Farming 4R Watershed
Kitchener, Ontario
7 March 2012

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INTERNATIONAL
PLANT NUTRITION
INSTITUTE

What belongs in a 4R Nutrient Stewardship Plan?

Tom Bruulsema, PhD, CCA
Director, Northeast Region, North America Program

Agrium Inc.

Arab Potash Company

Belarusian Potash Company

CF Industries Holdings, Inc.

Compass Minerals Specialty Fertilizers

Incitec Pivot

International Raw Materials LTD.

Intrepid Potash, Inc.

K+S KALI GmbH

The Mosaic Company

OCP S.A.

PotashCorp

Qatar Fertiliser Company (QAFCO)

Simplot

Sinofert Holdings Limited

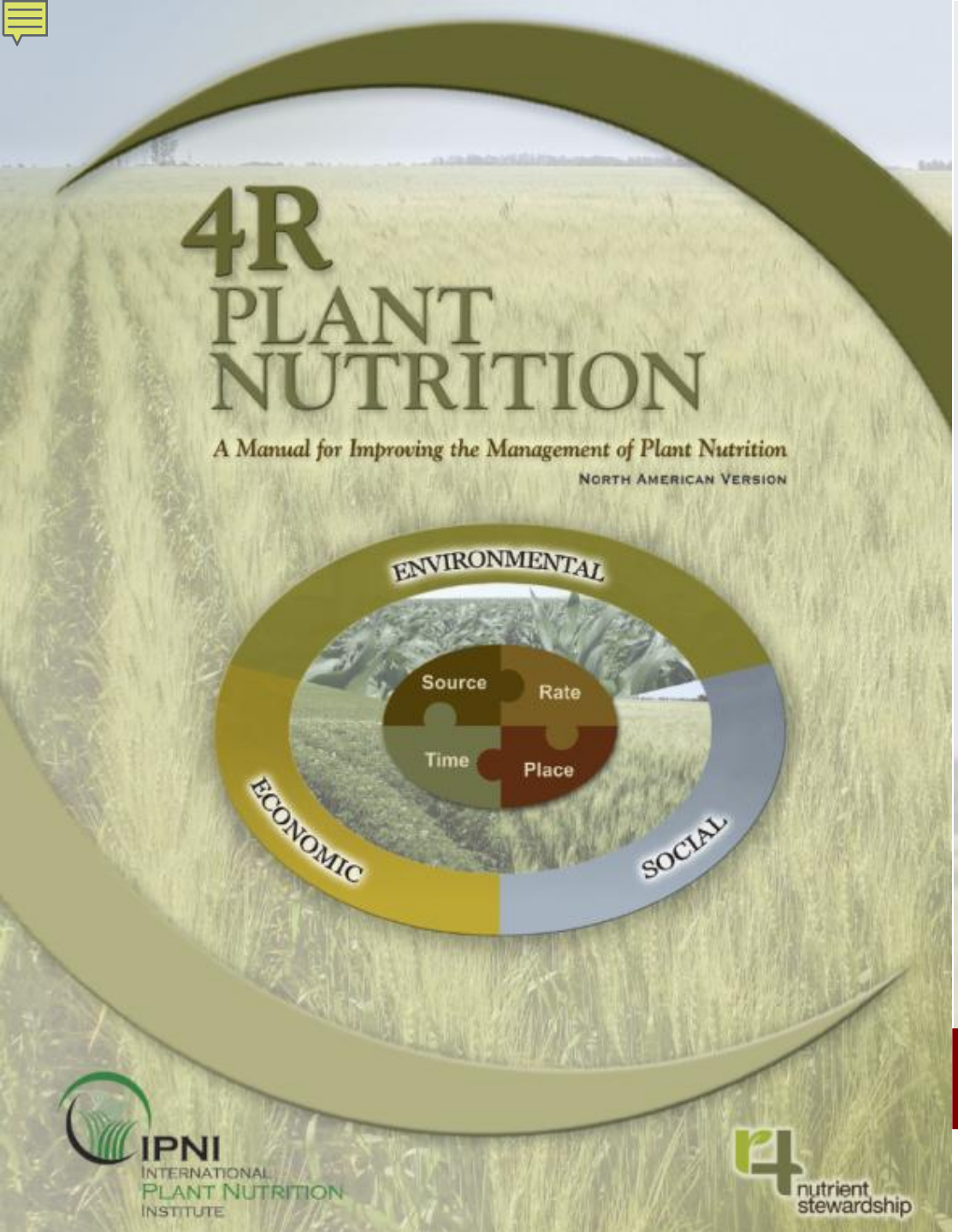
SQM

Uralkali

Formed in 2007 from the Potash & Phosphate Institute, the **International Plant Nutrition Institute** is supported by leading fertilizer manufacturers.

