



Ontario Federation of Agriculture  
Annual General Meeting  
“Precision Matters”  
Toronto, Ontario, Canada  
21 November 2016

# 4R Implementation in Ontario Phosphorus & Sustainability



**Tom Bruulsema**, Phosphorus Program Director, IPNI  
**Charles Lalonde**, CJ Agren Consulting Inc.



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



LUXI Fertilizer Industry Group



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



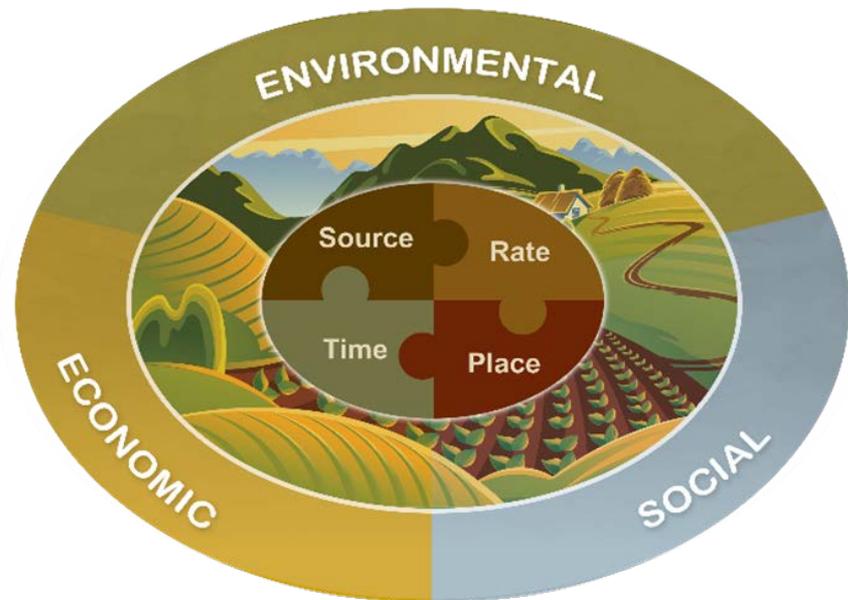
# Outline

## 4R Implementation in Ontario

1. Sustainability and Phosphorus – Tom Bruulsema
  - Western Lake Erie watershed
  - Ontario
2. Resiliency of 4R in Ontario – Charles Lalonde



<http://phosphorus.ipni.net>





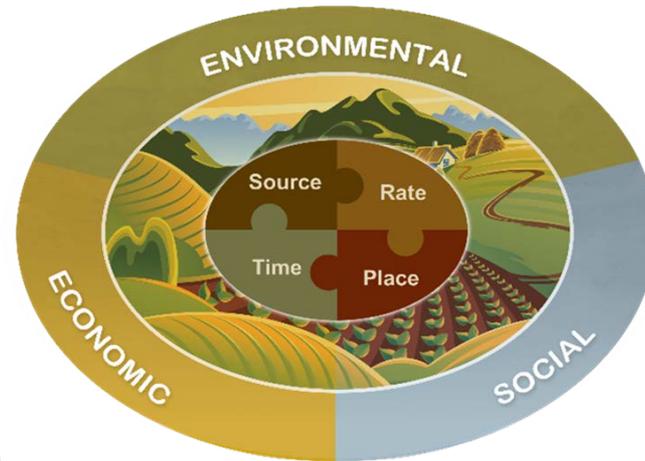
# As a sustainability system, 4R Nutrient Stewardship needs METRICS.



