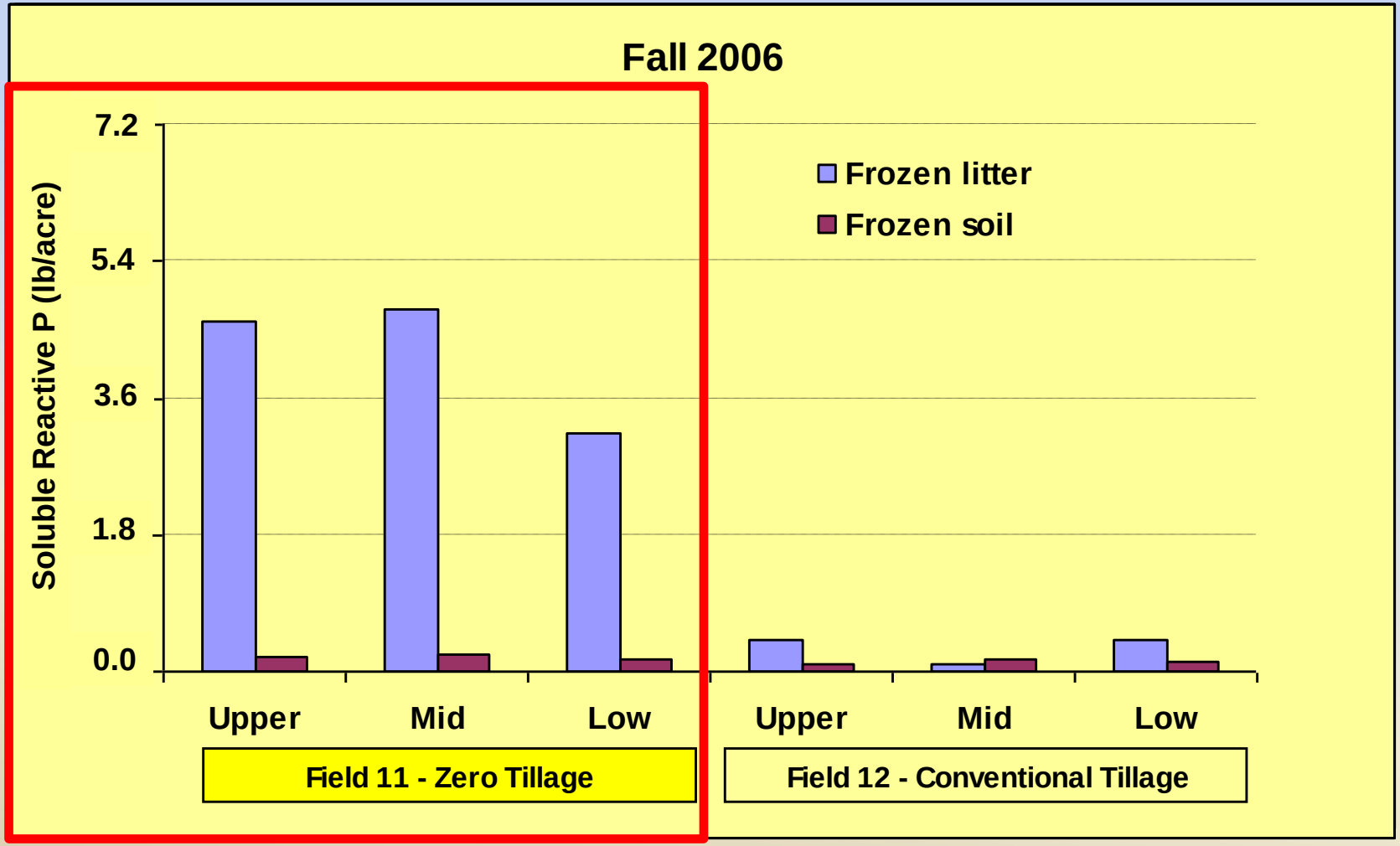
- ✔ **decreased total nitrogen export by 68%**
- ✔ **decreased sediment export by 65%**
- ✘ **but P was a different story ...**

South Tobacco Creek twin watershed study: P loss from conservation tillage was greater than from conventional tillage ... because erosion of soil particles was a minor contributor to P loss in both systems



(Tiessen et al. JEQ 2010)

Soluble Reactive Phosphorus (SRP) from Frozen & Thawed Vegetative Residues & Soil Collected in Late Fall



- South Tobacco Creek watershed project, Kumaragamage et al. 2007

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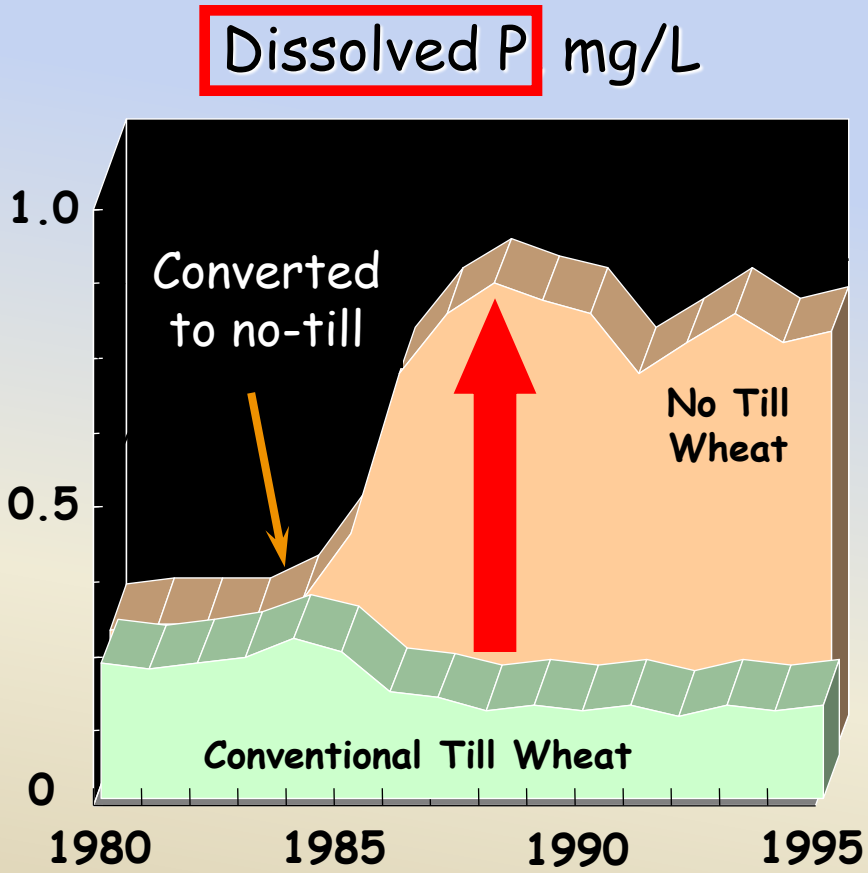
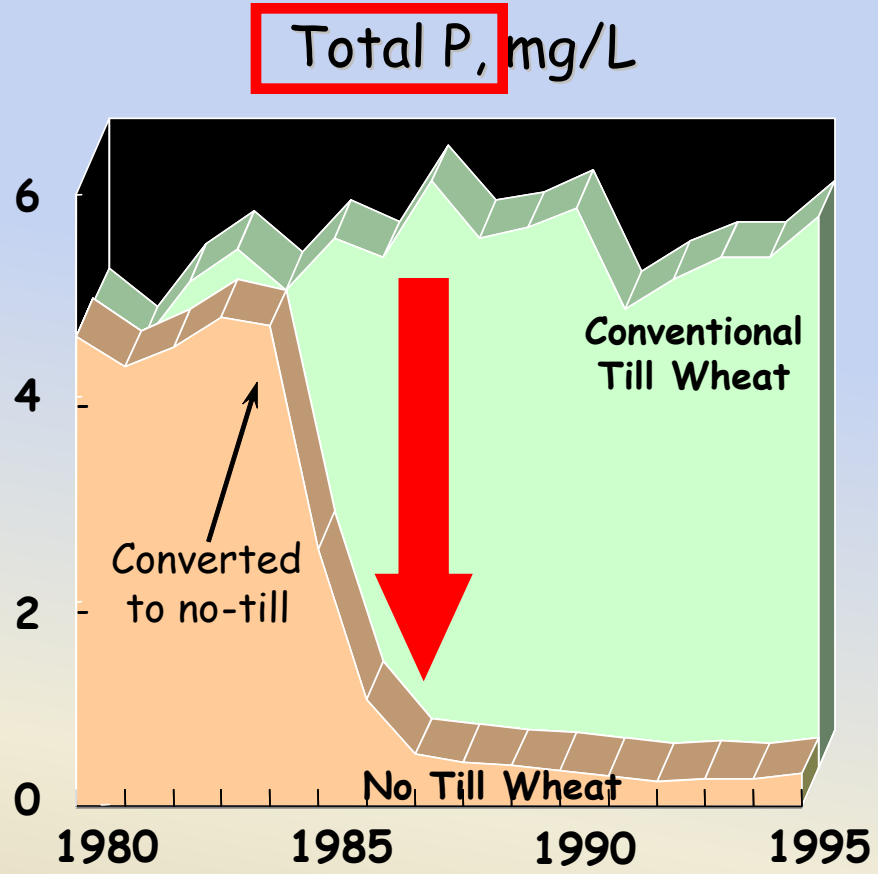
In Oklahoma, conservation tillage increased losses of dissolved P, but reduced total P loss from wheat by 95% ... where most of the P loss was by erosion





El Reno, OK - Sharpley and Smith, 1994

Published January 12, 2017

Journal of Environmental Quality

TECHNICAL REPORTS

SURFACE WATER QUALITY

Increased Soluble Phosphorus Loads to Lake Erie: Unintended Consequences of Conservation Practices?

Helen P. Jarvie,* Laura T. Johnson, Andrew N. Sharpley, Douglas R. Smith, David B. Baker, Tom W. Bruulsema, and Remegio Confesor

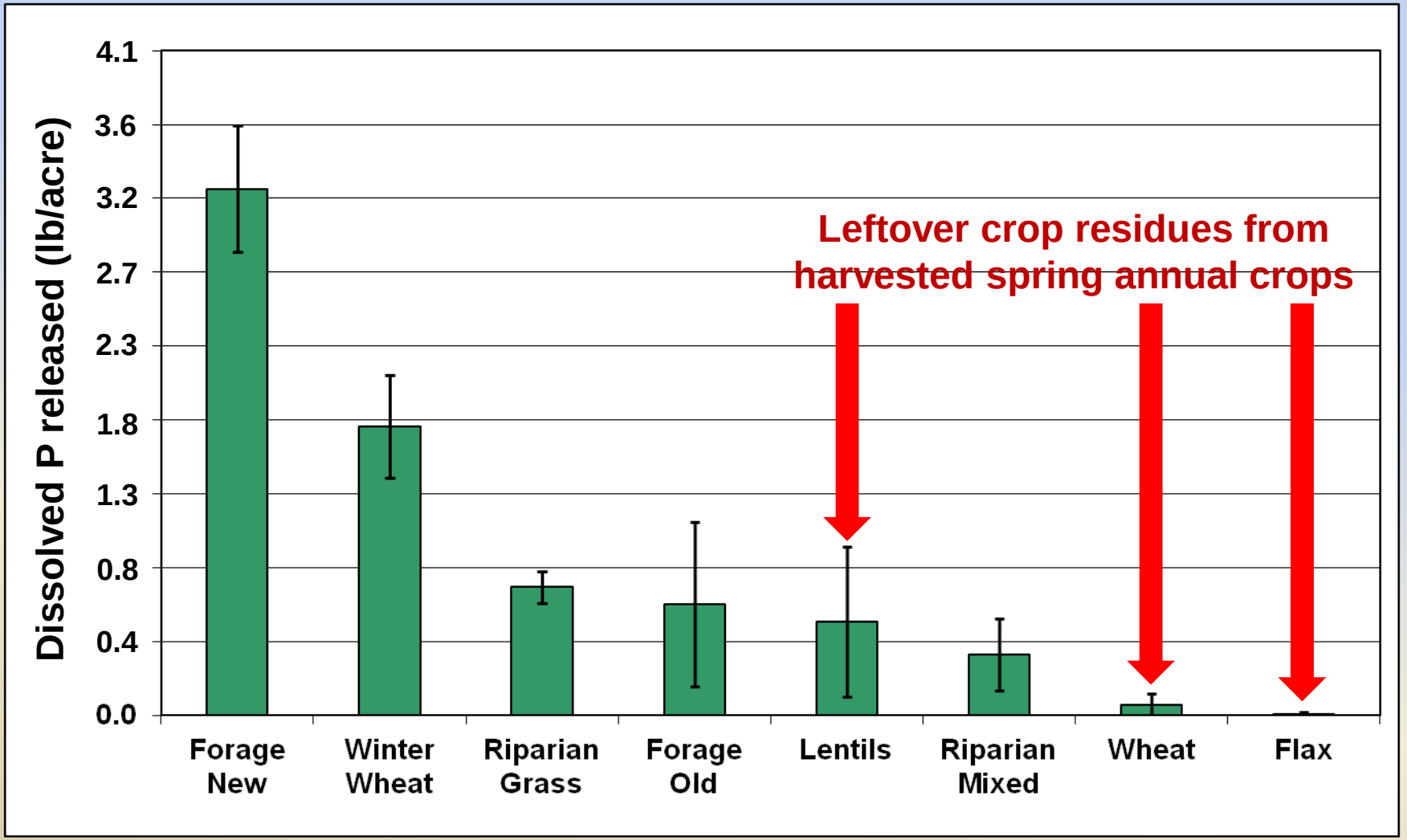
Abstract

Cumulative daily load time seri
marked a step-change increase
phosphorus (SRP) loads entering
from three major tributaries: the
Rivers. These elevated SRP loads
last 12 yr. Empirical regression m
the contributions from (i) incr
weather and precipitation patt
delivery (the combined effects c
and/or increased transport effici
fractions). Approximately 65% o
2002 was attributable to increa
runoff volumes accounting for
SRP delivery occurred concomita
P budgets. However, within these
long-term, largescale changes in
tillage to minimize erosion and particulate P loss, and increased tile drainage to improve field operations and profitability. These practices can inadvertently increase labile P fractions at the soil surface and transmission of soluble P via subsurface drainage. Our

"Our findings suggest that changes in agricultural practices, including some conservation practices designed to reduce erosion and particulate P transport, may have had unintended, cumulative, and converging impacts contributing to the increased soluble reactive P loads, reaching a critical threshold around 2002."