Ancaster, Ontario – 26 June 2009 – tilled corn

Ancaster, Ontario – 26 June 2009 – no-till soybeans



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The 4R Nutrient Stewardship Concept

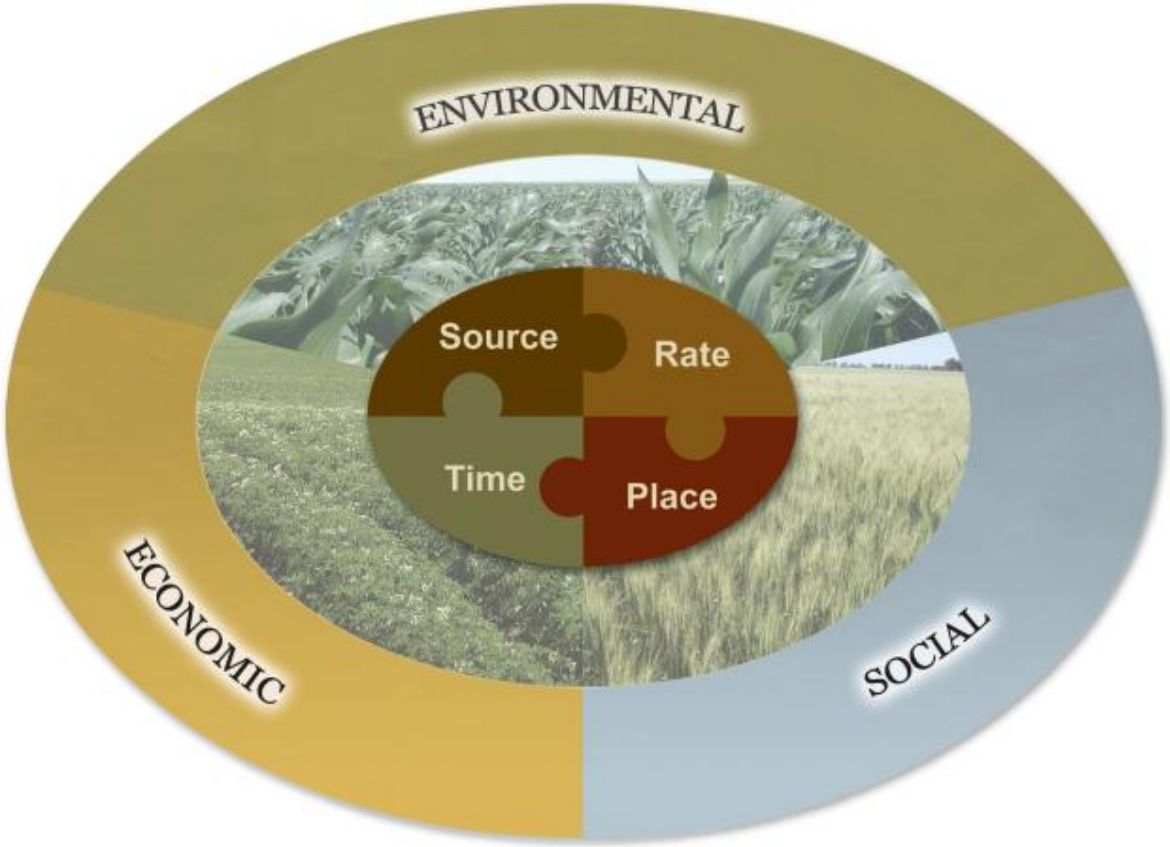
4R Plant Nutrition Manual

Chapter 2

Source, rate, time, and place describe any nutrient application

Right means Sustainable

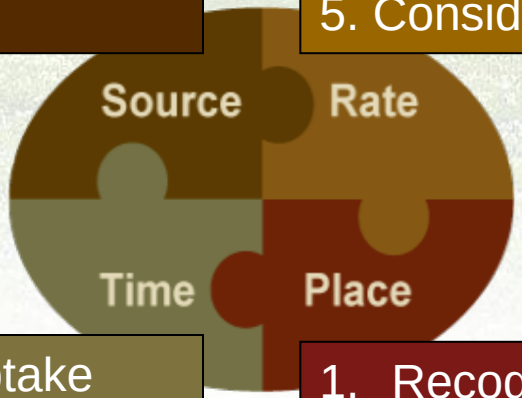
- Right source, rate, time, and place
- Outcomes valued by stakeholders