# 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

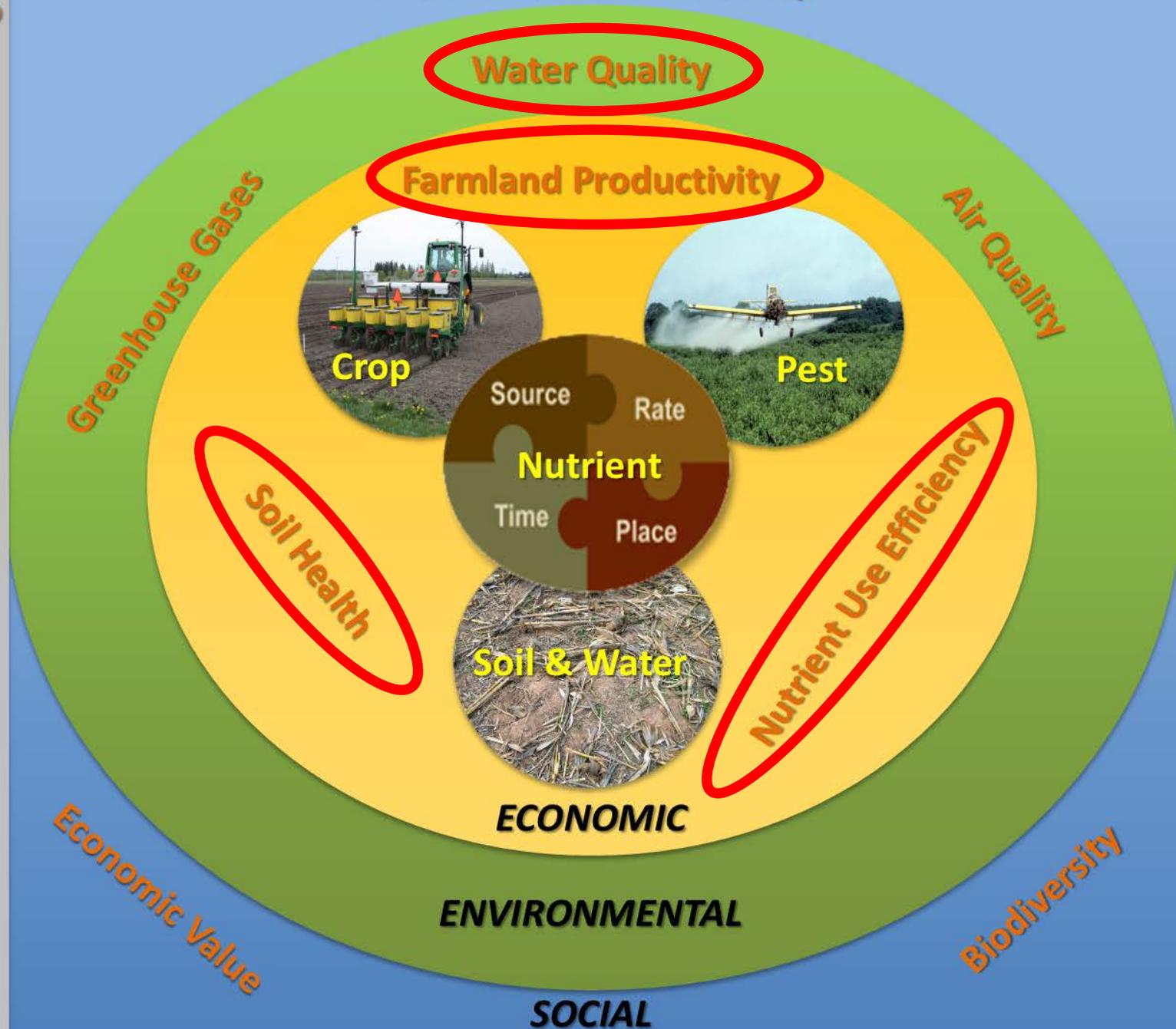
by

soil and water conservation practices

in the context of changing

weather and climate.