Priority was established in response to growing challenges relating to phosphorus (P) enrichment, compounded by climate change, and aquatic invasive species (IJC, 2014); in February 2016, the governments of Canada and the United States announced new P

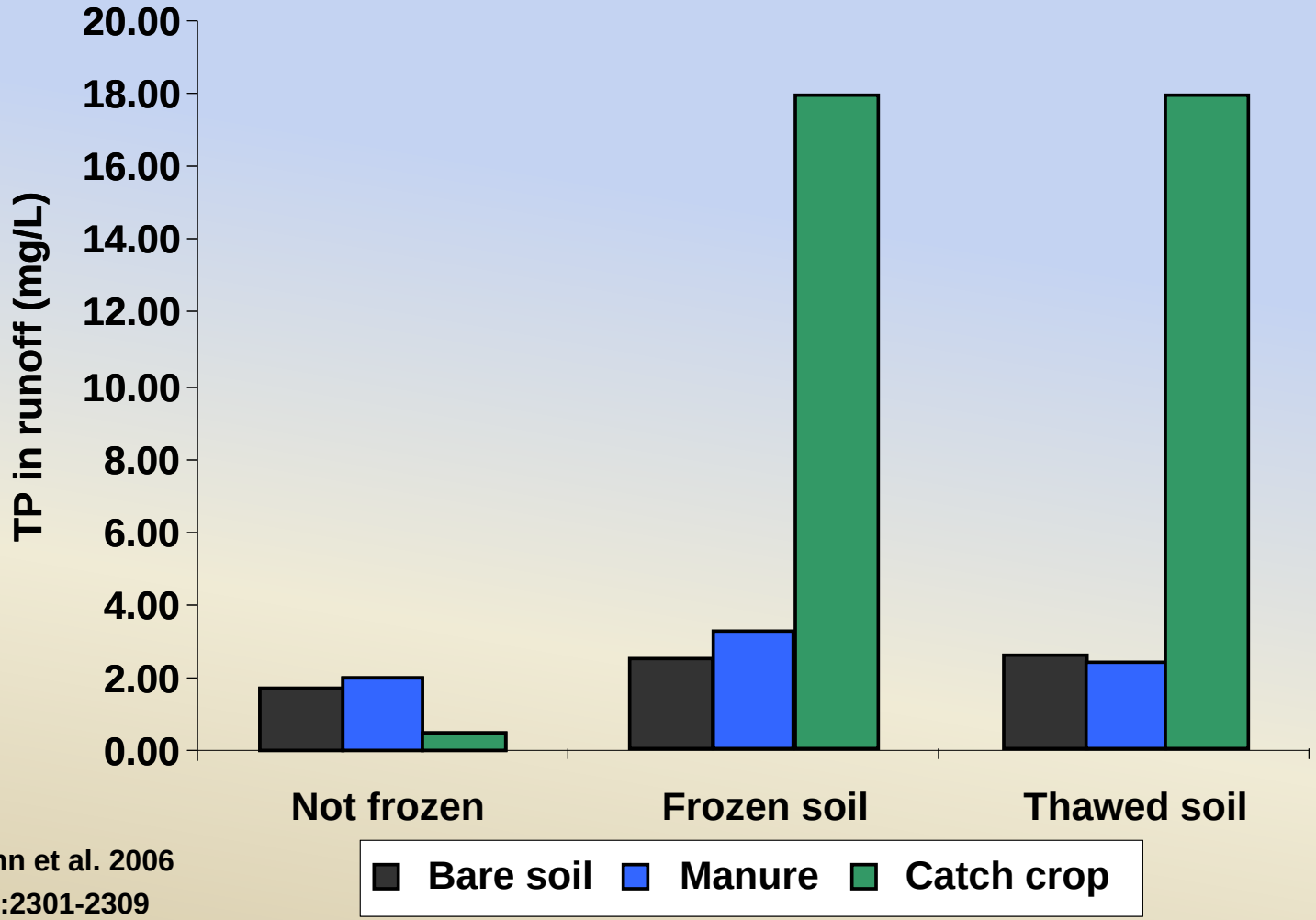
Fresh frozen green plant residues at greatest risk for simulated snowmelt runoff P losses



Elliott, J. 2013. Evaluating the potential contribution of vegetation as a nutrient source in snowmelt runoff. Can. J. Soil Sci. 93:435-443.

University of Manitoba

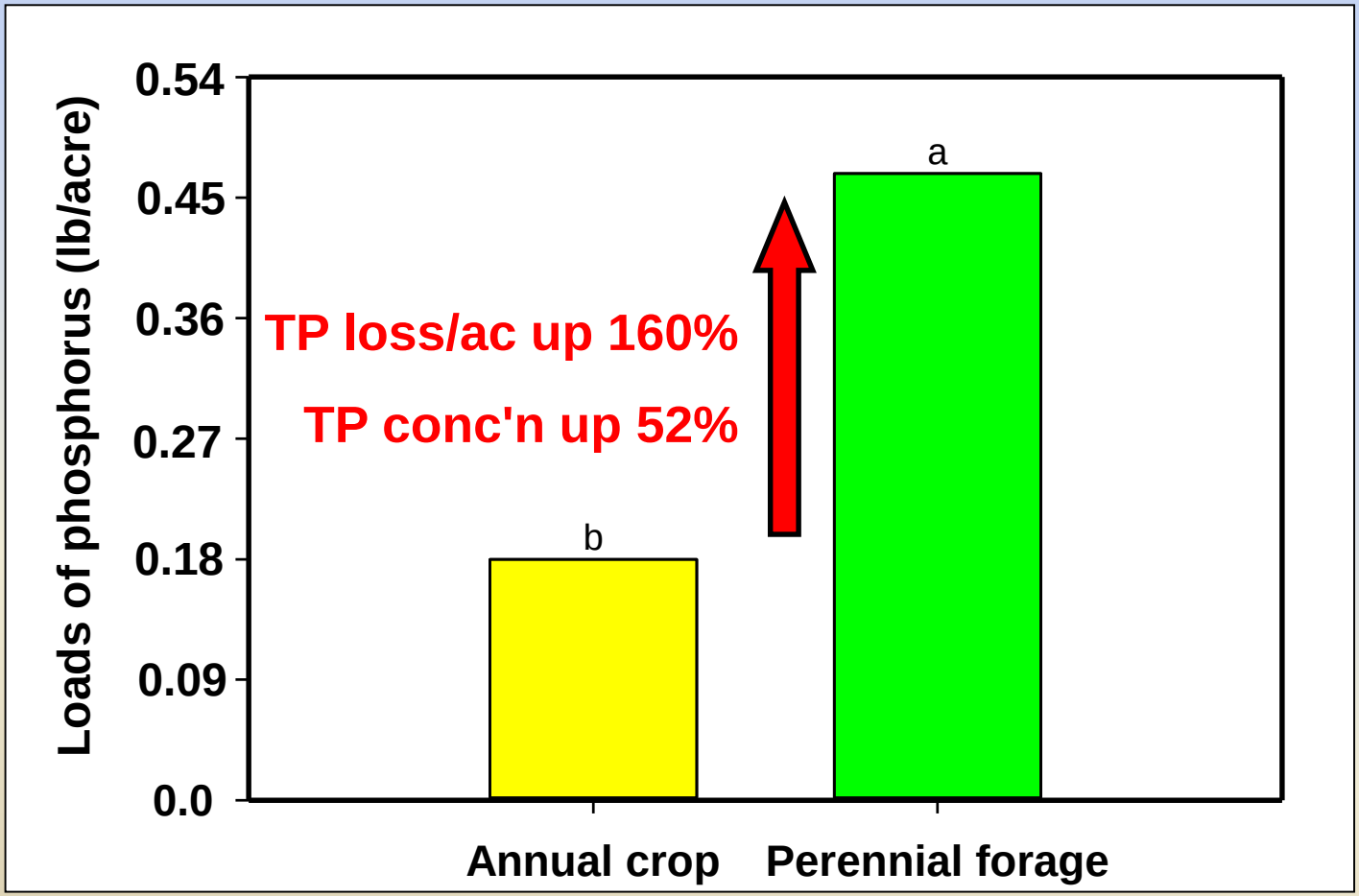
Freezing, thawing increases P loss from cover crops on manured soil: USDA research in PA



Bechmann et al. 2006
JEQ 34:2301-2309

University of Manitoba

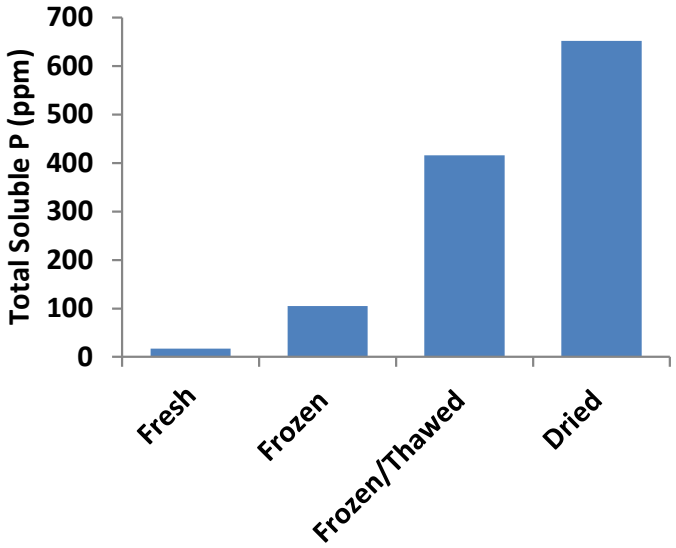
Perennial alfalfa forage loses more P in snowmelt runoff than conventionally tilled annual crops (8 site years)



South Tobacco Creek Model Watershed – Liu et al. J. Environ. Qual. 43:1644–1655 (2014)

WI studies show that P losses from alfalfa under laboratory conditions don't always match losses under field conditions

Lab Study



"Actual P losses likely depend on the timing and extent of plant freezing and drying and of precipitation events after freezing."

