



South West Agricultural Conference
Ridgetown, Ontario, Canada
4-5 January 2017

Sustainable Phosphorus



Tom Bruulsema, Phosphorus Program Director, IPNI
Dave Buttenham, CEO, Ontario Agri Business Association



Agrium Inc.



Arab Potash Company



BHP Billiton



CF Industries Holdings, Inc.



Compass Minerals Plant Nutrition



International Raw Materials LTD



Kingenta Ecological Engineering Group Co., Ltd.



K+S KALI GmbH



The Mosaic Company



OCP S.A.



PhosAgro



PotashCorp



Shell Sulphur Solutions



Simplot



Sinofert Holdings Limited



SQM



Uralchem, JSC



Uralkali



Yara International ASA

The **International Plant Nutrition Institute** is supported by leading fertilizer manufacturers.

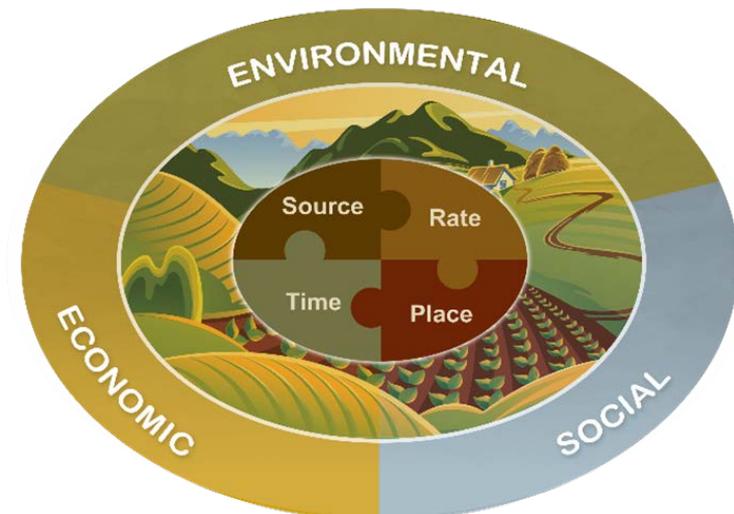
Formed in 2007 from the Potash & Phosphate Institute, its mission is to develop and promote science for responsible management of crop nutrition

Outline

- 1. Sustainability and Phosphorus – Tom Bruulsema**
 - Western Lake Erie phosphorus & algae
 - Ontario phosphorus balance & soil test levels
- 2. 4R Implementation in Ontario – Dave Battenham**
 - Memorandum of cooperation
 - Activities
 - Certification & designation



<http://phosphorus.ipni.net>



Phosphorus Sustainability Initiatives:

- resource consumption & use efficiency
- trace element loading
- water quality impacts

“Phosphorus Footprint”

“Peak Phosphorus”



**Sustainable
Phosphorus
Alliance**



August 16-20, 2016
Kunming, Yunnan, China



5th Sustainable Phosphorus Summit 2016
(SPS 2016)



PHOSPHORUS,

FOOD,

and our FUTURE

Edited by
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Andrea E. Ulrich *Editors*

**Sustainable
Phosphorus
Management**

A Global Transdisciplinary Roadmap

Rostock (Germany), September 12-16, 2016 PHOSPHORUS 2020
CHALLENGES FOR SYNTHESIS, AGRICULTURE, AND ECOSYSTEMS

IPW8: 8th International Phosphorus Workshop



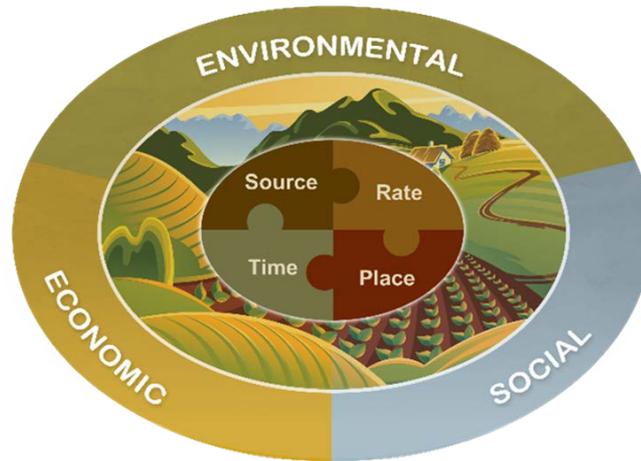
As a sustainability system,
4R Nutrient Stewardship
needs METRICS.



Nutrient Stewardship Metrics for Sustainable Crop Nutrition

Enablers (process metrics)

- Extension & professionals
- Infrastructure
- Research & innovation
- Stakeholder engagement



Actions (adoption metrics)

- Cropland area under 4R [Requires regional definitions of 4R practices]

Outcomes (impact metrics)

1. Farmland productivity
2. Soil health
3. Nutrient use efficiency
4. Water quality
5. Air quality
6. Greenhouse gases
7. Food & nutrition security
8. Biodiversity
9. Economic value