## Food & Nutrition Security

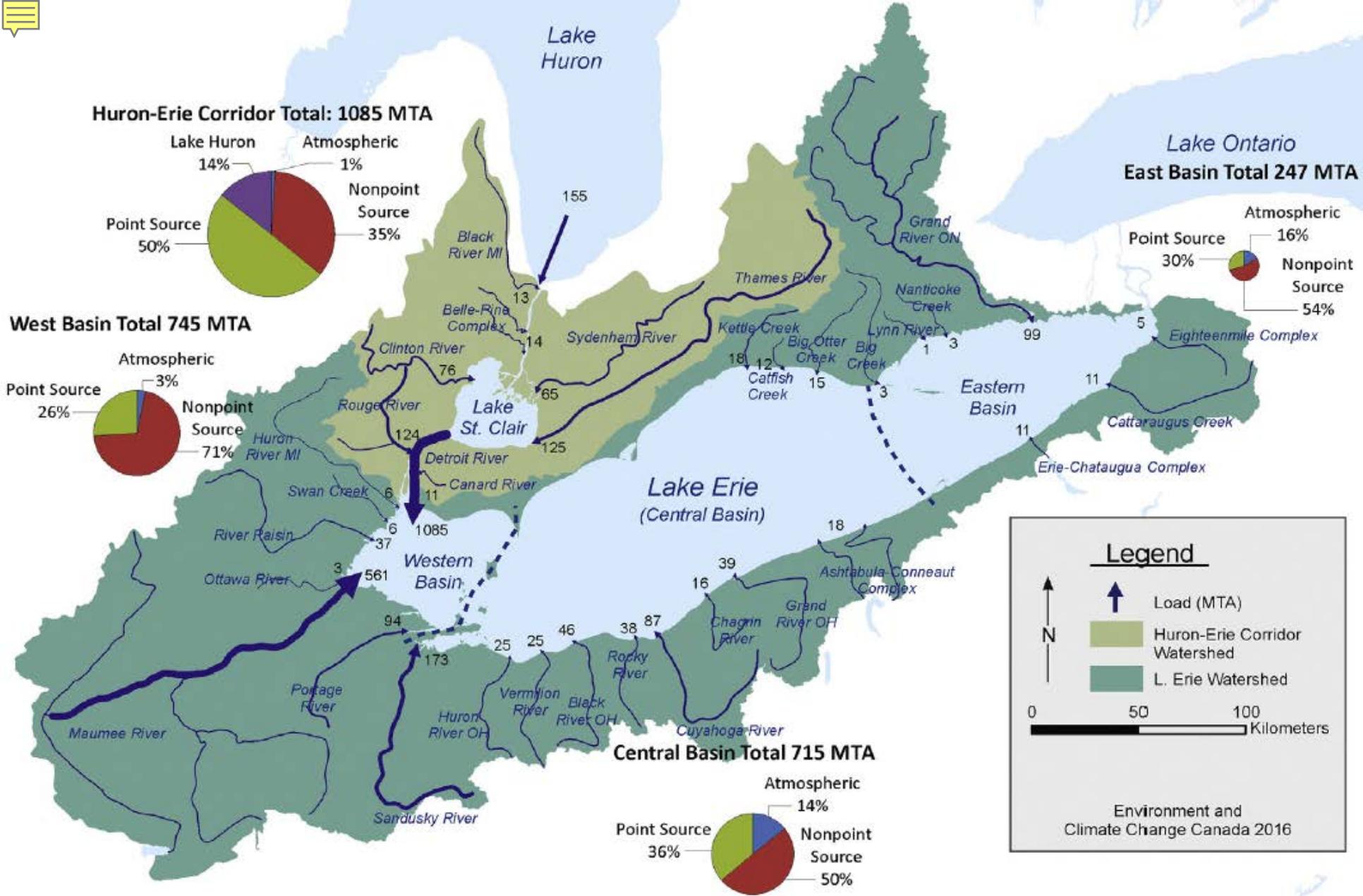




**We All  
Play A  
ROLE**

Western Lake Erie  
Watershed  
4R Certification Program