Field Study

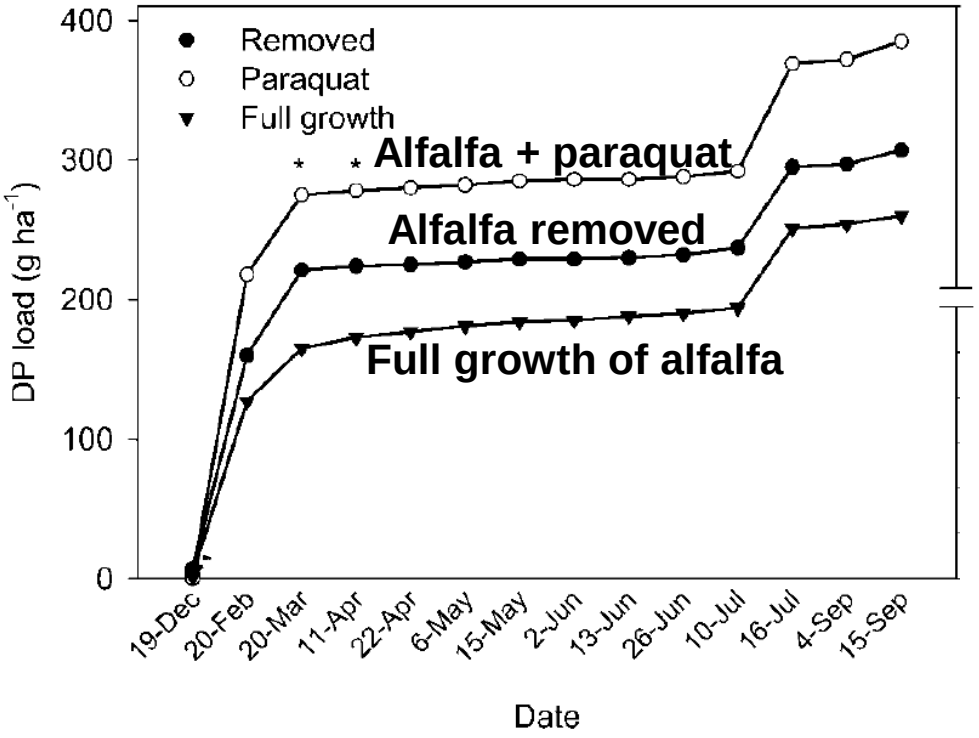


Fig. 4. Effect of fall cutting height and paraquat application to alfalfa (15 Oct. 2002) on cumulative dissolved reactive P (DP) (solid line) and natural runoff (dashed line) load at site 7, Oct. 2002 through Sept. 2003. (*) Orthogonal comparison of full growth and paraquat treatment on cumulative DP load was significant at the 0.20 probability level. (Roberson and Bundy. JEQ 36:532–539 (2007)

Vegetated buffer strips in Manitoba not as effective as expected

Sheppard et al. CJSS 2006 (SE MB)

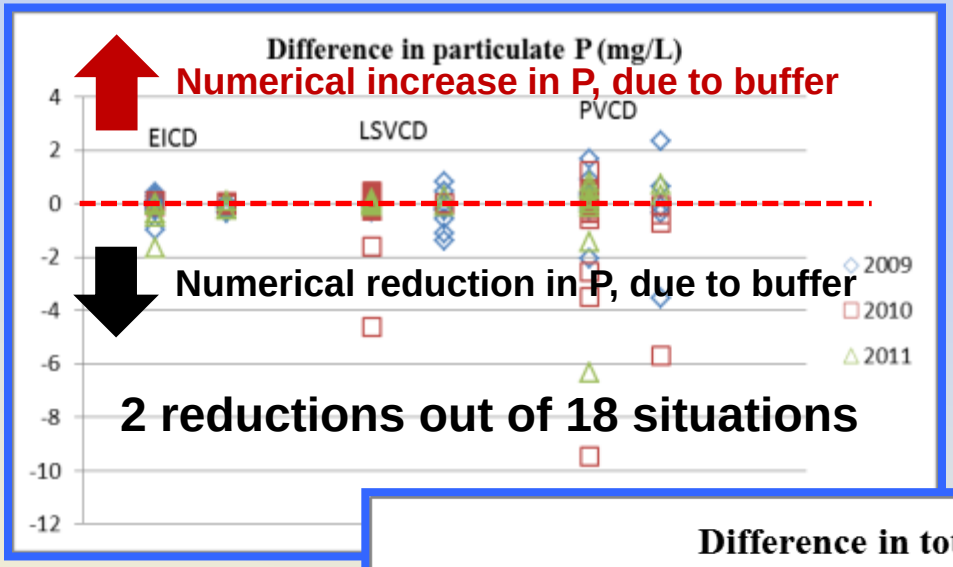
- **VBS reduced runoff [TP] in 50% of cases,**
- **increased P in 18%, had no effect in 32%**
- **overall average … only 4% reduction in runoff [TP]**

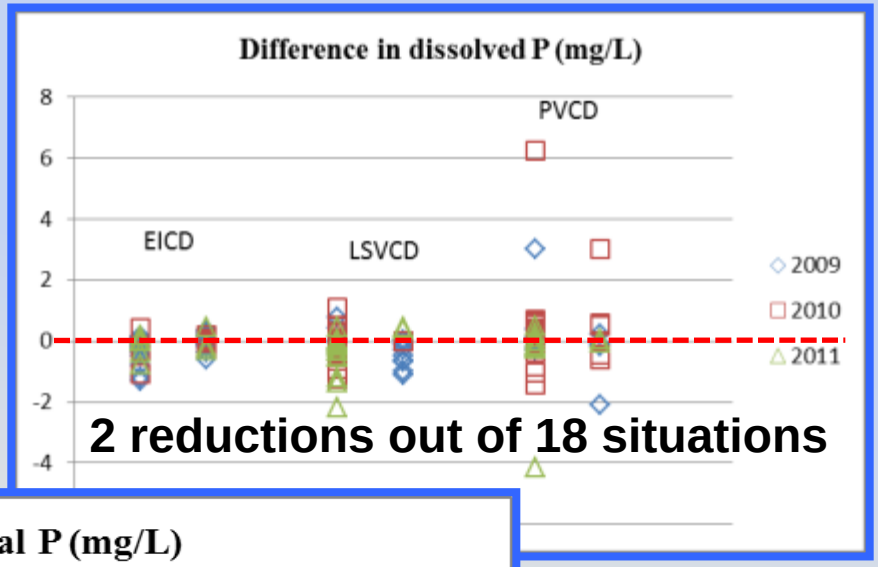
Sheppard et al. 2011 &

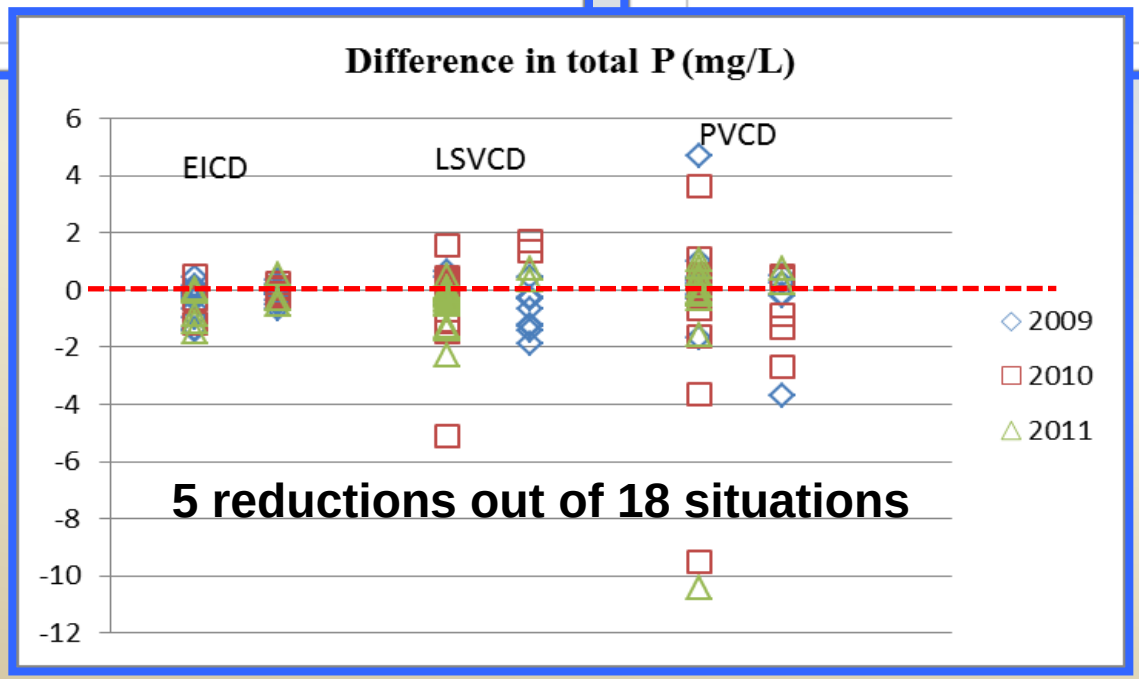
Habibiandehkordi et al. 2017

- **No significant reduction in P with VBS in 45 of 54 seasonal measurements in Eastern-Interlake CD, Pembina Valley CD, and Little Sask. CD trials**

P concentration for water flowing through vegetated buffers in MB was not significantly reduced in most situations (Sheppard et al. 2011, Habibiandekhordi et al. 2017)







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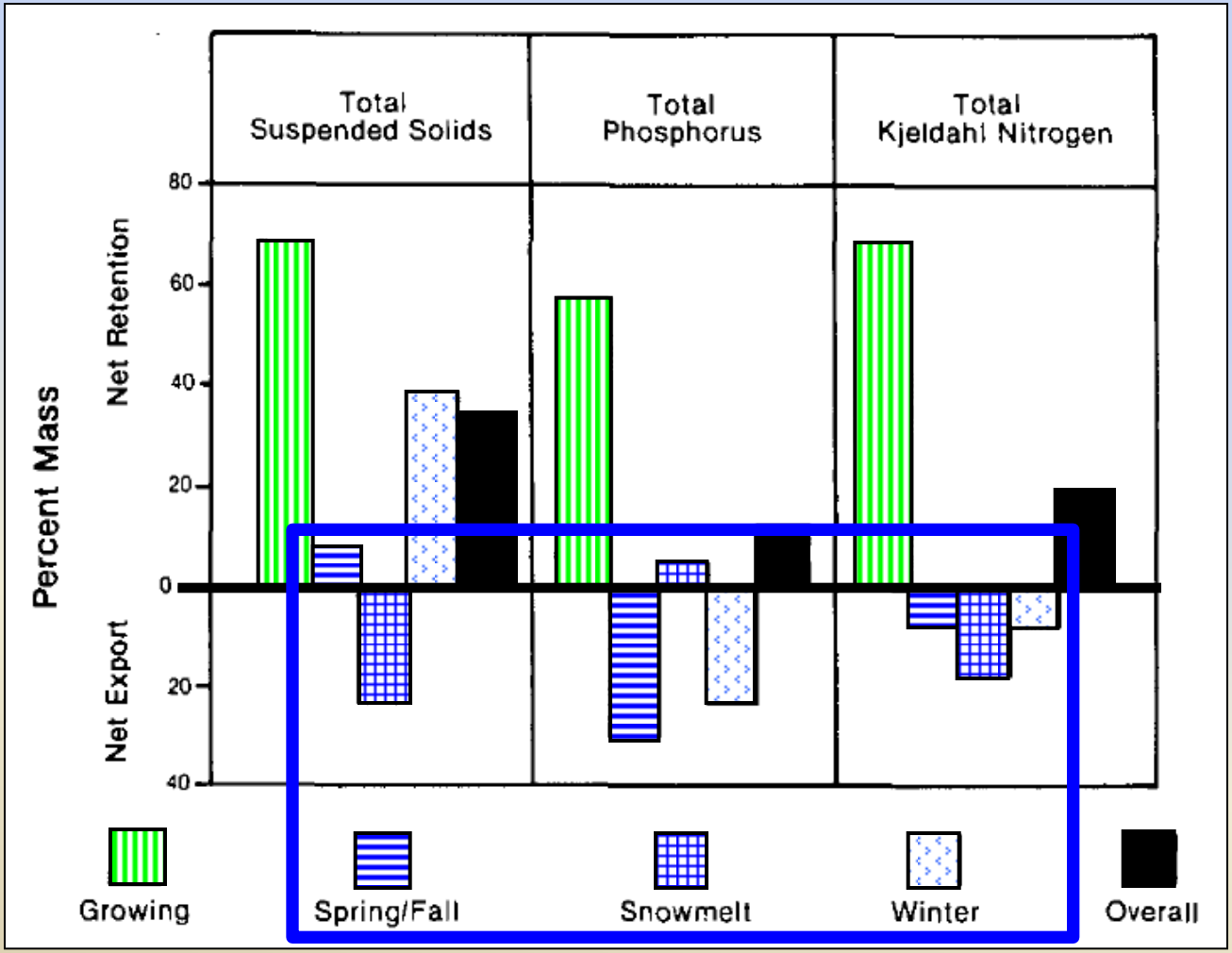
In-stream and near-stream processes (eg. vegetated buffers and biological uptake) are minimal during snowmelt