**4R Outcome Metrics
are influenced by
4R and more.**



OUTCOMES

of



are influenced by

by

crop and pest management,

and

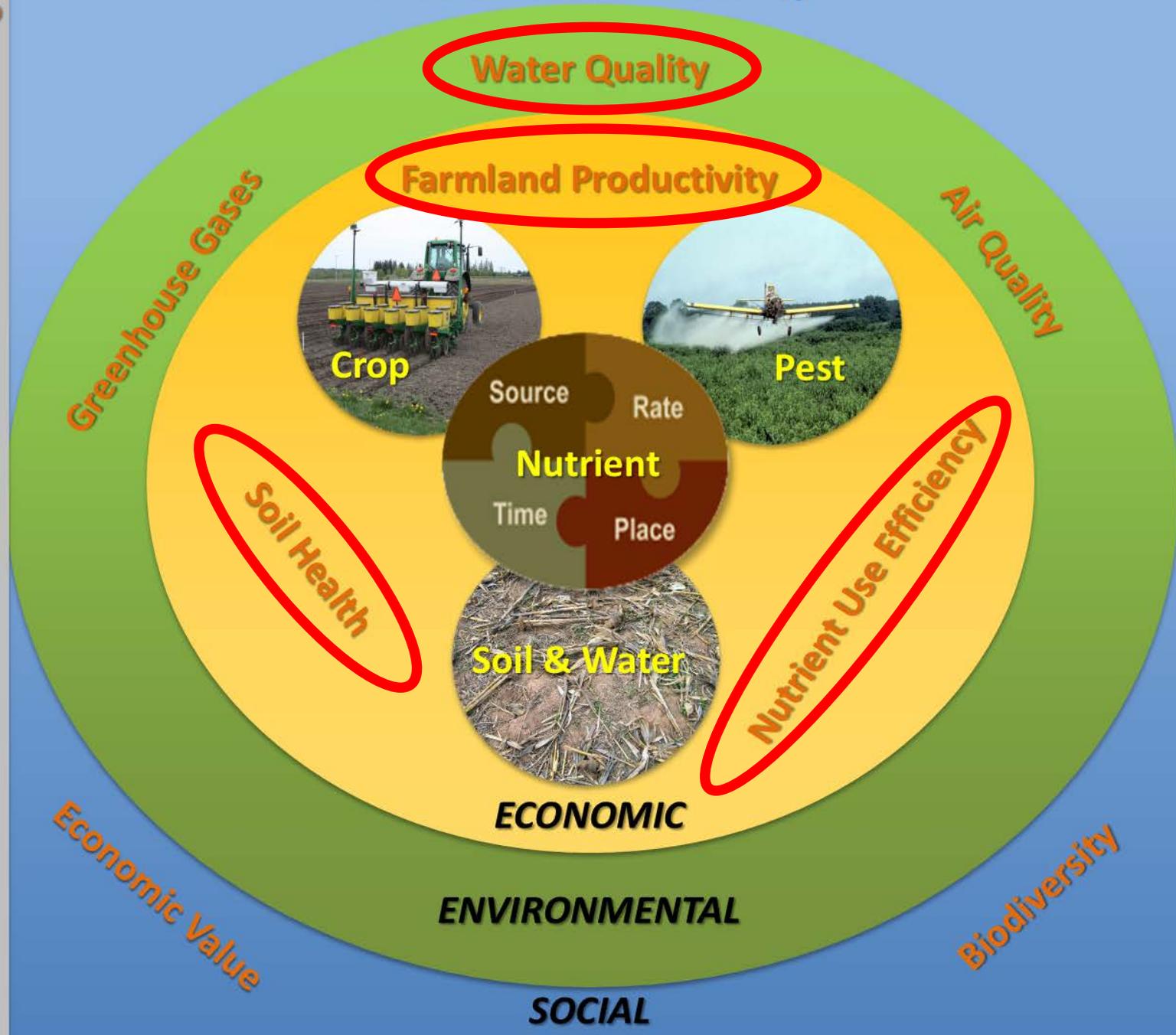
by

soil and water conservation practices

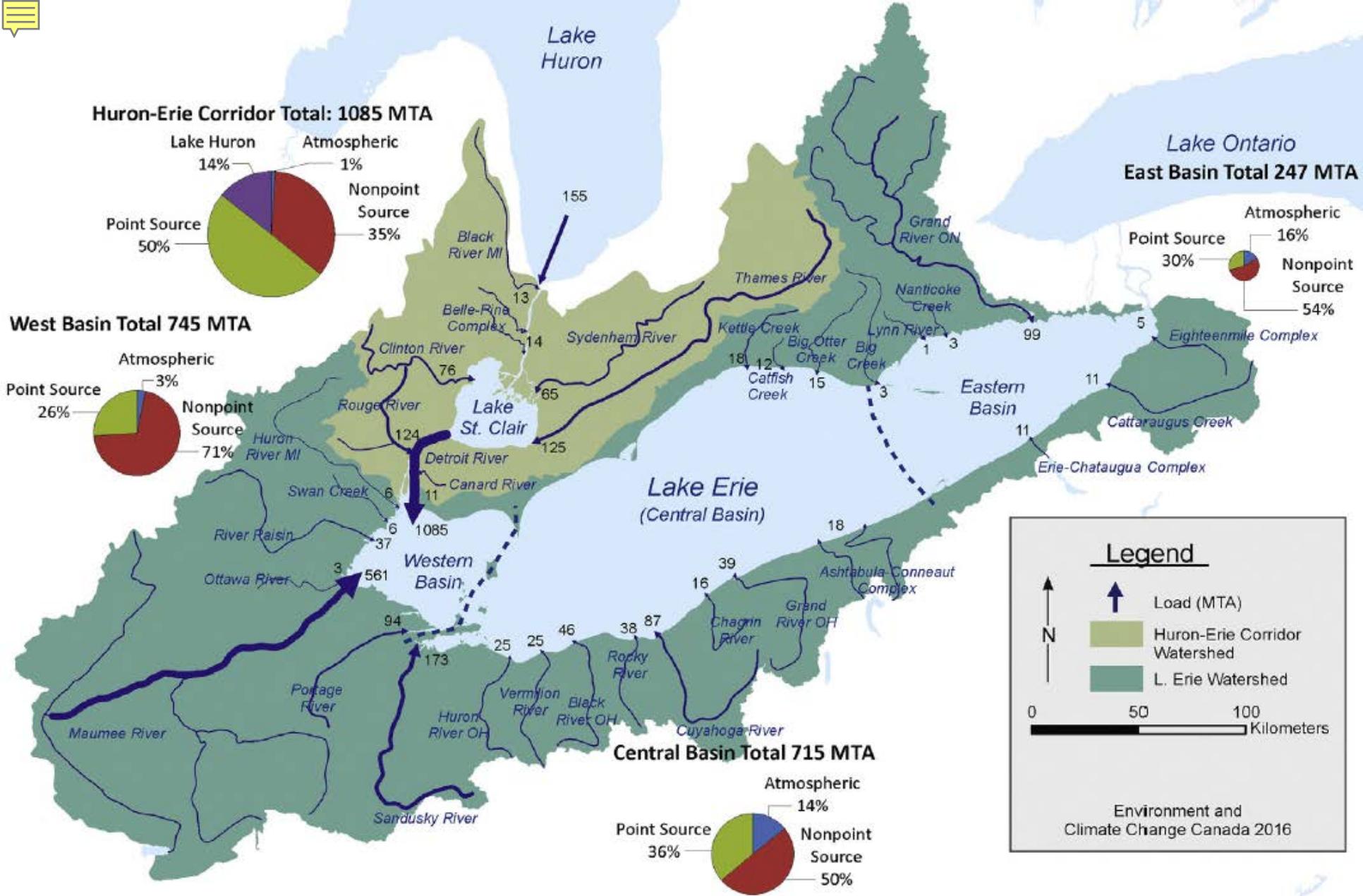
in the context of changing

weather and climate.