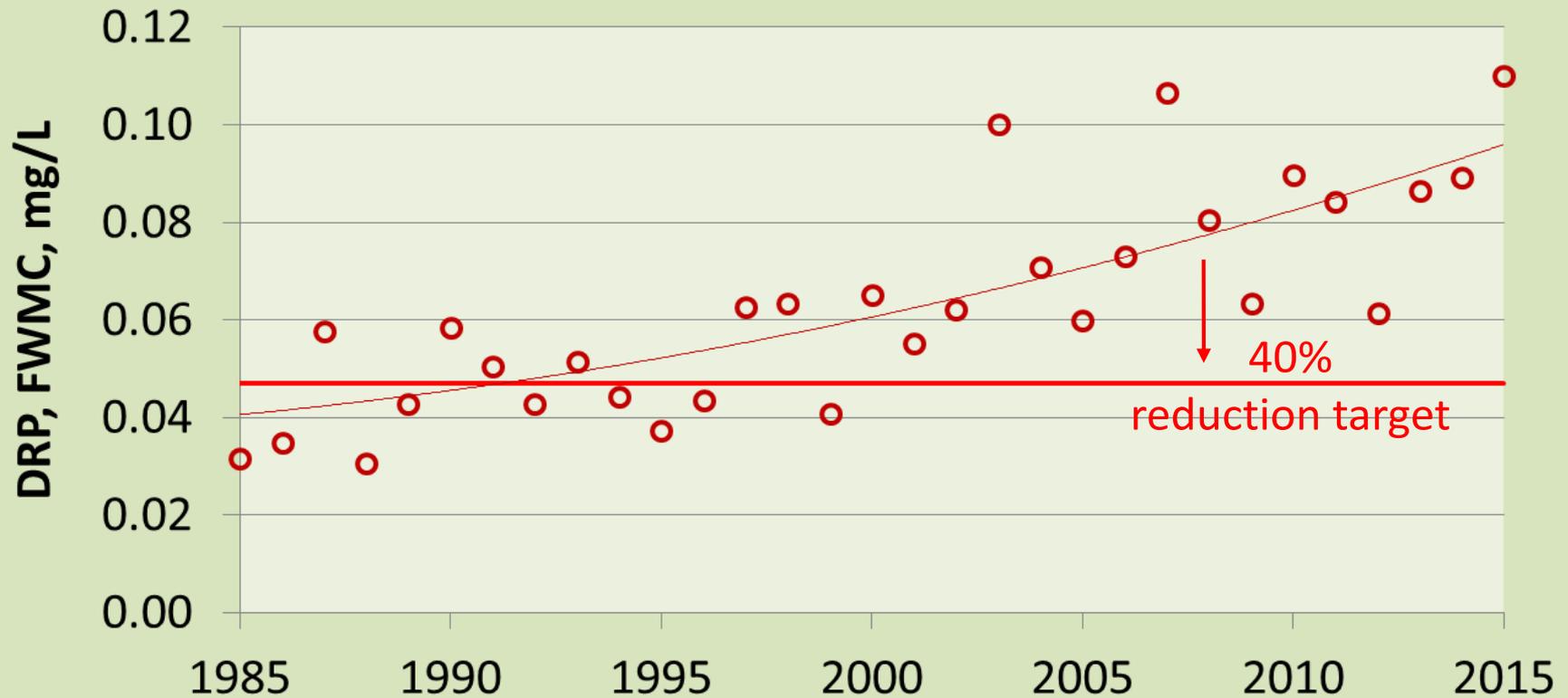
Maccoux, M.J., et al., **Soluble reactive phosphorus loadings to Lake Erie**, J. Great Lakes Res. (2016), <http://dx.doi.org/10.1016/j.jglr.2016.08.005>