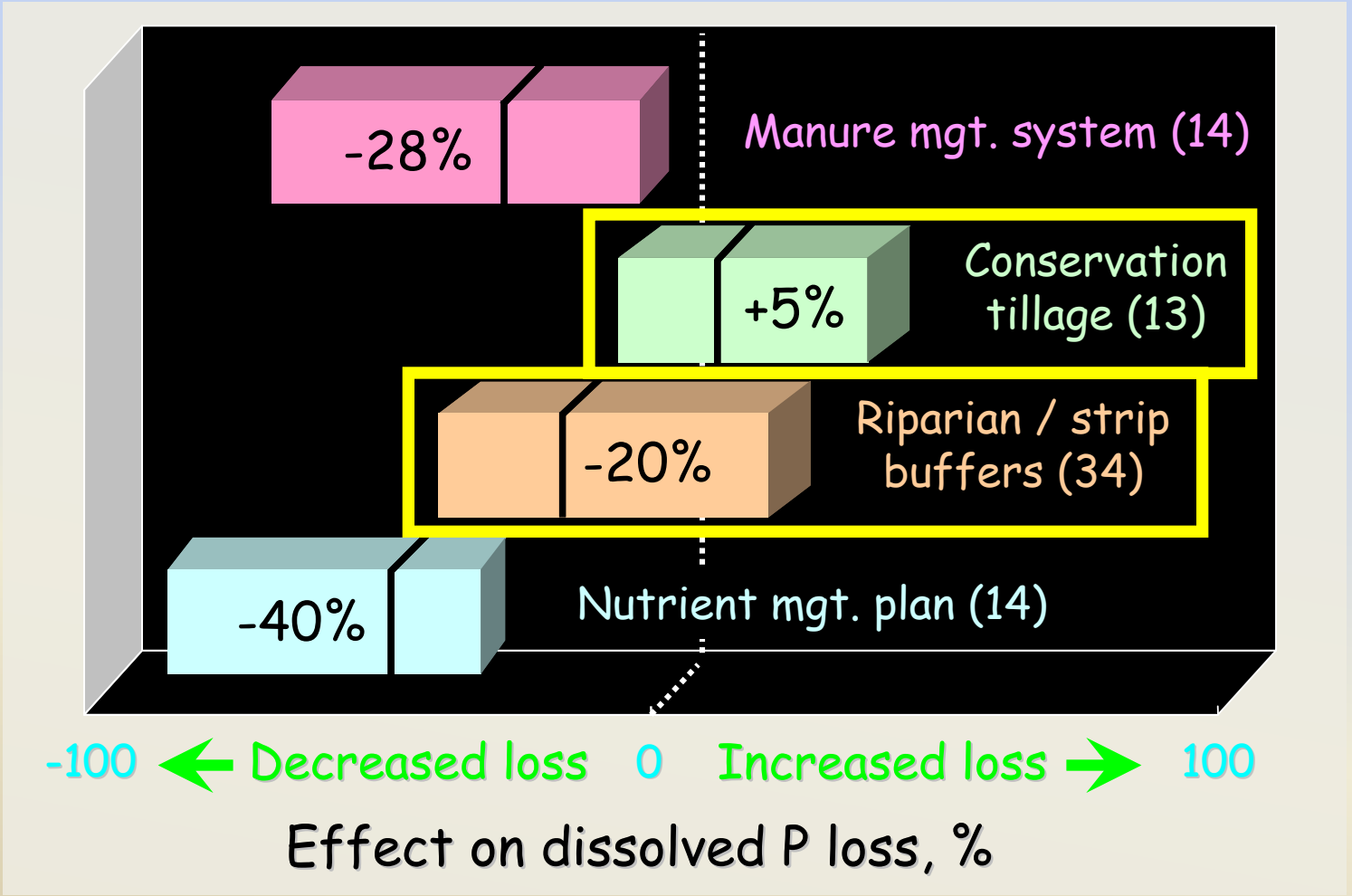
Flow is often concentrated in only a small area of the buffer, overwhelming the nutrient retention system

Barnyard vegetative filter strips: Ineffective outside growing season in Vermont



Schellinger & Clausen JEQ 1992

BMP effectiveness for reducing losses of dissolved P (Sharpley, adapted from Gitau et al. JSWC, 2005)



Small dams & reservoirs reduce sediment and nutrient loading in Manitoba

eg. small reservoirs in South Tobacco Creek WEBS project reduced loads of:

- sediment (77%)
- TN (15%), TDN (14%)
- TP (12%), TDP (10%)*
- mechanisms?

- relevance to natural or restored wetlands?

* Tiessen et al. 2011 JSWC 66:158-171

Targeted capturing of runoff and irrigation … eg. from confined cattle overwintering areas can reduce farm watershed P loading by ~50%

Integrated Water Management: Offstream Drainage/Irrigation Reservoirs

Carl Classen ‘s farm reservoir near Elm Creek, MB for collecting surface & tile drain water for subsequent irrigation

Large dams and reservoirs: Saskatchewan River Tonnes P in/out/retained, Sept. 2008–Sept. 2009

Brian Parker (formerly with Environment Canada)

PPT 6

N Sask R

30 (10%)

Sask R 264 out

Sask R 1301 in

PPT 68

1067 (76%)

Total: 1516 t P sequestered

Codette-Tobin Reservoirs

Sask R 287 in

Sask R 301 out

Cedar Lake

PPT 5

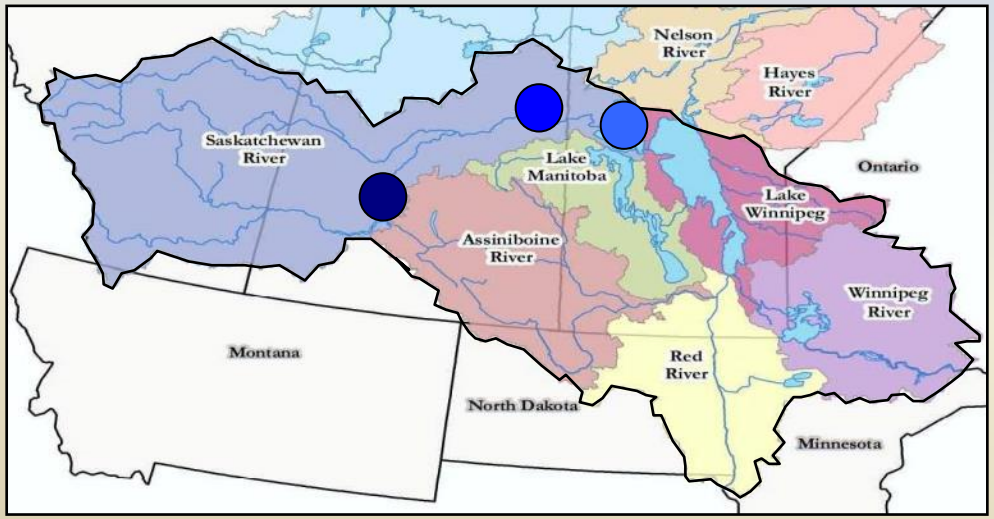
S Sask R 29 out

419 (89%)

Lake Diefenbaker

S Sask R 466 in

Lake Winnipeg



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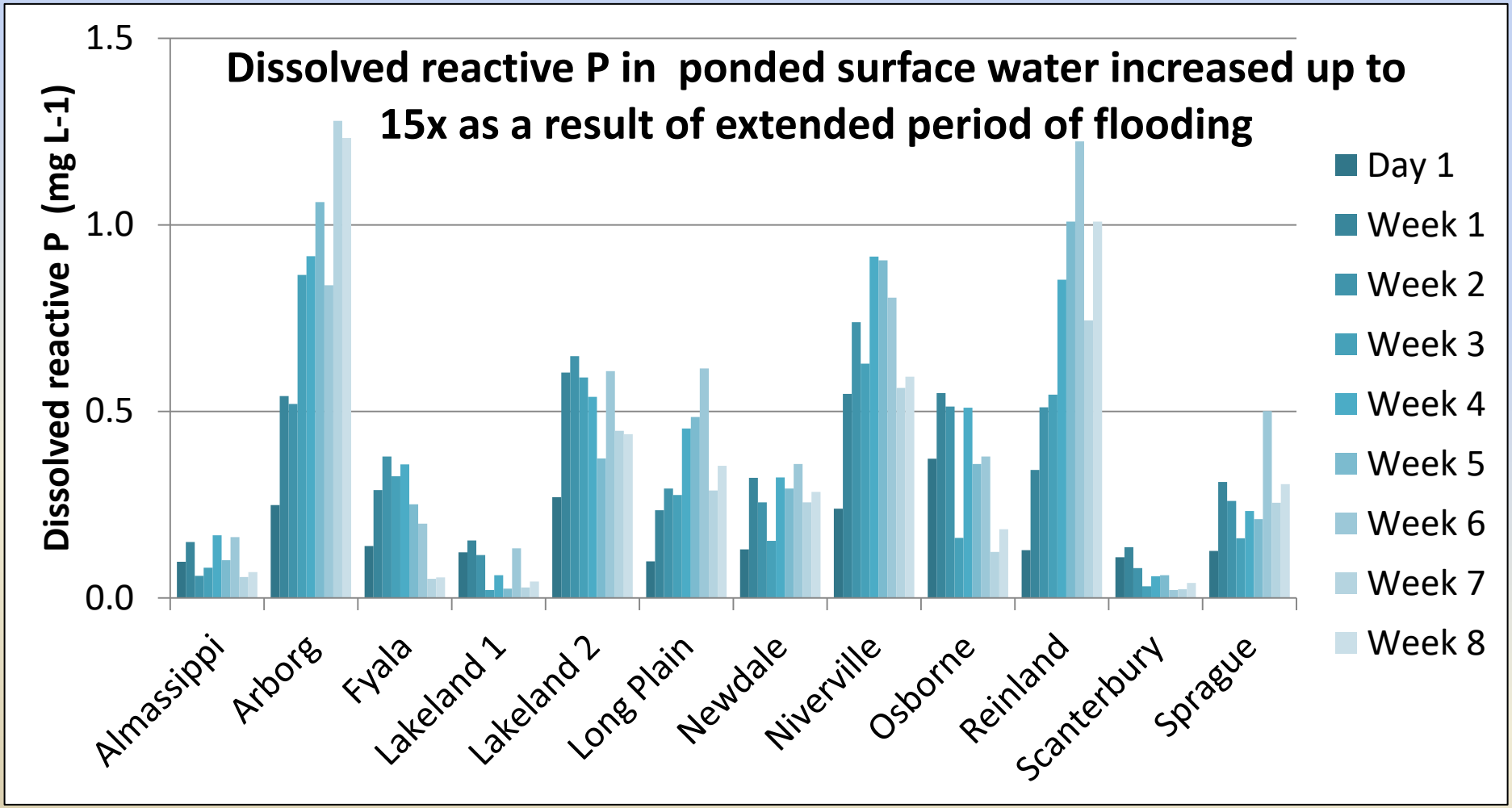
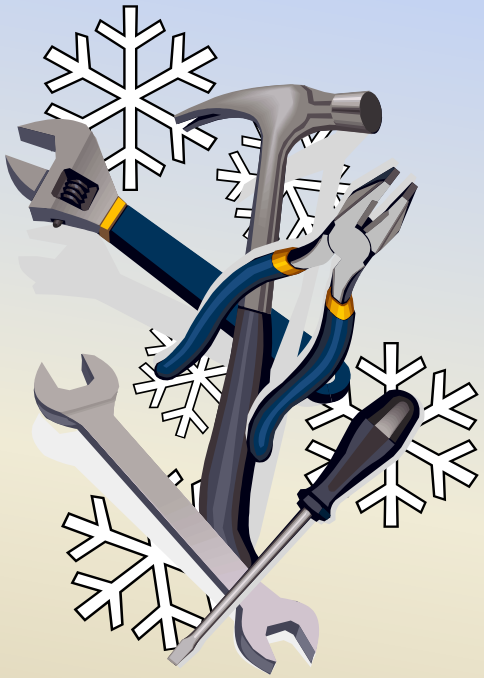
P Release from Submerged Agricultural Soils

- Many flooded ag soils release large amounts of P to ponded surface water if the soil becomes anaerobic
- Attributed to dissolution of Fe-bound P for low pH soils
- Processes & magnitude for high pH Prairie soils not well understood
- Major implications for BMPs that “slow the flow” of water off ag land … eg. restricted drainage, restored wetlands

Dissolved Reactive P Released to Ponded Surface Water: Lab Study (Amarawansha et al. JEQ 44:1252)