Food & Nutrition Security



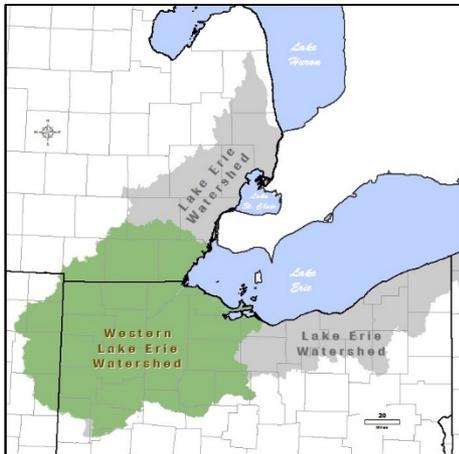
As the dominant land use in the Lake Erie watershed, agriculture plays a role in its phosphorus load and water quality issues.



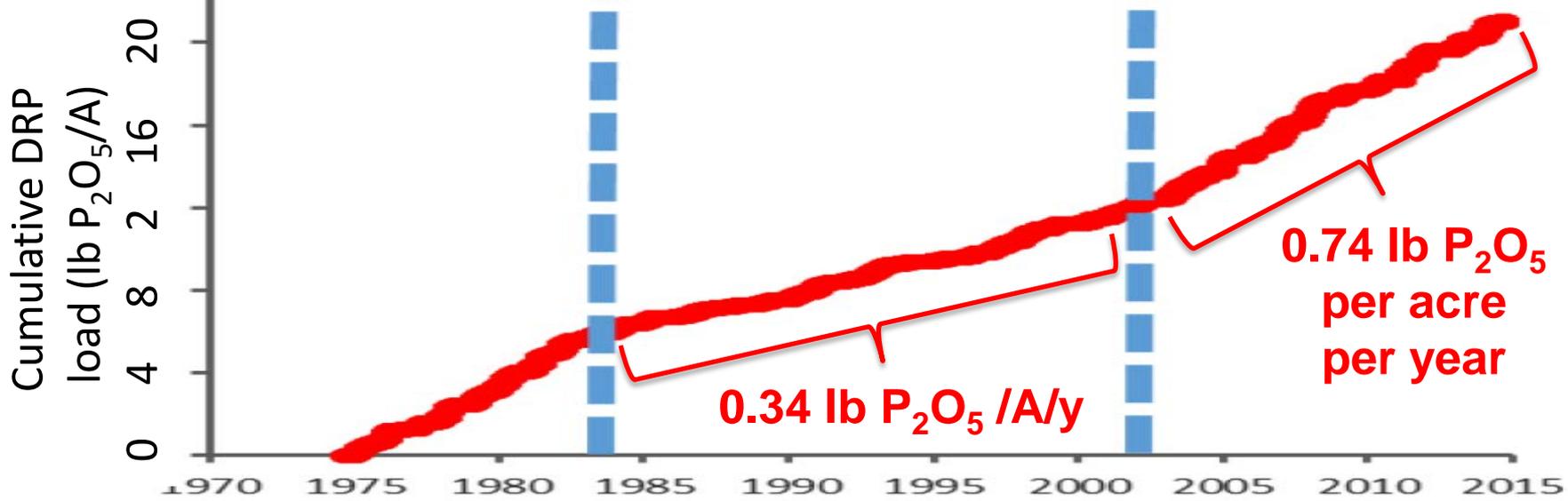
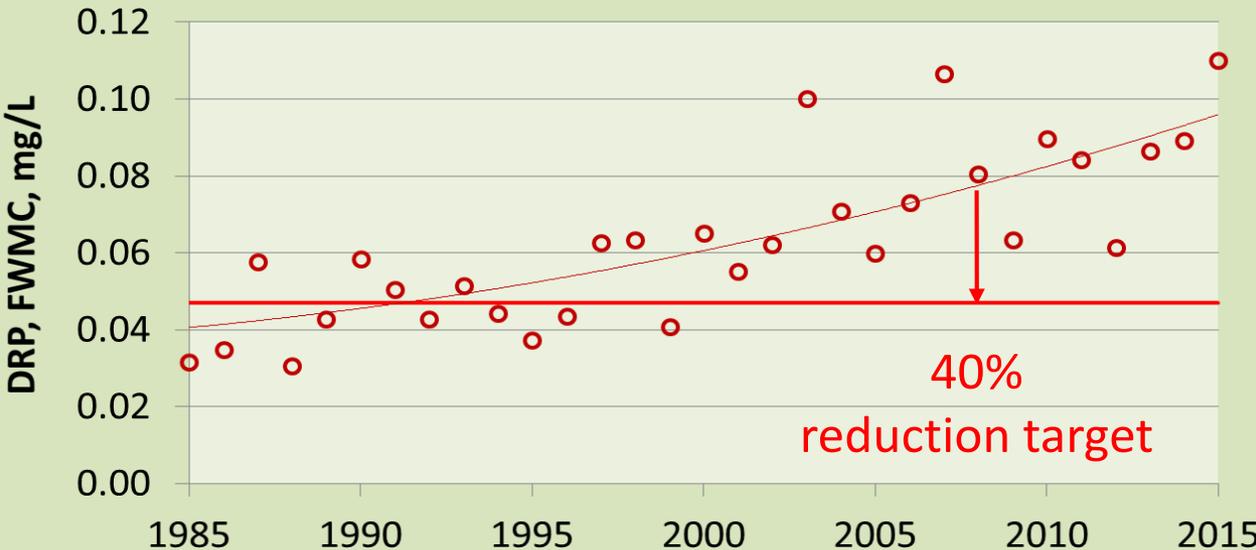
Maccoux, M.J., et al., Soluble reactive phosphorus loadings to Lake Erie, J. Great Lakes Res. (2016), <http://dx.doi.org/10.1016/j.jglr.2016.08.005>



**Western Lake Erie:
dissolved P trends
increasing since 2002**



Maumee River, Mar-Jul DRP, 1984-2015
flow-weighted mean concentration



1. David Baker & Laura Johnson, National Center for Water Quality Research, Tiffin, OH
 2. Jarvie et al., 2016, J Environ. Qual.