# Western Lake Erie watershed: dissolved P losses increasing

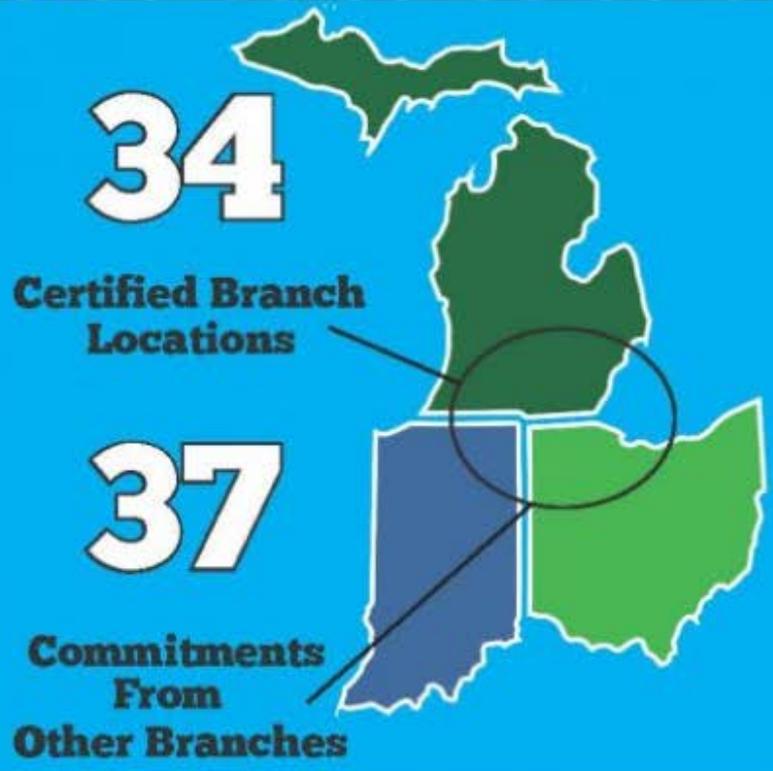


## Maumee River, Mar-Jul DRP, 1984-2015 flow-weighted mean concentration



# 4R NUTRIENT STEWARDSHIP CERTIFICATION PROGRAM

Western Lake Erie Basin - Ohio, Michigan, and Indiana



Acres serviced or applied in WLEB	1,900,000
Acres outside WLEB serviced or applied	800,000
<b>Total</b>	<b>2,700,000</b>
Number of Clients Serviced in WLEB	4,000
Clients Serviced Outside WLEB	1,500
<b>Total</b>	<b>5,500</b>



**2.7M acres in OH-IN-MI**  
extending to all of Ohio

# 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. Wide range of efficacies demands a site-specific focus.
2. 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