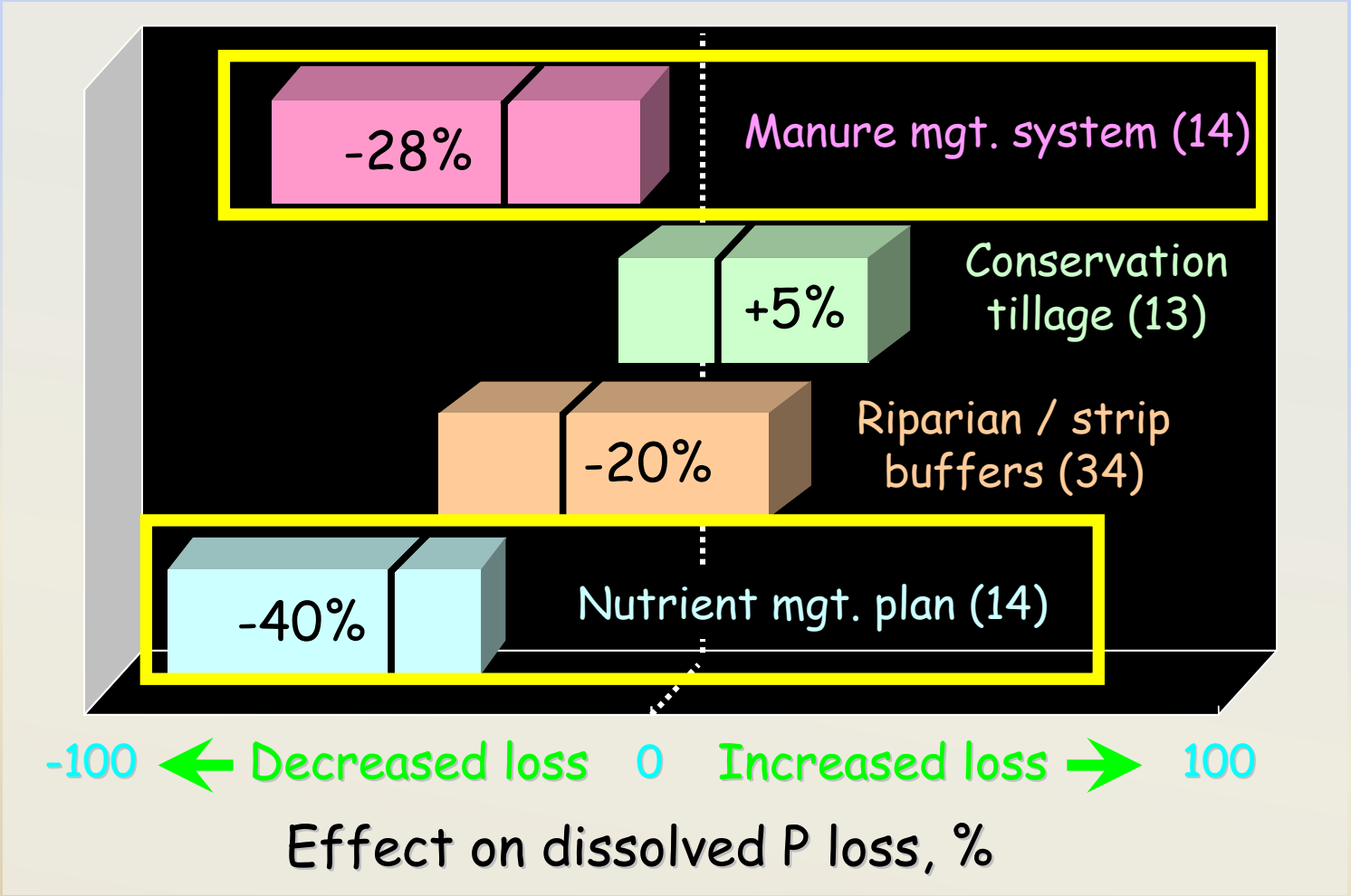


What beneficial management practices (BMPs) do we expect farmers to use?

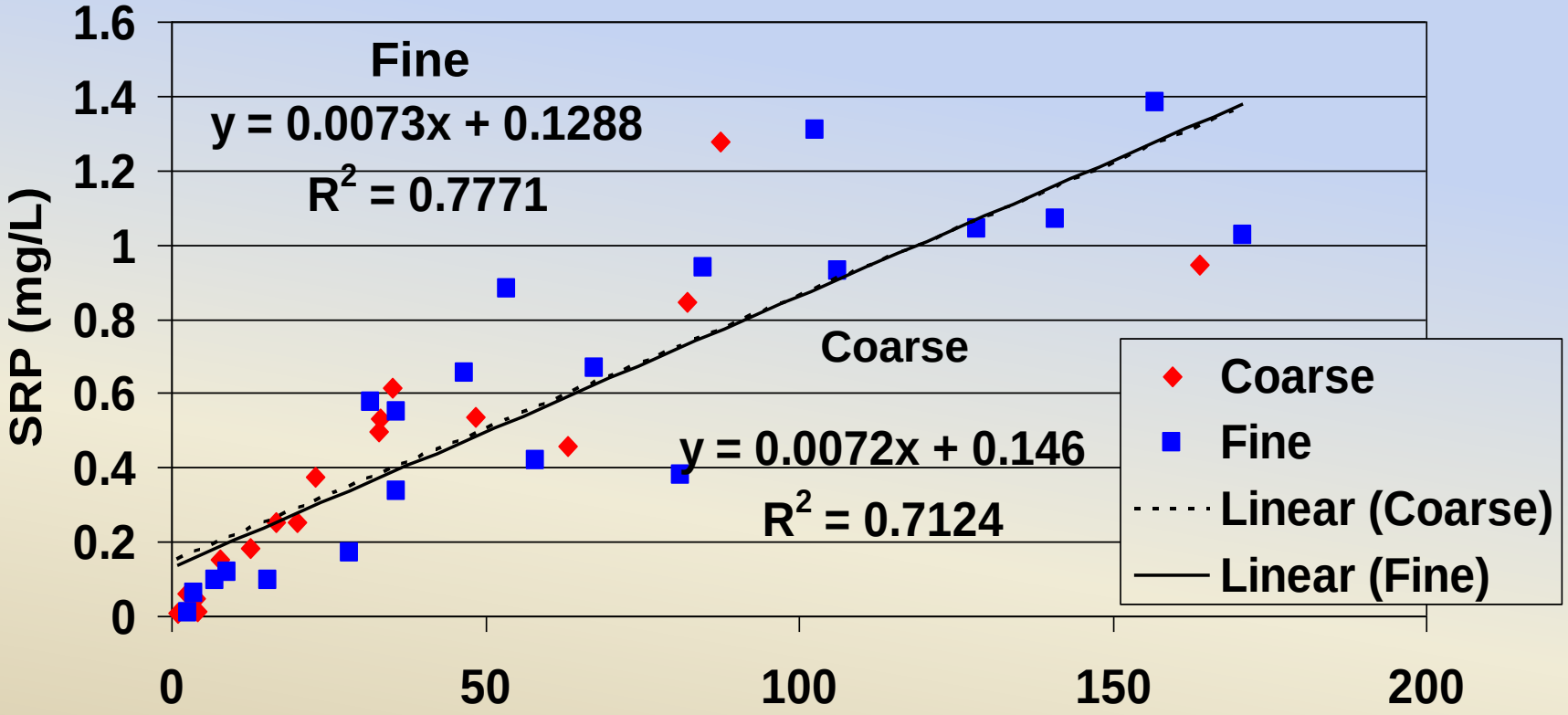


- **Source BMPs (in field)**
  - **Rate, placement, timing of manure and synthetic fertilizer application**
- **Transport BMPs (field to stream)**
  - **Conservation tillage?**
  - **Vegeta d bu ers?**
  - **Cover crop and perennial forage**
  - **Constructed wetlands and small reservoir… to manage <u>water</u>**

BMP effectiveness for reducing losses of dissolved P (Sharpley, adapted from Gitau et al. JSWC, 2005)



Olsen soil test P is strongly related to soluble P concentrations in simulated runoff from coarse and fine-textured Manitoba soils



Sawka, C. A. 2009.

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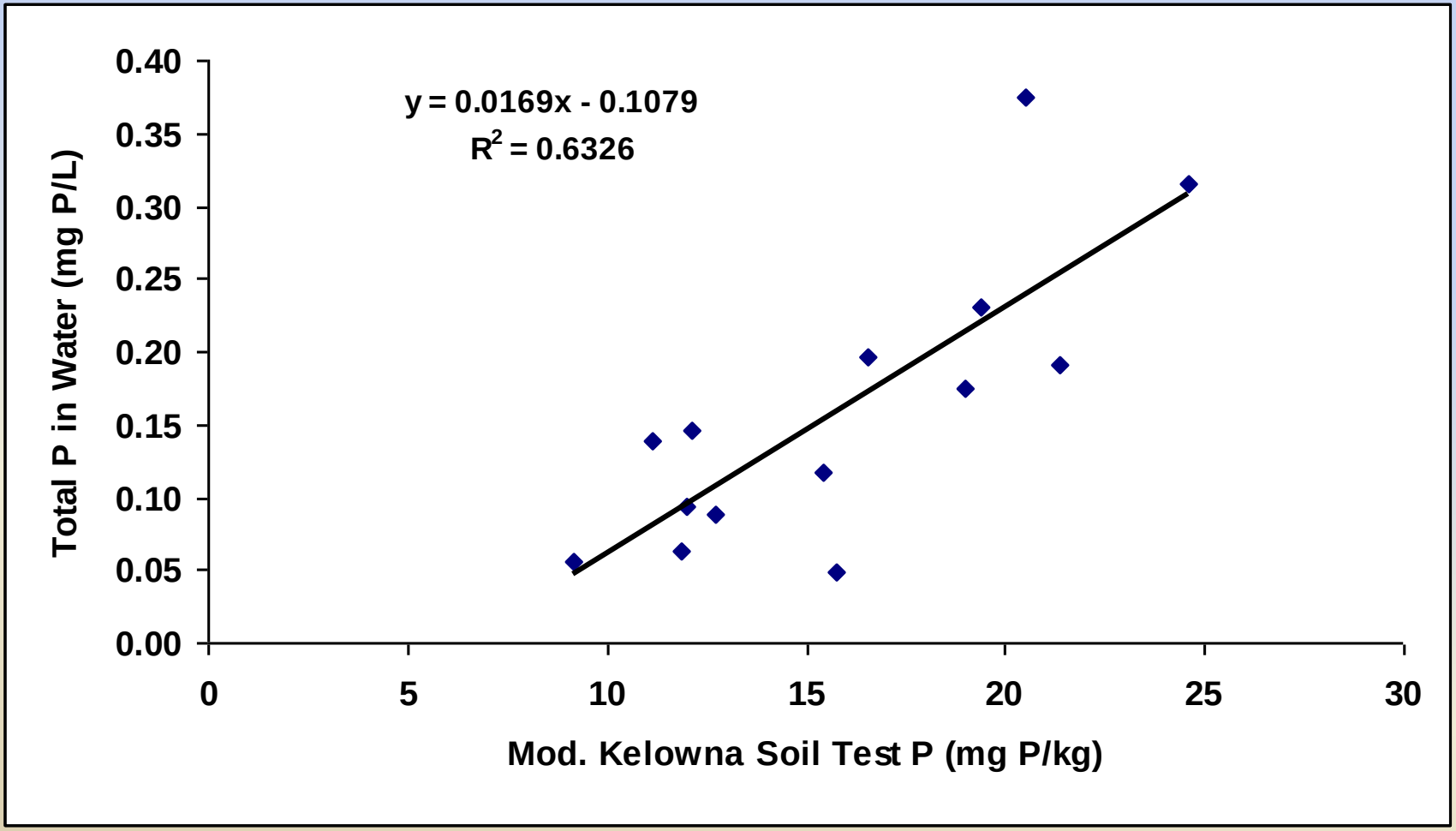
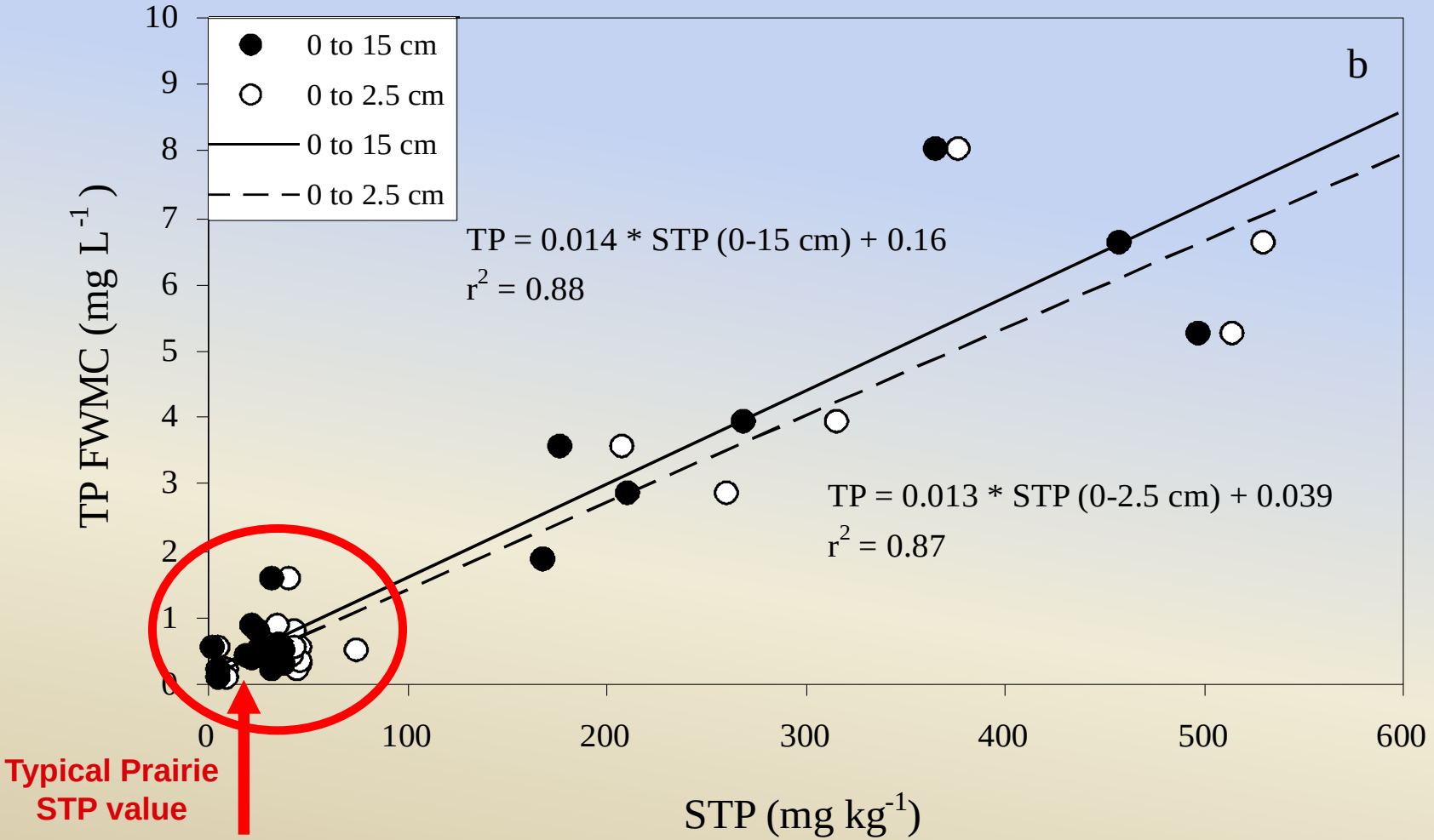
Soil test P is related to river P concentrations in 14 regional Manitoba watersheds



Adapted from Salvano and Flaten. 2006. Phosphorus risk indicators: Correlation with water quality in Manitoba. JEQ

At high levels of STP, STP is strongly related to total P concentrations in runoff in Alberta



Little, J.L, Nolan, S.C, Casson, J.P. and Olson, B.M. 2007. Relationships between soil and runoff phosphorus in small Alberta watersheds. J. Envir. Qual. (2007). Snowmelt > 90% of runoff, DP = 55 % of TP, Modified Kelowna STP extraction method.