4R efficacy for reducing P loss, % reduction

- ranges found in field experiments across the USA and Canada

Practice	Dissolved P	Particulate P
Source	---	---
Rate	60 to 88%	0
Time	41 to 42%	0
Place	20 to 98%	-60% to 0
Soil inversion	0 to 92%	-59% to 0
Conservation tillage	-308 to -40%	-33 to 96%

Dodd & Sharpley, 2015. Nutrient Cycling in Agroecosystems.

1. Mix of scales: plot, edge-of-field, catchment
2. Wide range of efficacies demands a site-specific focus.
3. Trade-off between dissolved and particulate is important.



Some growers fertilize all their crops in bands near the seed.



Fall Strip-till Banding

- Puts the P in the soil
- Keeps residue on the soil
- RTK GPS for precision planting

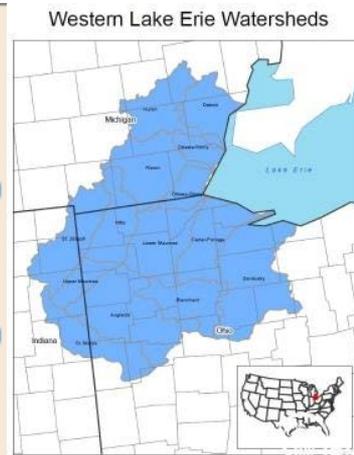
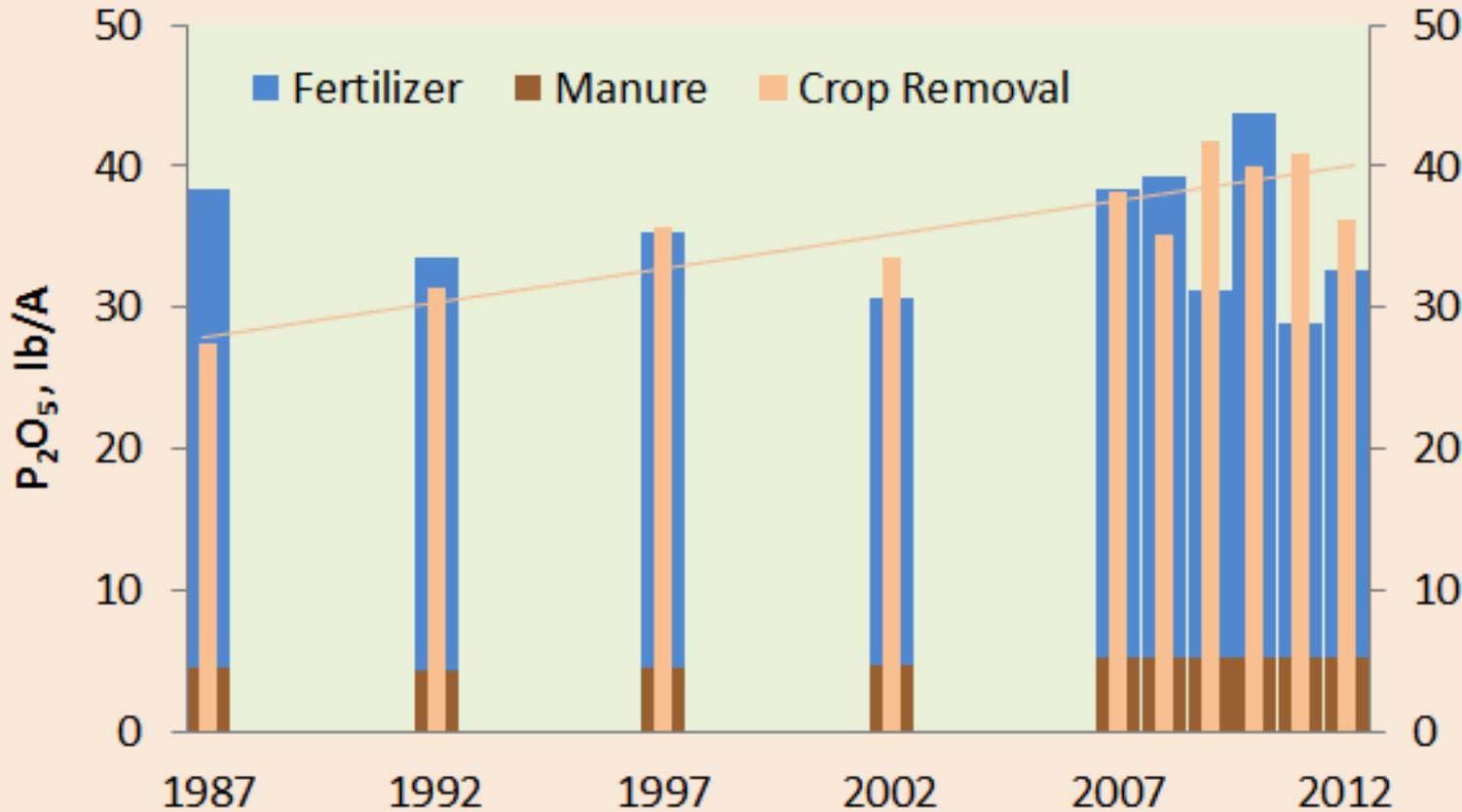
*Greg LaBarge, Ohio State
University Extension*