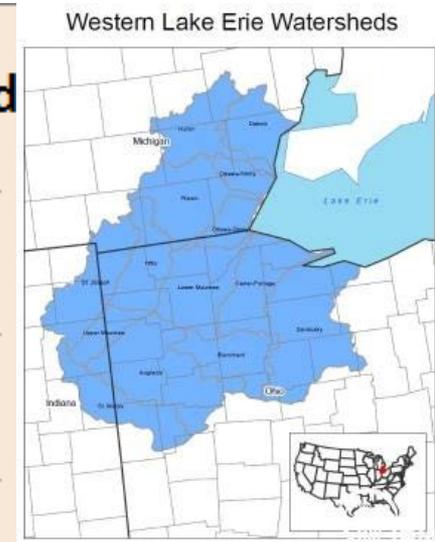
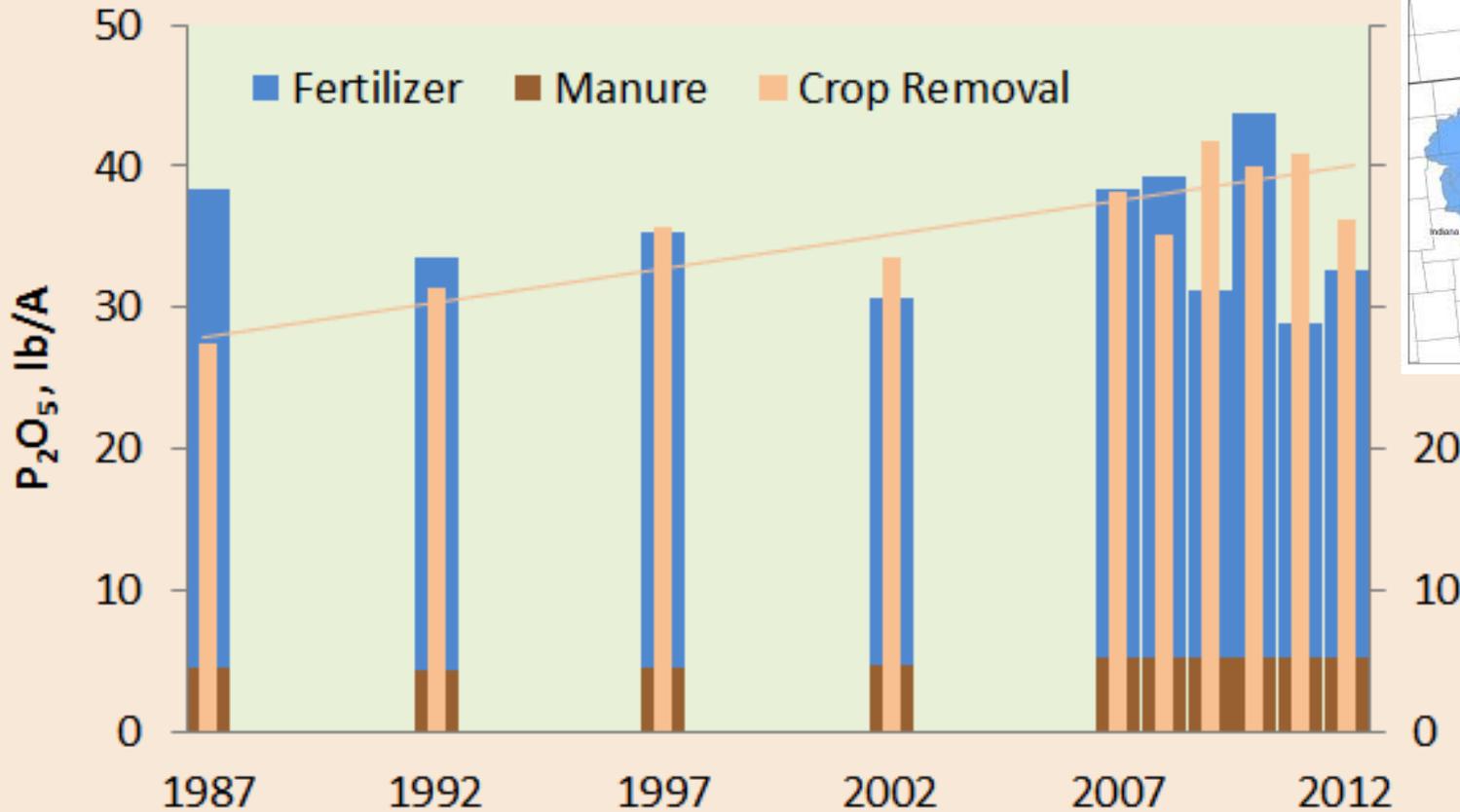
*Greg LaBarge, Ohio State  
University Extension*