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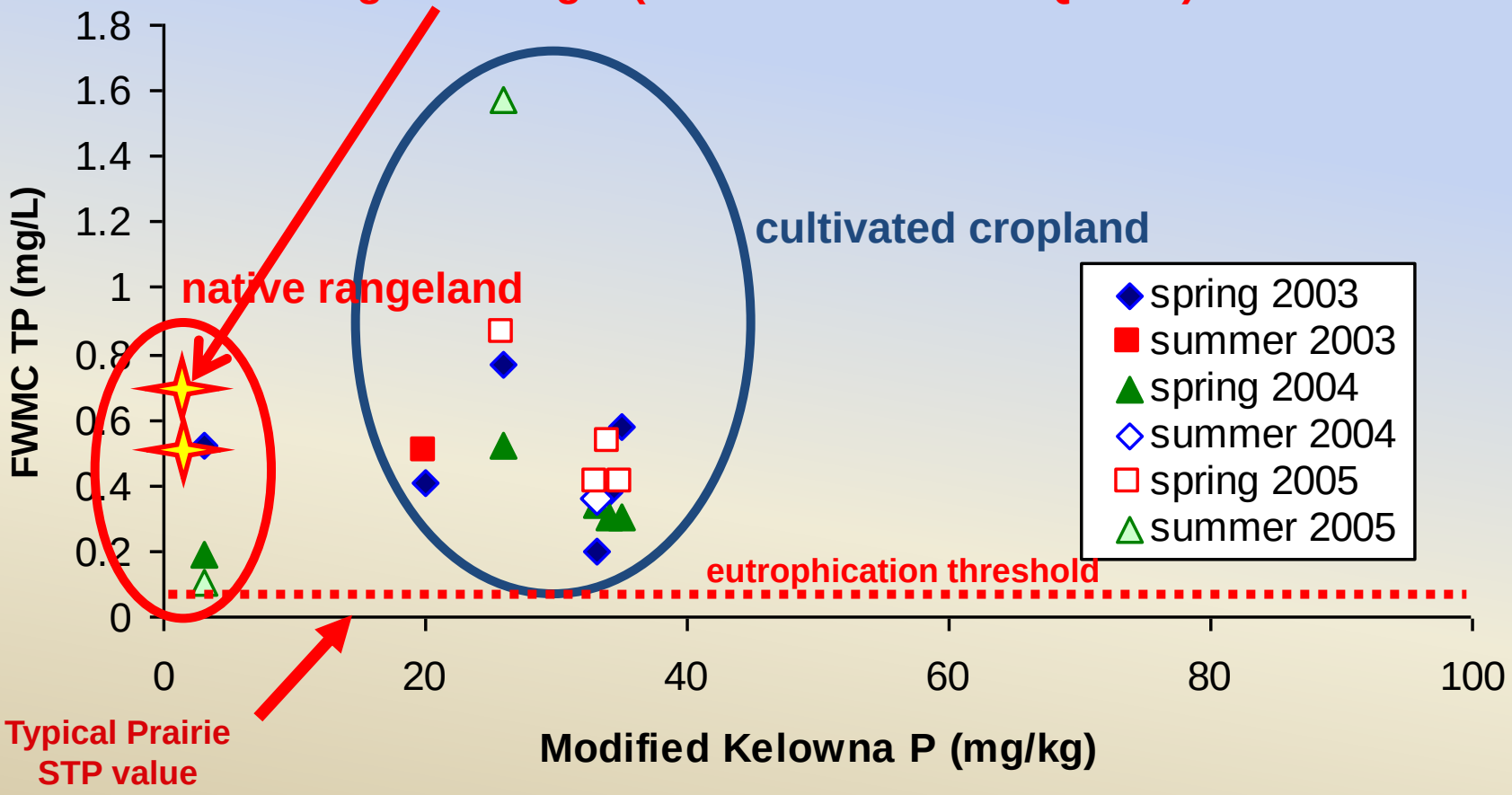
At low levels of STP, STP is not related to total P concentrations in runoff in Alberta

Native prairie near Ortonville, Minnesota yielded average of 0.5 mg/L TP in runoff where 80% of runoff was snowmelt ... rainfall runoff averaged 0.7 mg/L (Timmons & Holt JEQ 1977)



Little, J.L, Nolan, S.C, Casson, J.P. and Olson, B.M. 2007. Relationships between soil and runoff phosphorus in small Alberta watersheds. J. Envir. Qual. (2007). Snowmelt > 90% of runoff, DP = 55 % of TP, Modified Kelowna STP extraction method.

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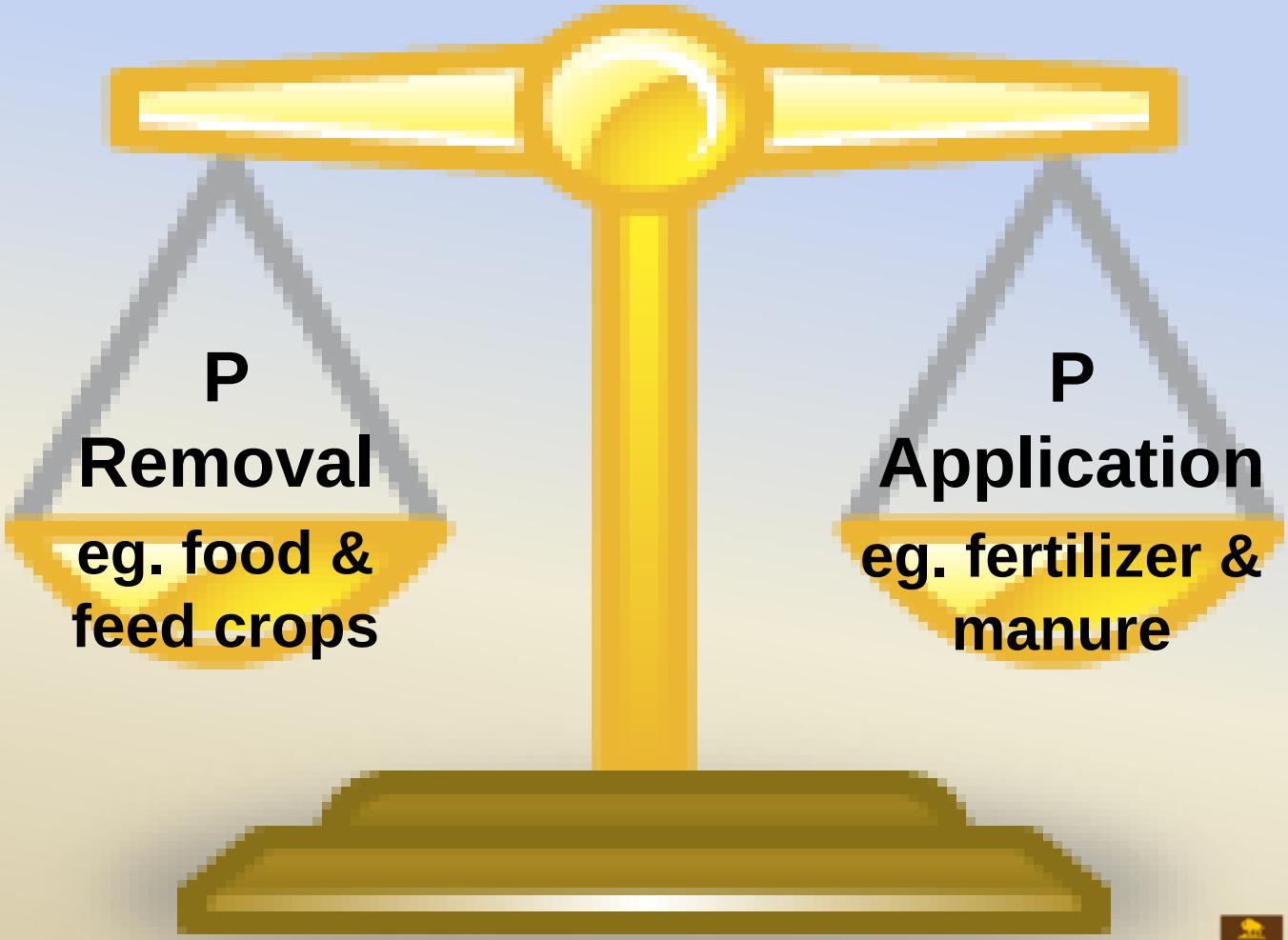
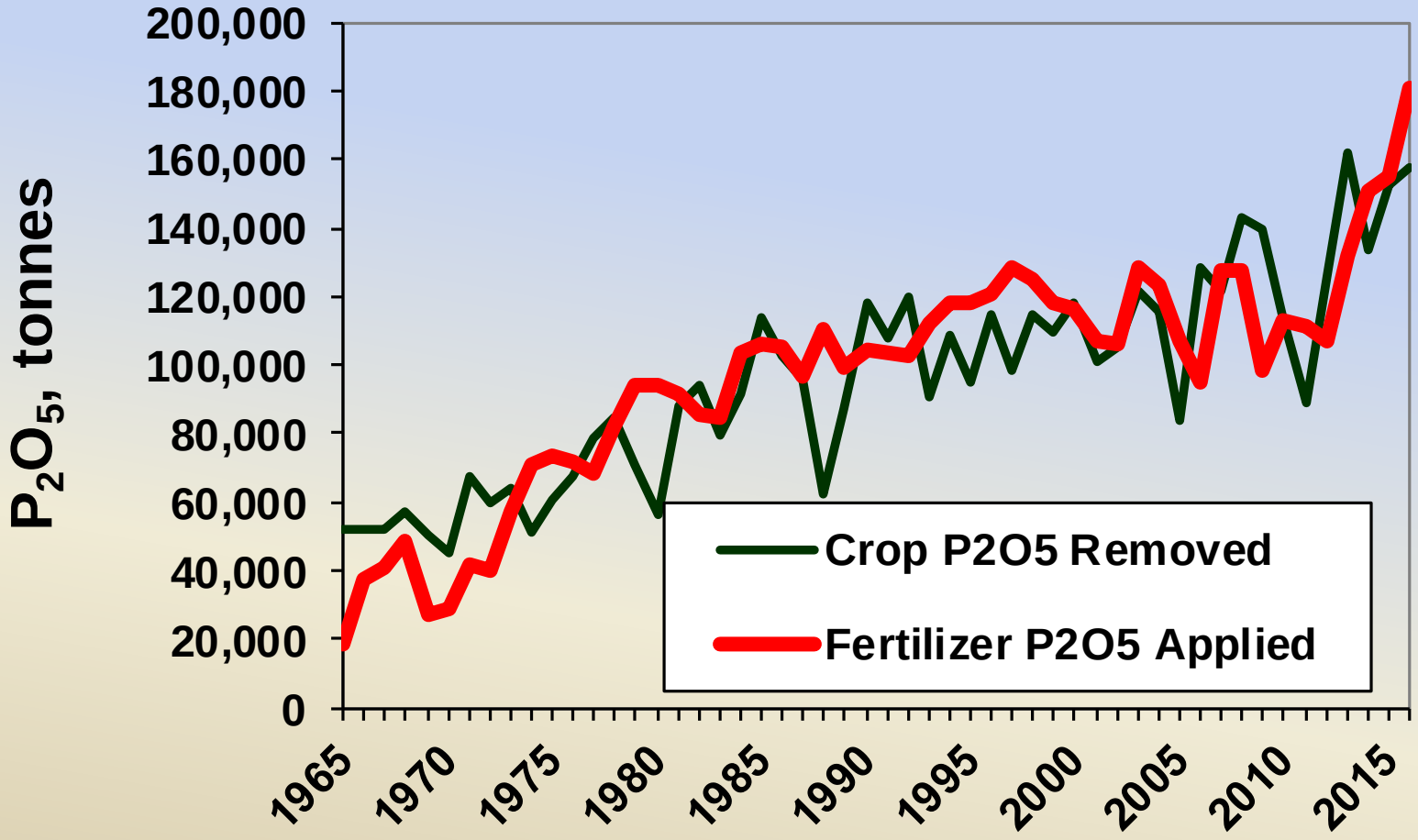
P Rate: Balancing P application with crop removal is essential for sustainable crop production and environmental protection