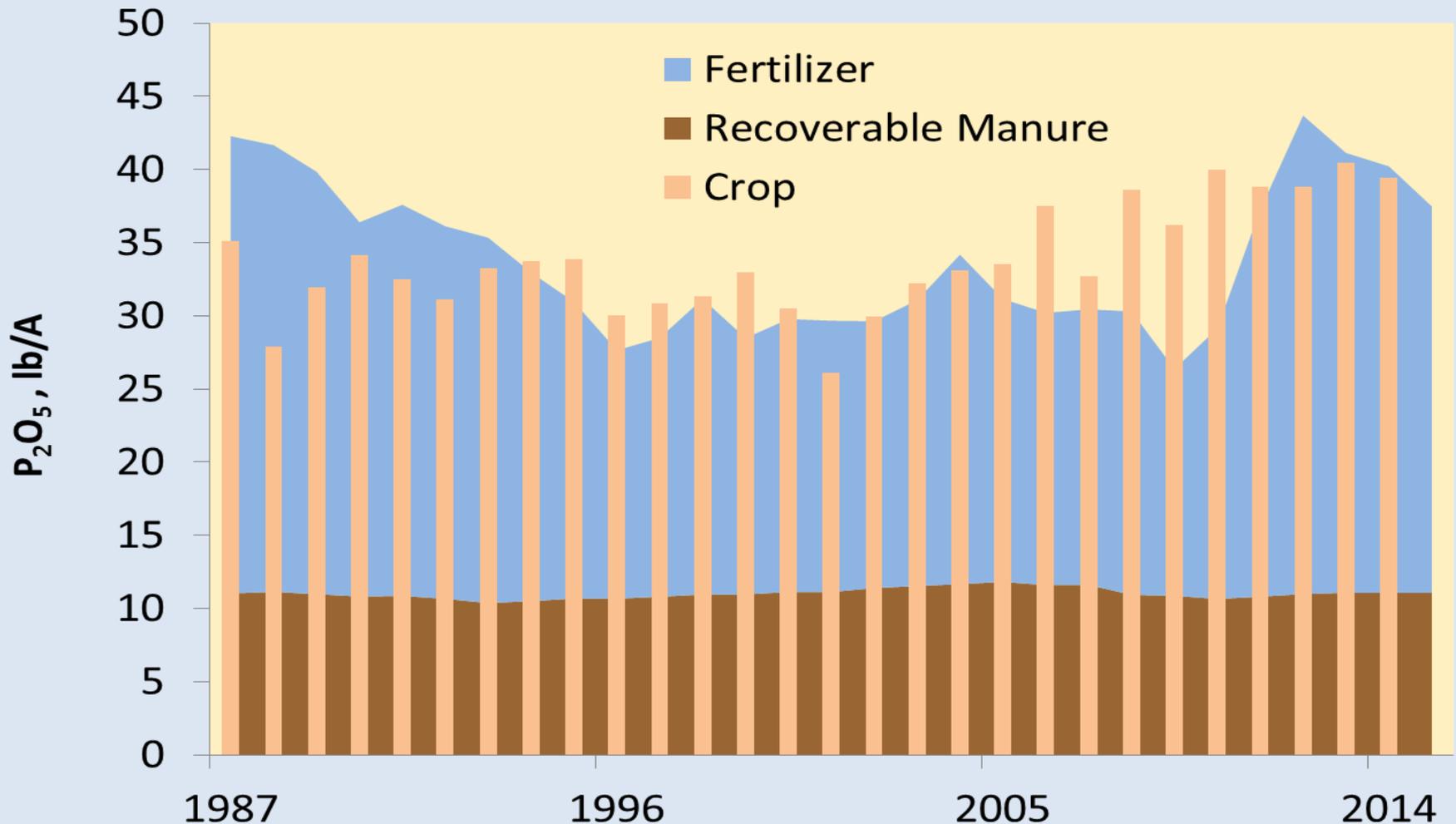
Strip tillage with granular placement puts P in the right place – and controls erosion.

Cropland P Balance, Western Lake Erie Watershed



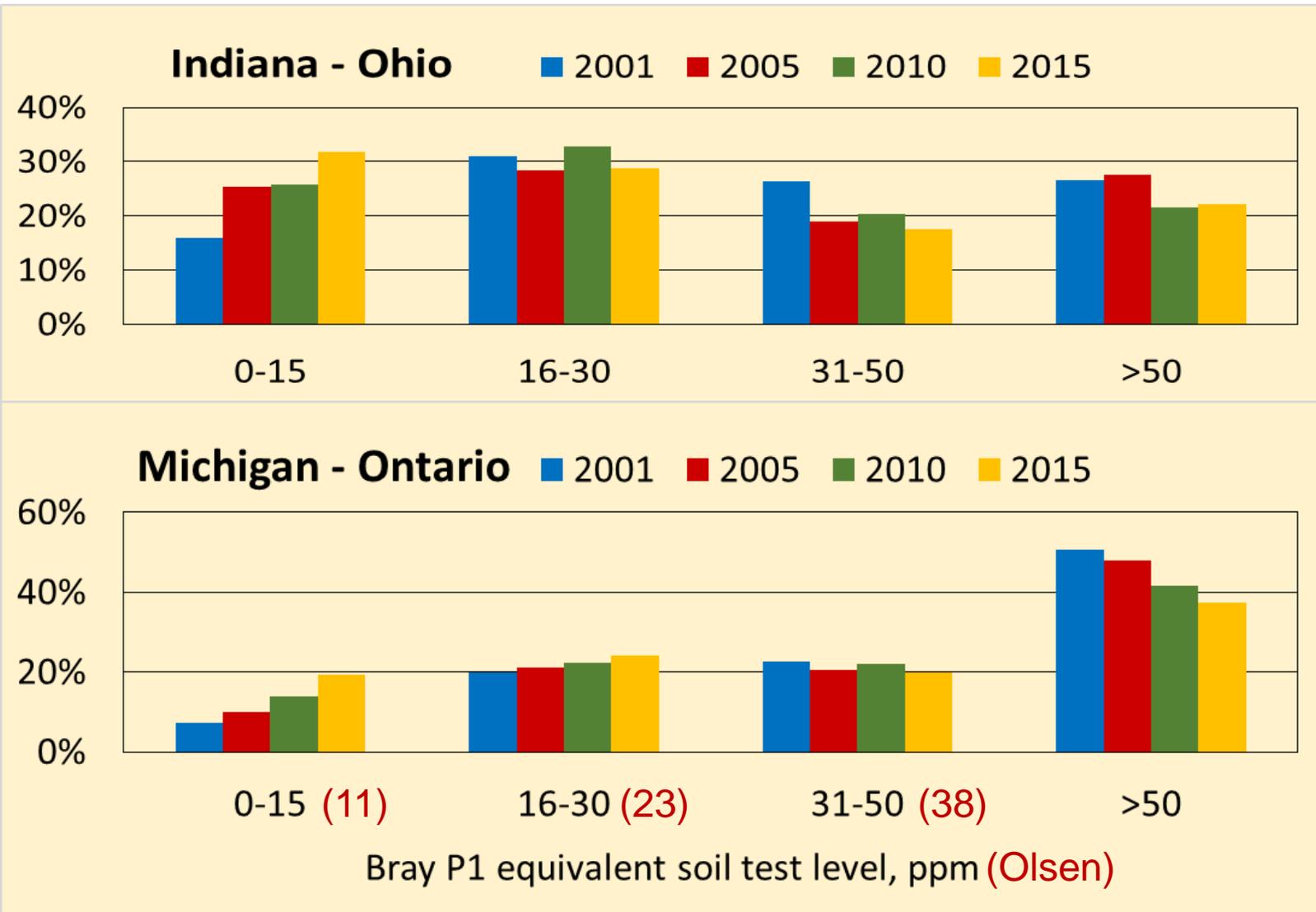
1. Crop removal is increasing with yield.
2. Application rates are falling short of crop removal.