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

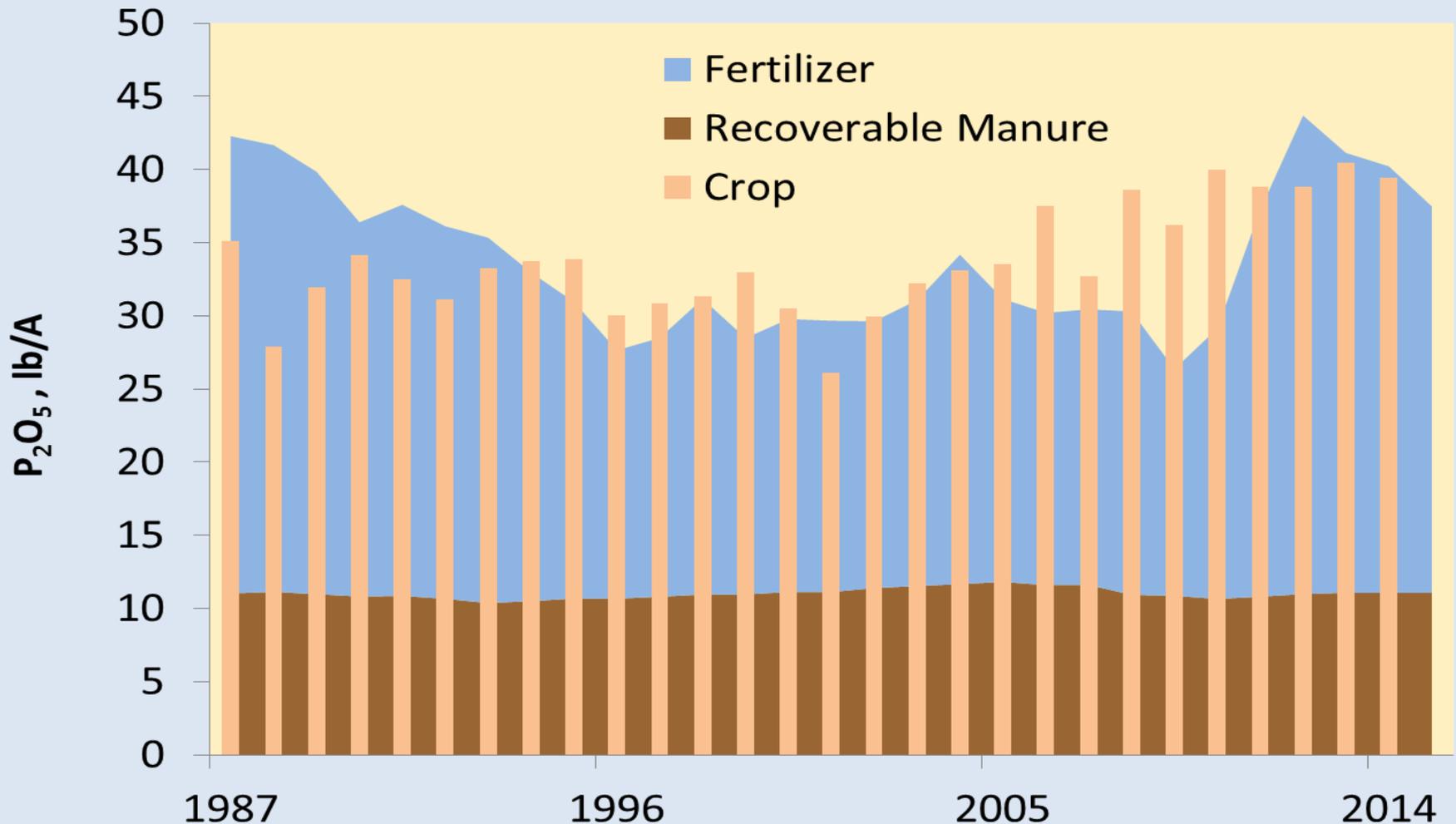
# Cropland P Balance, Western Lake Erie Watershed