Crop Removal and Replacement of P in Manitoba (1965-2016)*



*John Heard (Manitoba Agriculture) with data from Statistics Canada data, does not include additions of manure or removal of straw P

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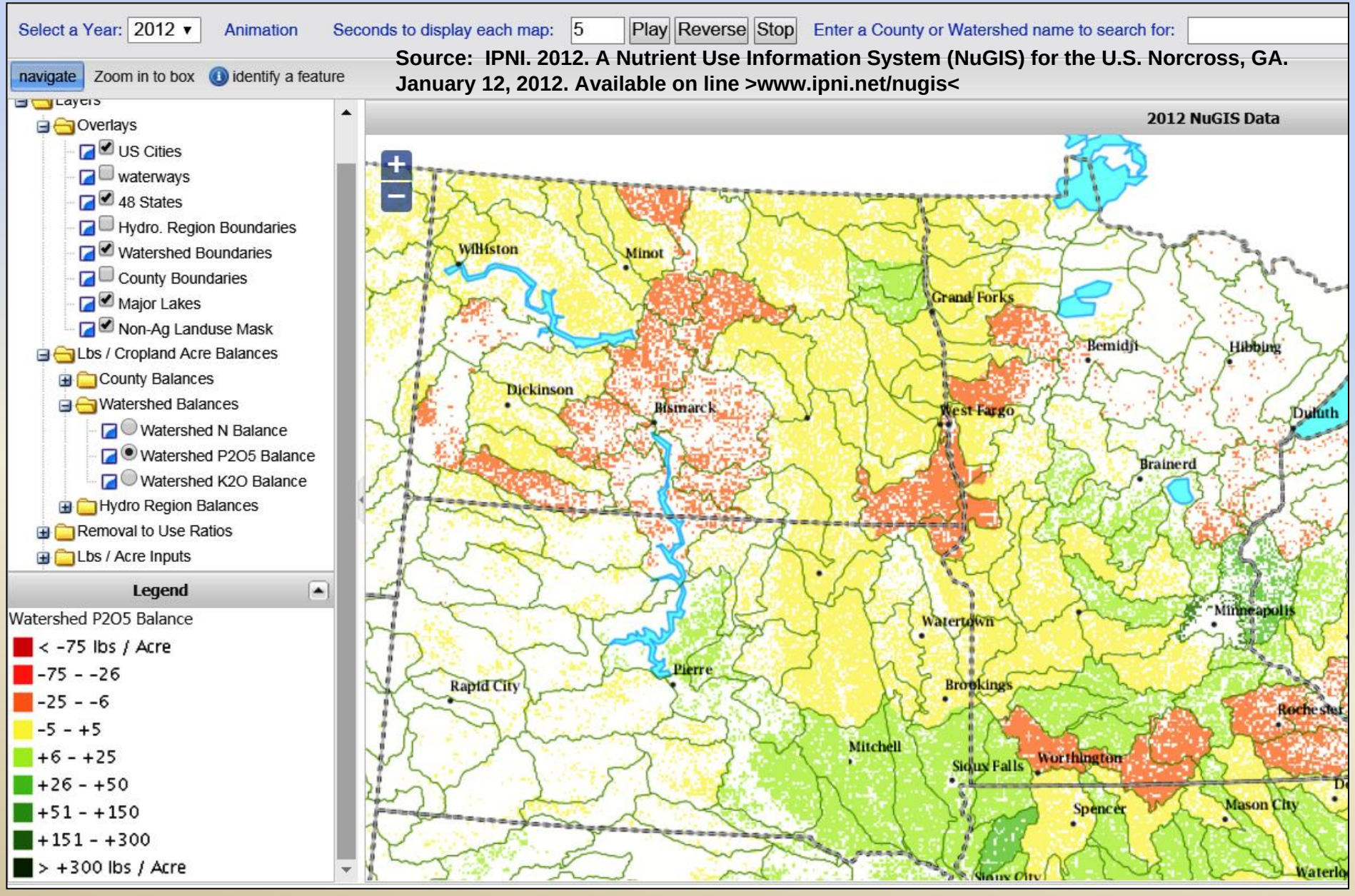
Phosphorus Balance in ND, SD, MN



Source: IPNI. 2012. A Nutrient Use Information System (NuGIS) for the U.S. Norcross, GA. January 12, 2012. Available on line >www.ipni.net/nugis<

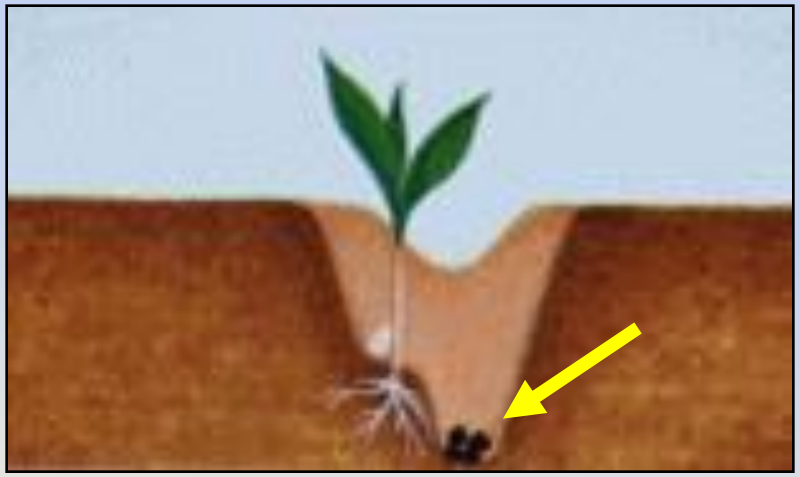
Livestock Manure: A Rich Source of P for Crops

- Ratio of available N:P_2O_5 ratio of most manures is < 1:1
- Ratio of N required:P_2O_5 removed by most crops > 2:1
- Application of manure to meet the crop's N requirements results in application of enough P for several years of crop production

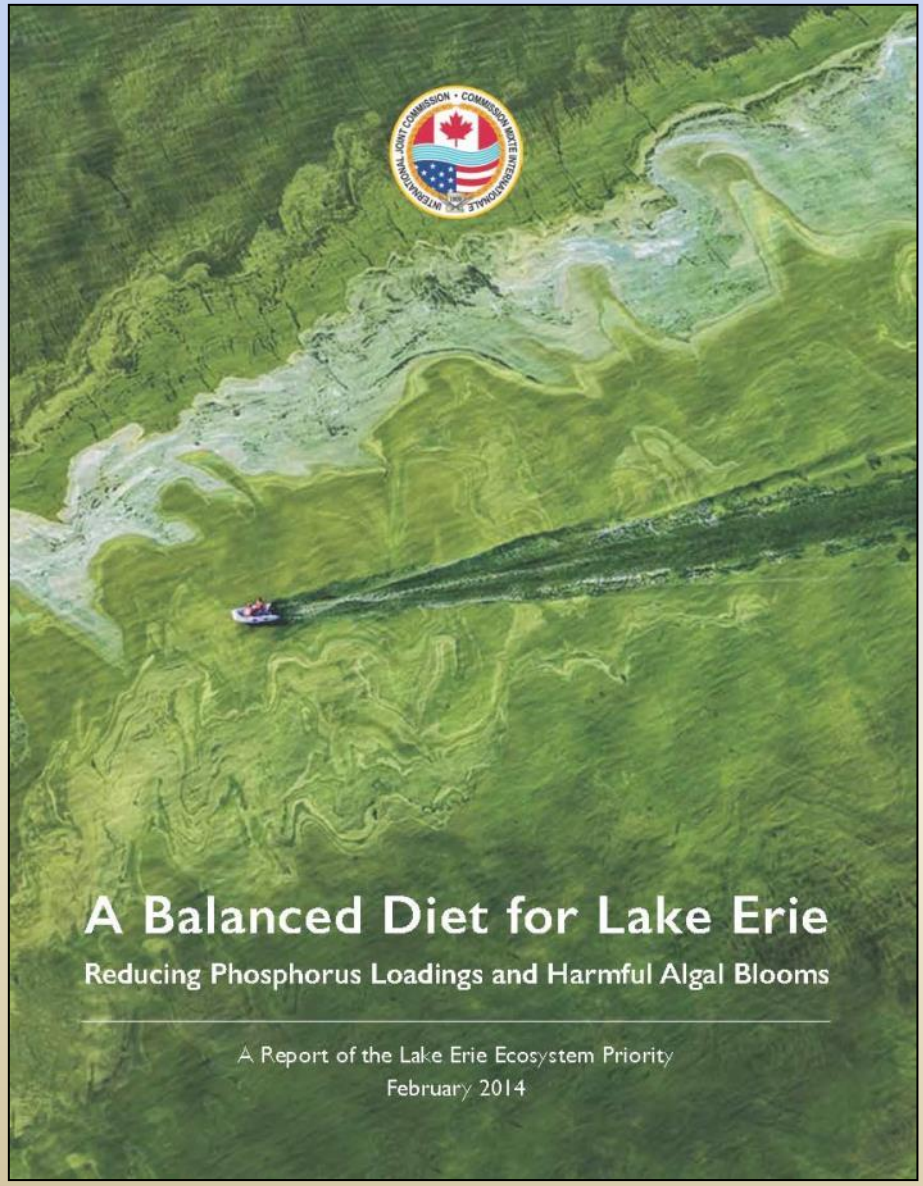
P Placement: Almost all fertilizer P in MB is banded under soil surface, in or near seedrow, at planting

<u>Agronomically</u> beneficial

<u>Environmentally</u> beneficial because P placed under soil surface after spring runoff



International Joint Commission Report on Improving Water Quality in Lake Erie – February 2014



"The control of phosphorus in agricultural operations must focus on changes in agricultural practices that have been implemented in recent decades, such as increased prevalence of fall application of nutrients, applying two years' worth of fertilizer in a single application, and broadcast application."

page 7 of International Joint Commission (2014). A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms. Report of the Lake Erie Ecosystem Priority.

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Excess P & toxic blue-green algae in Lake Erie shuts down water supply to Toledo, Ohio – August 2014

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By MARK PETERS and MATTHEW DOLAN CONNECT

Updated Aug. 5, 2014 7:47 p.m. ET

Algae floats in Lake Erie on Monday at Maumee Bay State Park in Oregon, Ohio. *Getty Images*

The drinking-water crisis in one of Ohio's largest cities is drawing attention to a new requirement for farmers in the state: a license to fertilize.

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What's the right placement for manure?

- Manure should be injected or incorporated, wherever possible … especially if applied in fall
- In MB, approx. 60% of solid manures and 83% of liquid manures are injected or incorporated (Stats Canada 2006)
  - better agronomically
  - less odour and risk of nutrient loss

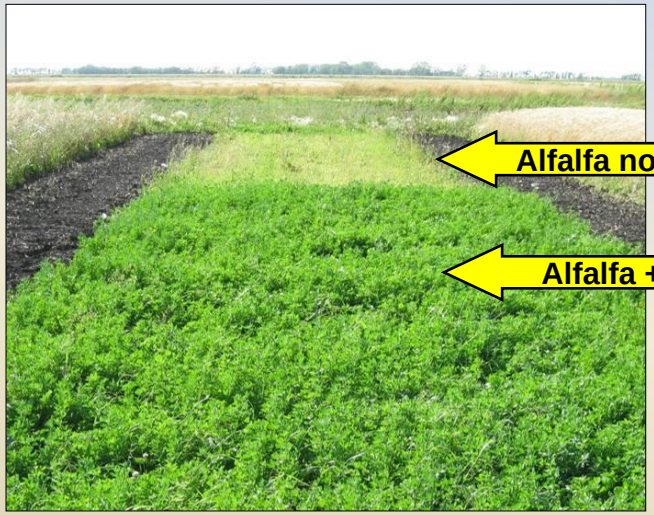
Photo: Rahman et al. 2005. Cdn. Biosys. Eng. 47: 6.9-6.16.