Ontario Cropland Phosphorus Balance



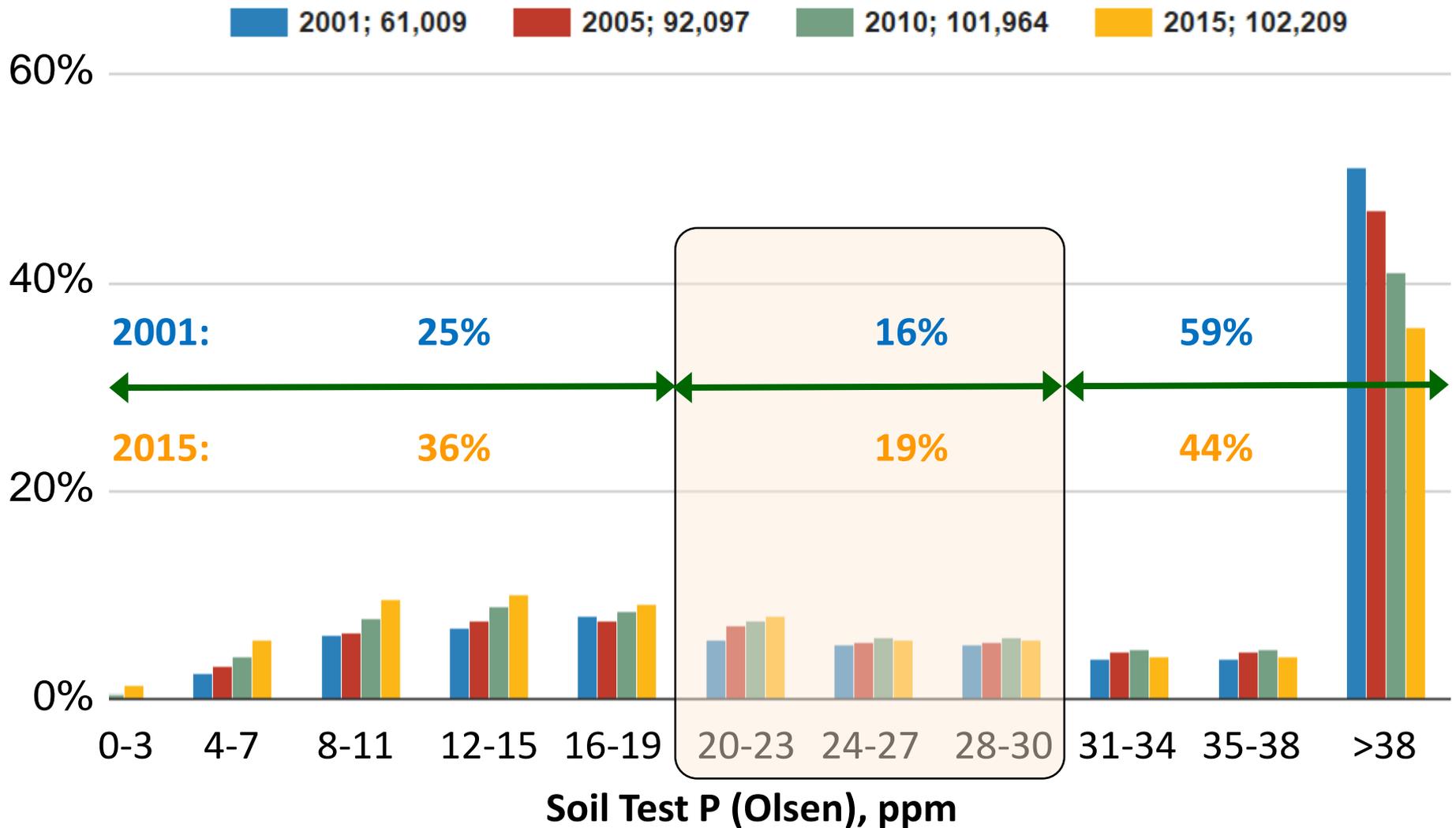
Ontario's P balance: manure is a bigger proportion of the input than in the Western Lake Erie watershed

Ontario has more soils very high in P than Ohio



<http://soiltest.ipni.net>

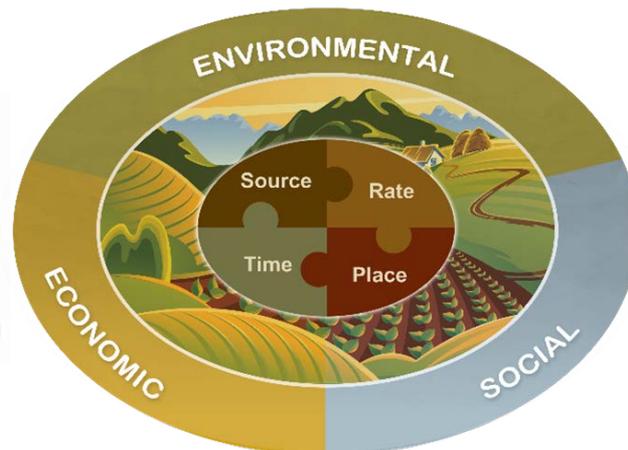
Ontario soil test P is declining



<http://soiltest.ipni.net>

Summary

- The sustainability movement can increase public appreciation of industry efforts to implement 4R phosphorus practices.
- 4R practices can reduce phosphorus loads. Right place, right time, right rate, right source – specific to soil and landscape.
- The agri-retail industry can work with you to document
 1. trends in right place, right time, right rate;
 2. the resulting impact on things that matter.