The basic scientific principles of managing crop nutrients are universal

1. Provide essential elements
2. Supply plant-available forms
3. Suit soil properties
4. Synergisms, blend compatibility
5. Associated elements

1. Assess plant demand
2. Assess soil supply
3. Assess all available sources
4. Predict fertilizer use efficiency
5. Consider resources and economics



1. Assess timing of crop uptake
2. Assess dynamics of soil supply
3. Assess timing of weather factors
4. Evaluate logistics

1. Recognize root-soil dynamics
2. Consider soil chemical reactions
3. Manage spatial variability
4. Fit needs of tillage system

Equal attention to all 4Rs

- Balance attention to all 4Rs
- Rate: easily overemphasized
- Source, time, place: often require major changes and investments

nutrient stewardship

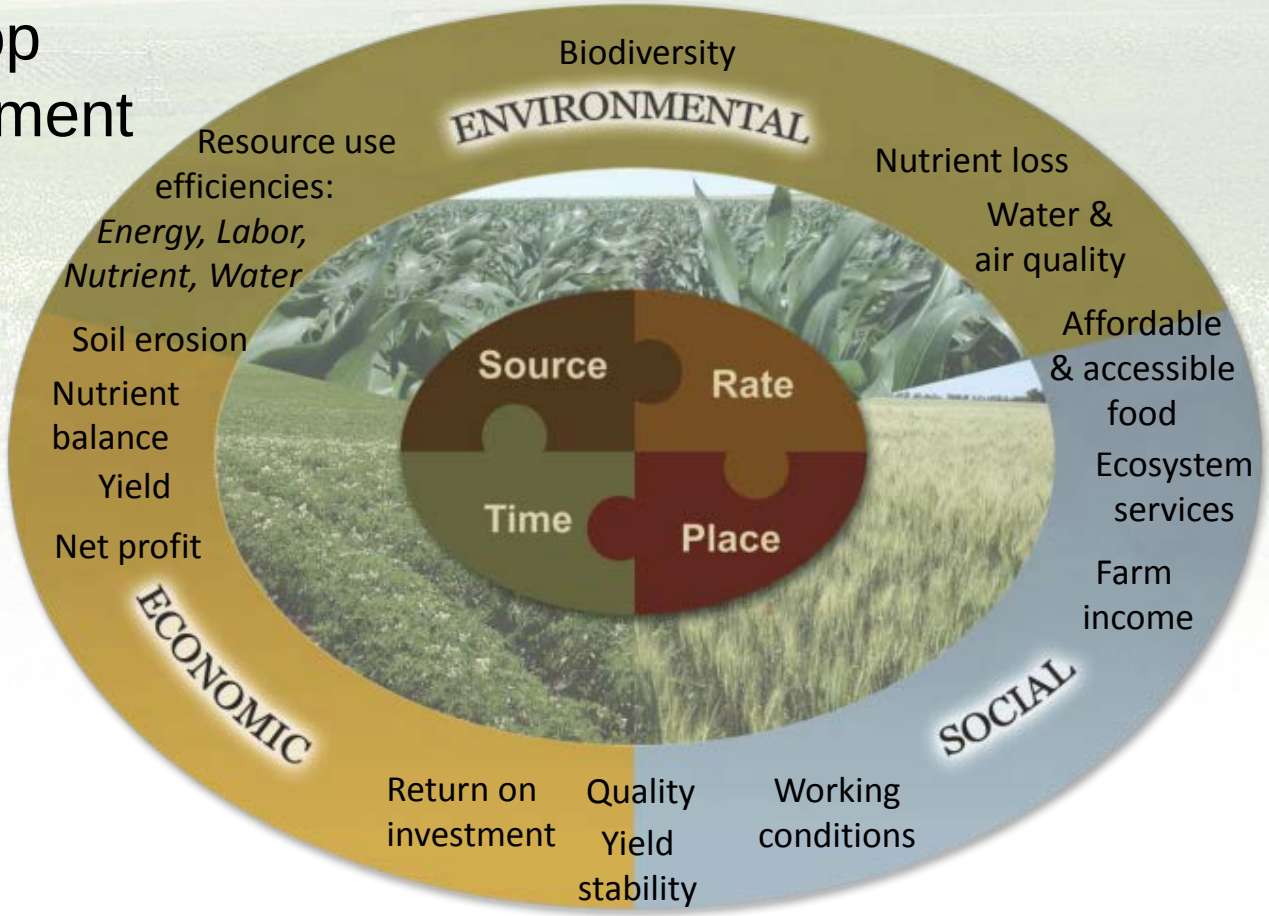
The 4Rs Interconnect

- with each other
- with local soil and climate factors
- with management of soils and crops