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

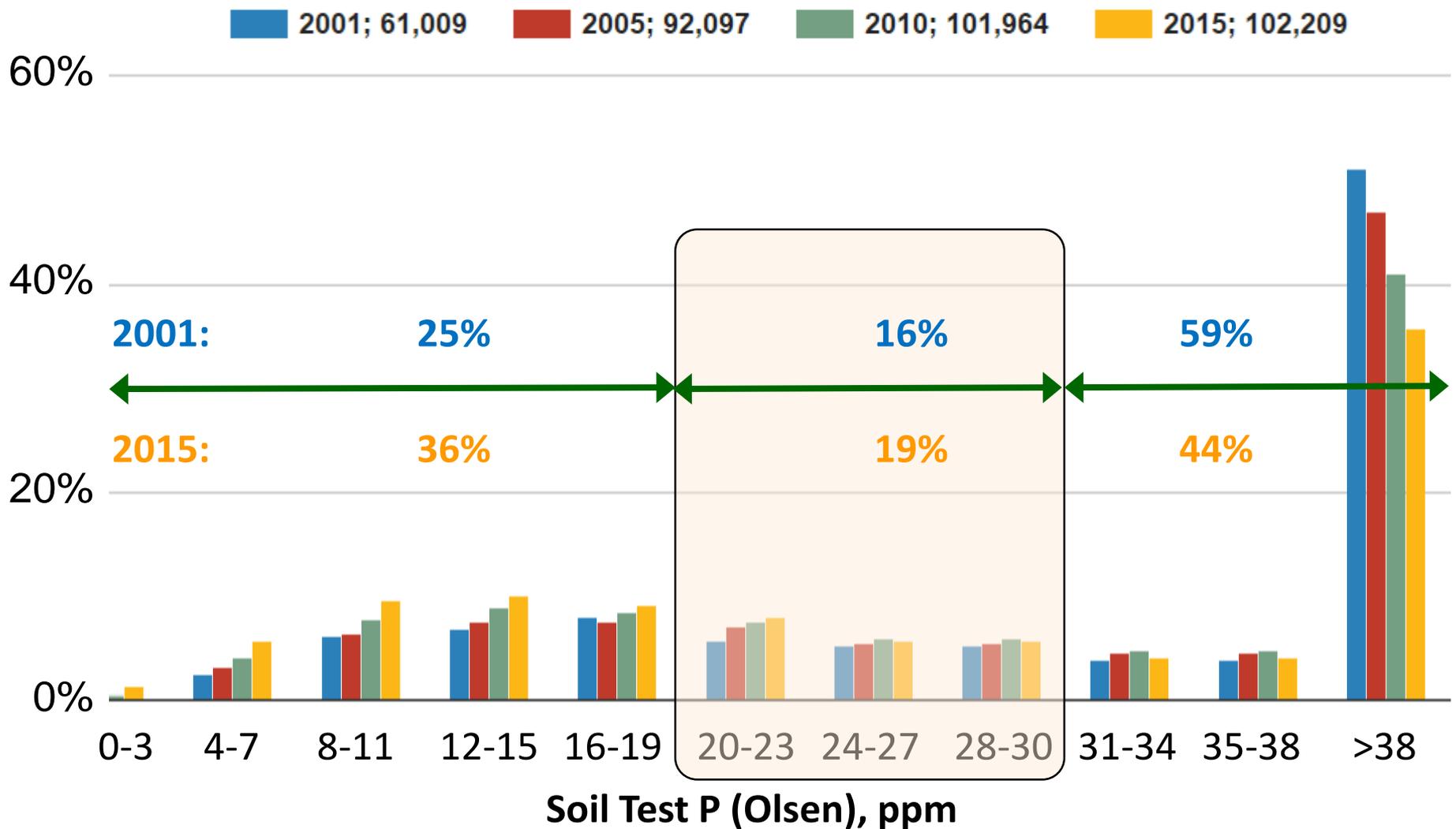


# Ontario Cropland Phosphorus Balance



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>

# Summary

- The sustainability movement can increase public appreciation of industry efforts to implement 4R phosphorus practices.
- The Western Lake Erie 4R Certification program offers a model of 4R implementation that can be adapted to Ontario.
- 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.