4R Nutrient Stewardship

Right Source @ Right Rate, Right Time, Right Place®

Ontario 2016



Ministry of Agriculture,
Food and Rural Affairs



FERTILIZER CANADA
FERTILISANTS CANADA

4R Ontario

- Memorandum of Cooperation signed (2015) between the Government of Ontario Ministry of Agriculture Food and Rural Affairs, Fertilizer Canada, and the Ontario Agri Business Association



4R Nutrient Stewardship can **help** grow crops sustainably

The 4Rs work to increase production/profitability for farmers while ensuring the future of the agricultural industry



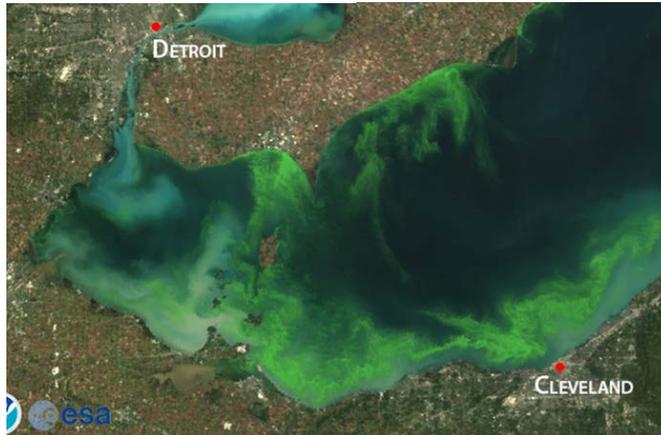
4R Ontario...

What are the key messages?

1. Crop nutrients are essential for the growth of nutritious food to feed Ontarians, Canadians and people around the world.
2. The efficient use of nutrients from mineral fertilizers, manure or other sources, minimizes the risk of nutrient losses to ground and surface water sources.
3. 4R Nutrient Stewardship provides farmers with practical, evidence-based solutions that benefit both the environment and their profitability.



Why 4R?



- Algal Blooms in Western Basin of Lake Erie
- Increased focus on environmental issues by current government
- 4Rs referenced in MOECC Action Plan and Canada – U.S Great Lakes Agreement
- Ag sector needs to take a leadership role in developing a solution
- 4R is a ‘good fit’ with current move toward sustainability programs



4R Ontario Activities

- Partnered with 6 producers for 4R Demonstration Farm project
- Fertilizer Canada sponsored development of 4R Specialty Designation for CCA's
- Two Pilot Projects:
 - Voluntary designation of 4R acres
 - Crop input retail certification



4R Retail Certification Pilot Program

- The 4R Ag Retail Certification pilot program involves voluntary certification of agri-retail facilities based on a series of 41 auditable criteria established by the Ohio program and based on the principles of 4R Nutrient Stewardship.
- **4** Ontario agri-retail locations in the Western Basin of Lake Erie volunteered to participate in the audit program for the Pilot program:
 - Thompsons Limited
 - Settingington's Fertilizer Service Ltd.
 - Agris Co-operative Ltd.
 - South West Ag Partners Inc.
- Audits conducted by the lead auditor from the 4R Ohio indicated that Ontario ag-retailers were very close to meeting the audit standards with business as usual practices.