nutrient stewardship

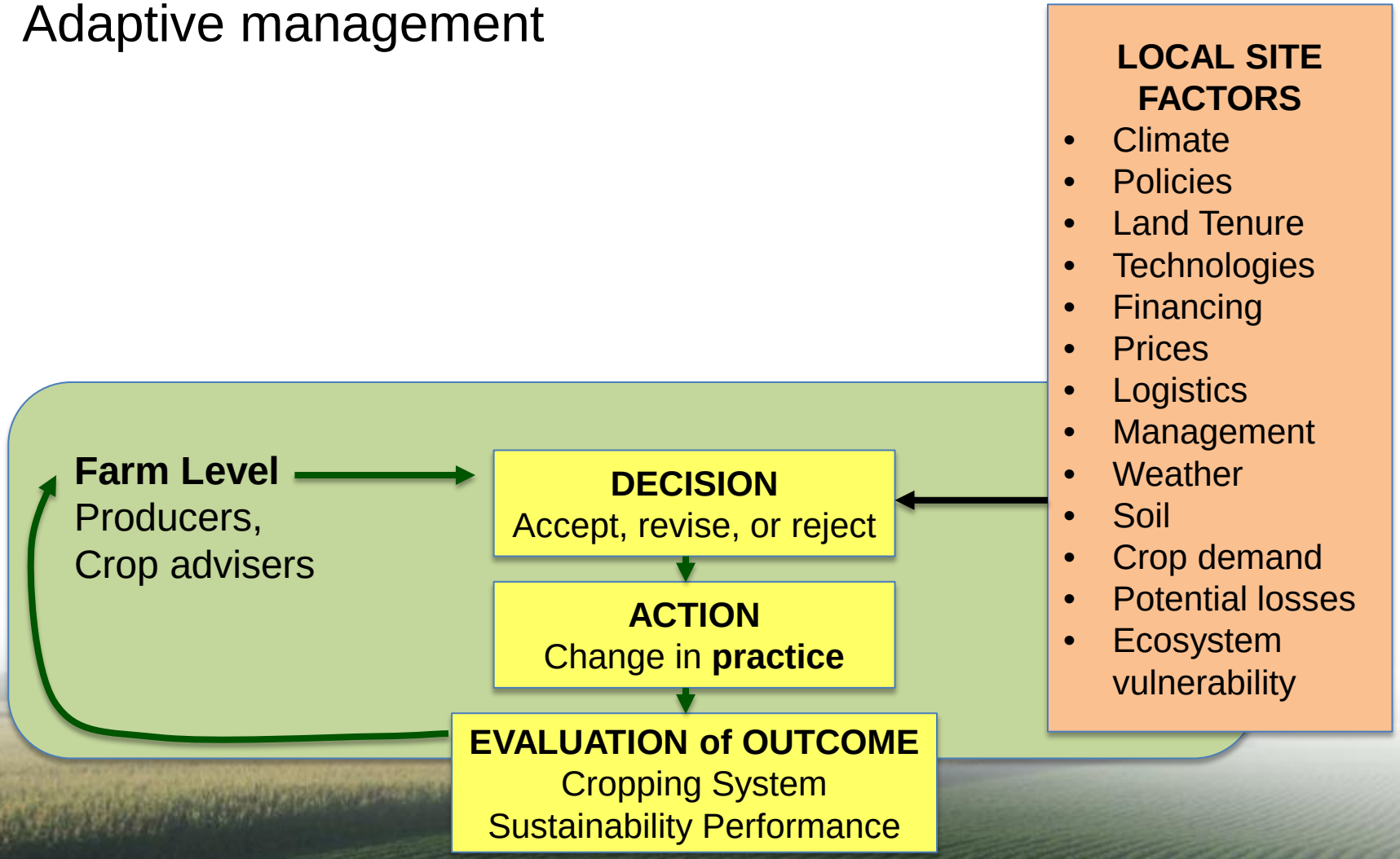
The 4Rs influence many performance indicators

- social, economic and environmental performance
- influenced by crop and soil management as well
- whole system outcomes