Timing of nutrient application

- **Manure or fertilizer broadcast on frozen soil or snow is bad agronomically and environmentally (eg. Srinivisan et al. 2006, Klausner 1976, Young & Mutchler 1976)**
- **In Manitoba, winter application of manure prohibited for large livestock operations in 1999 and universally for manure and fertilizer in 2013**

Summary and Conclusions

- **Phosphorus is essential for all forms of life**
- **Over the short and long term, we need to add P to cropland to maintain long term productivity**



Summary and Conclusions, cont'd.

September 3, 2006. The largest area of algal blooms ever seen on Lake Winnipeg (G. McCullough, U of MB)

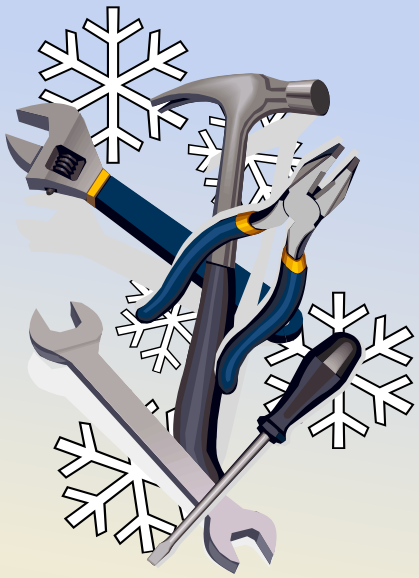
- **Small amounts of excess P in runoff cause big problems with water quality**
- **Many small sources of P contribute to the problem**
- **Agriculture needs to find ways to reduce its share of the P load to surface water**

Summary and Conclusions, cont'd.

- **Snowmelt runoff is the dominant form of runoff in many parts of the Northern Great Plains**
- **Processes and BMPs that control P loss in snowmelt runoff are not well known … but they are different from those that control P loss in rainfall runoff**

Photo: David Lobb

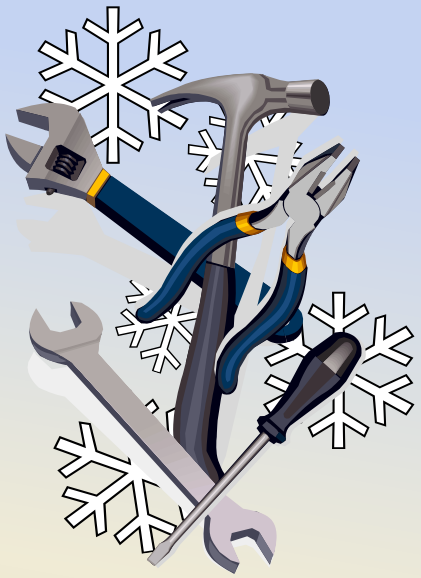
Summary and Conclusions, cont'd.



Source BMPs

- **Many nutrient management BMPs are available and widely used (e.g., 4Rs - right source, rate, placement, timing of P fertilizer and livestock manure)**
- **Aim for P balance, avoid high soil test P, avoid winter application of fertilizer and manure, avoid fall broadcast P fertilizer without incorporation**

Summary and Conclusions, cont'd.



Transport BMPs

- **Practical BMPs for intercepting nutrients in Northern Great Plains soils, landscapes and climate need more development**
- **If erosion is not the main cause of P loss, erosion control measures such as conservation tillage, perennial forage or vegetated buffers will do little to reduce P loss**
- **Careful selection and management of transport BMPs is required to avoid <u>increasing</u> P losses, partly because vegetation can be a P <u>source</u>, instead of a P <u>sink</u>, especially during snowmelt**

Summary and Conclusions, cont'd.

- **BMPs require <u>local</u> investigation and validation to ensure that they actually work**
- **Outsourced science & computer models may not be valid, hurting farmers & the environment**


Photo: Deerwood Soil & Water Mgmt Ass'n


Photo: AAFC

Summary and Conclusions, cont'd.

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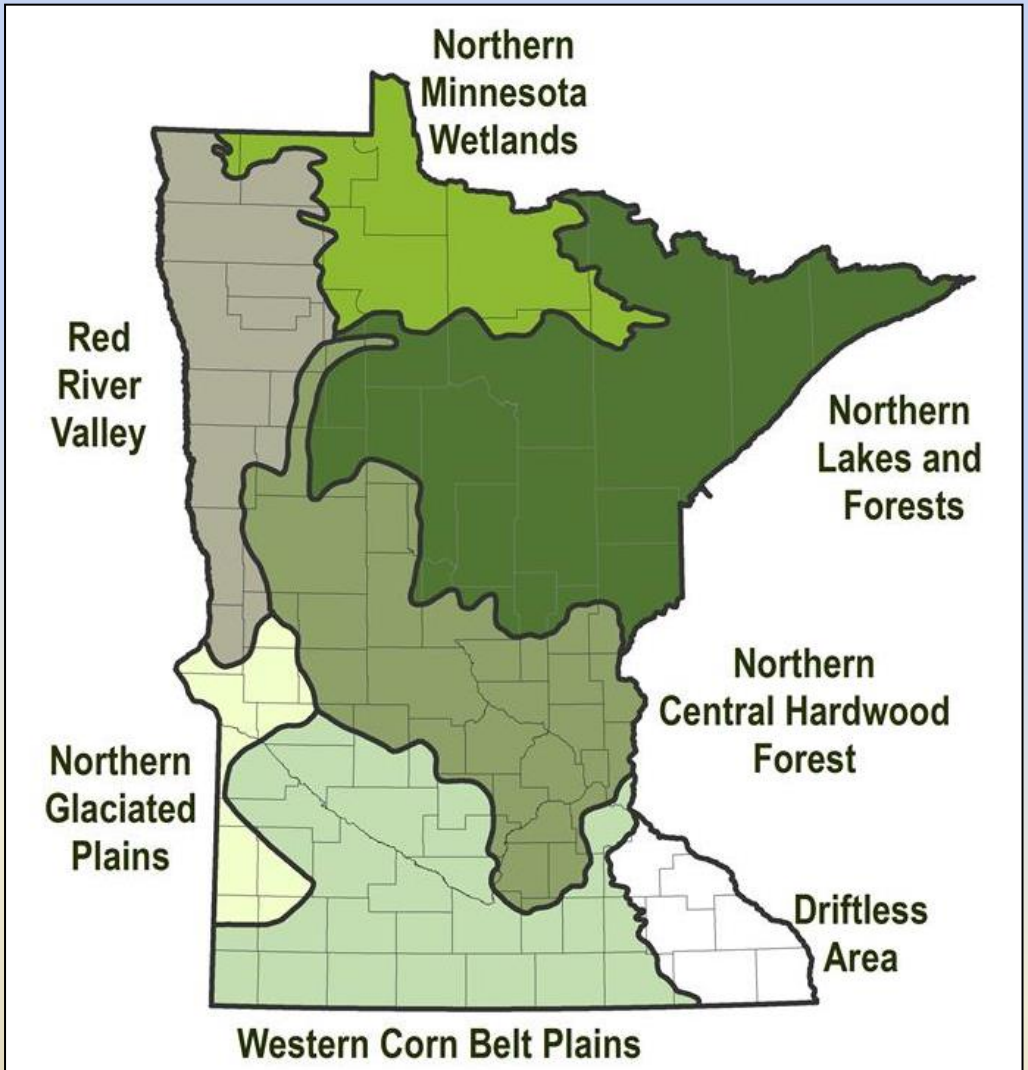
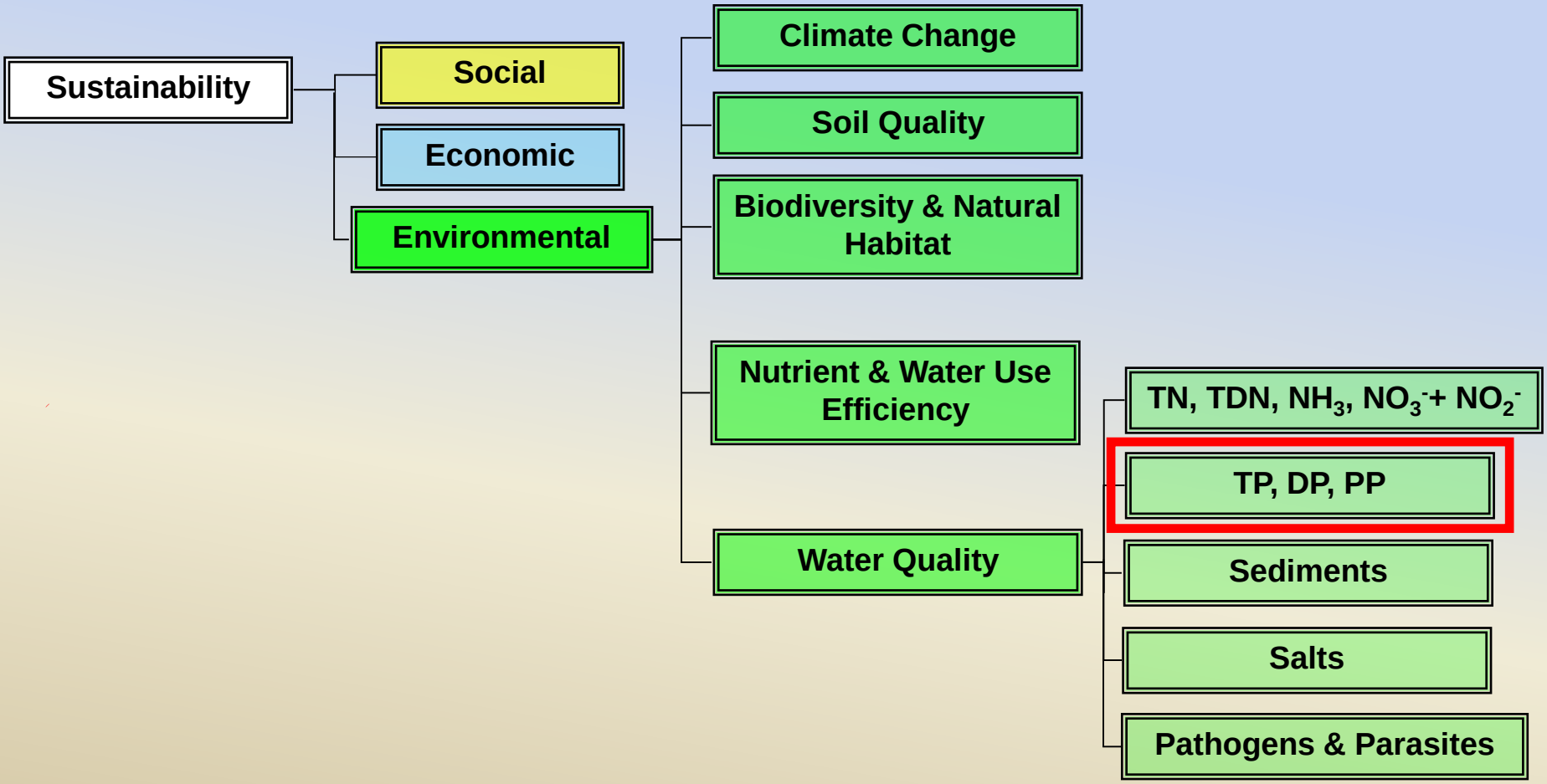


Source: RMB Environmental Laboratories, Inc.

Summary and Conclusions, cont'd.

- **Also, remember that P loss is only one of many objectives that agricultural practices must address to be sustainable**



Summary and Conclusions, cont'd.

- **No BMP, including conservation tillage, perennial forage or vegetated buffers is a cure-all, for all environmental issues and situations**

- **BMPs have different effects on different issues (eg. N vs P) in different environments (eg. rainfall on sloping land vs. snowmelt runoff on plains)**
- **Trade-offs & synergies are inevitable … let's use knowledge to maximize synergies & minimize trade-offs**

Summary and Conclusions, cont'd.

- **Perhaps it's time to treat <u>environmental</u> health like <u>human</u> health ... with more effort to aim for improved overall health:**

  - **Diagnose the correct <u>cause</u>**
    - **assess each case individually and comprehensively**
    - **identify the real cause of the most important problem(s)**
  - **Prescribe the right <u>cure</u>**
    - **make sure the "cure" works**
    - **treat with precision**
    - **consider all the benefits**
    - **consider all the side effects**
    - **continuously monitor, adapt & fine tune the treatment**

Acknowledgements

- David Lobb, Kui Liu, Kevin Tiessen, Sheng Li, Univ. of Manitoba
- Jim Yarotski, Larry Braul, Erin Zoski, Gao Chen & others in AAFC*
- Jane Elliott, Nancy Glozier, Environment Canada
- Kelvin Hildebrandt, Don Cruikshank, Bill Turner, Dale Steppler & others in Deerwood Soil & Water Management Association*
- Darshani Kumaragamage, Univ. of Winnipeg
- Manitoba Agriculture, Food and Rural Development
- Steve Sheppard, Ecomatters

* main sponsors for South Tobacco Creek Model Watershed