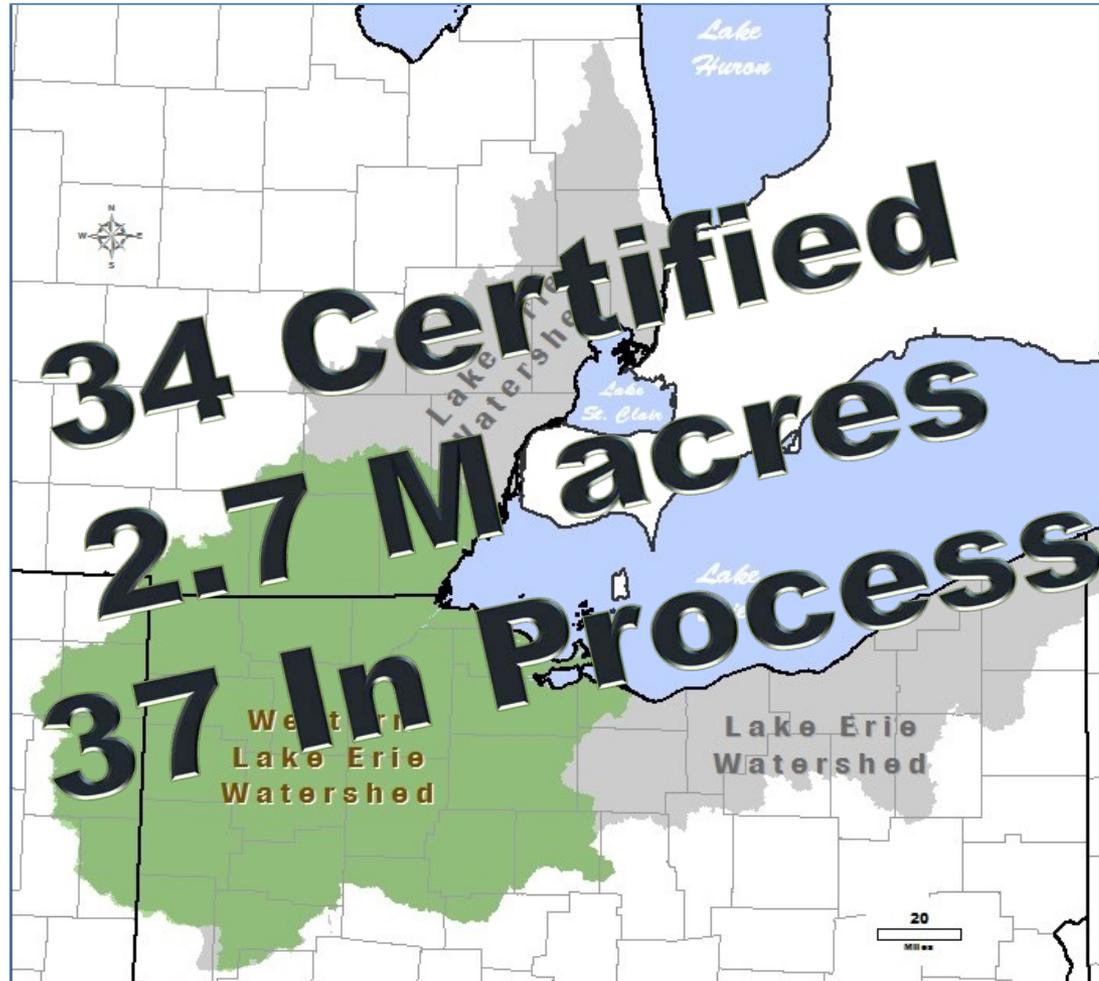


4R Retailer Certification

- Based on pilot project results 4R Ontario Steering Committee has approved the development of a voluntary agri-retailer 4R certification program
- 4R Science & Tech Committee working on Ontario specific certification standards



Learning from the “Ohio Experience”





Ohio Retailer Certification Program Requirements

1. Training and Education
2. Nutrient Recommendation and Application
3. Monitoring of 4R Implementation

PROOF



The 4R Nutrient Stewardship Certification Program outlines an initial three-year plan for Nutrient Service Providers. A brief summary of standard requirements during the first three years is provided below.

YEAR 1

Nutrient Service Providers and their grower customers shall be educated and trained on the principles of 4R Nutrient Stewardship, and support the adoption of new research and technologies for nutrient management.

- Education of staff on 4R Nutrient Stewardship
- Maintain records with soil test at least every four years, recommendations based on university recommendations and actual applications reviewed with client
- Account for all sources of nutrient applied
- Identify sensitive areas of nutrient applied

YEAR 2

The implementation of 4R principles and practices are recorded and monitored. Records of implementation are checked by the Nutrient Service Provider to evaluate progress of the implementation of 4R principles and practices over time.

- Continued education on 4R Nutrient Stewardship internally to staff and to growers through meetings or materials
- Maintain records of conditions at time of application and consider pre-application weather conditions
- Have digital field boundary maps and identify sensitive features with soil tests and yield maps
- Soil test no larger than 25 acres

YEAR 3

Nutrient recommendations and application are made with the goal of maximizing crop uptake (with goals for crop yields calculated and included) and minimizing nutrient losses to the environment. Records are maintained for customers and their nutrient recommendations. Soil testing must be based on appropriate sampling frequency and intensity. Recommendations and application must be consistent with the Tri-State Fertilizer Recommendations or other recommendations recognized and supported by a land-grant university, allowing for adaptive management based on documented on-farm data showing reasonable expectations of improved crop yield without increased risk of harm to water quality.

Nutrient recommendations and application must observe setbacks to water bodies and other features. Nitrogen and phosphorus must not be applied on frozen ground. All sources of nutrients must be accounted for in the recommendation and must be reviewed by a certified professional. Variable Rate Application is used when justified. Nutrients are not applied at more than a two-year application rate.

- Field records include watershed information for fields
- Customer signature on 4R Nutrient Stewardship support
- Geo-referenced soil testing
- Include weather criteria as part of application planning
- Use of variable rate planning
- Use of variable rate technology

Download complete requirements and details at 4Rcertified.org/how



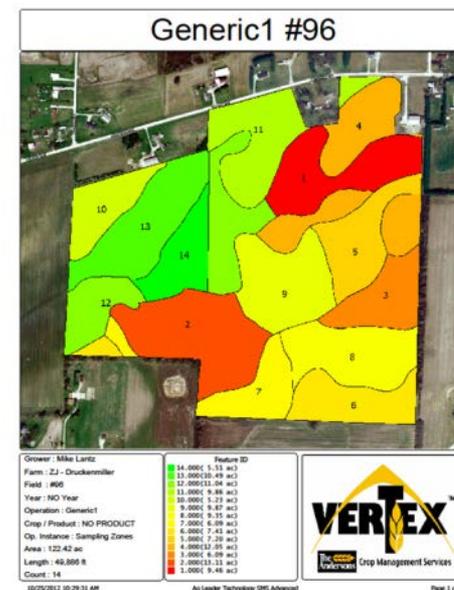
Training & Education

- Certified Professionals must have Initial Training and 5 CEUs every 2 years
- Sales and application staff – 2 hours training every 2 years
- Provide 4R materials for all customers
- Sponsor training for growers/customers



Nutrient Recommendations

- Soil Test – 4 year minimum interval
- Nutrient Recommendations:
 - provided by certified professional
 - science-based
- Utilize crop history and yield goals





Nutrient Application



- Annual calibration of equipment
- Application consistent with recommendations
- No application to **frozen or snow-covered** soil
- By year 3 of audit cycle - no surface application without immediate incorporation if NOAA forecast exceeds a 50% chance of one inch or more of rain
- By year 3 - utilize GIS and VRT on 35% of custom application acres





Monitoring & Implementation

- Number of customers and acres participating
- Records that document recommended rates, application and compliance with 4R audit standards.
- Records that growers support 4R nutrient stewardship



Validation by Third Party Audit

Third party audits conducted by the Nutrient Stewardship Council

Nutrient Stewardship Council (NSC)

Agricultural Business

Grower Organization

Government

Environmental NGO (Nature Conservancy)

Universities / Researchers



4R Ontario is Moving Forward...

- **4R Ontario MOC: 2015-2018**

- Continue to promote increased adoption of 4R; provide general retailer staff and farmer training; and develop affiliated resources
- 4R Retailer Certification – focus on building capacity, industry accountability, relevant targets, program standards
- Identify research gaps
- Increased communication efforts