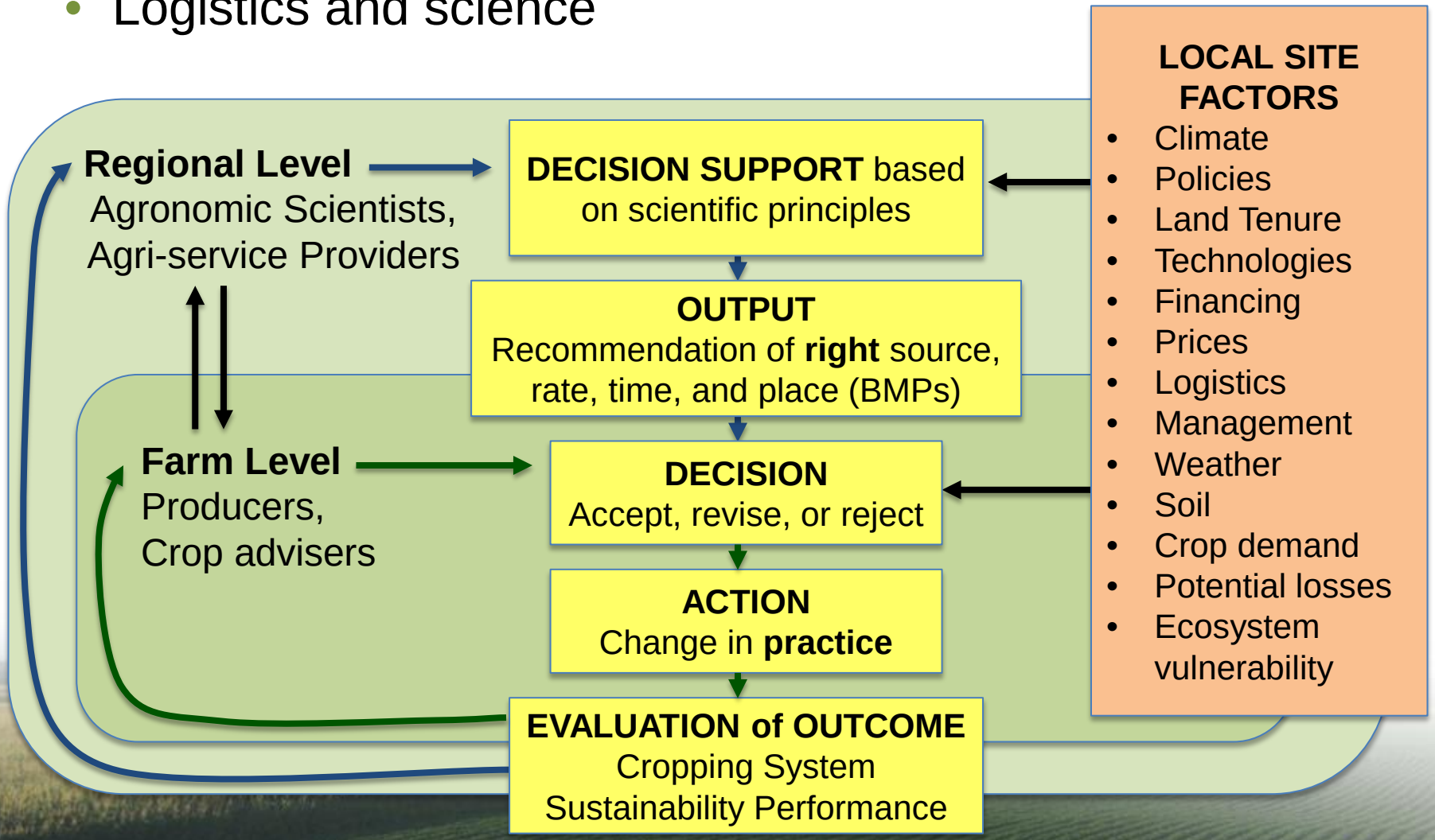
BMP adoption and evaluation – farm level

- Adaptive management



BMP adoption and evaluation – regional level

- Logistics and science



4R Nutrient Stewardship plan - principles

- For each farm:
  - sustainability goals
  - performance indicators
- For each field:
  - Management information (proprietary)
    - Soil test data
    - Nutrient application data (SRTP for each application)
    - Nutrient balance
  - Performance indicator data (public)
    - Yield? Nutrient balance?
    - Crop Quality? Working conditions? Water quality monitoring?

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NMAN3

NMAN3

NMAN3 Software Application

Ontario

Start Page | File Information | Field Plan A

Print | Add Another NMAN Calculation

- General Information
- Farm Unit
  - Farm A
    - Field #1
- Materials
  - Material #1

Field Information

Field Name: Field #1

Description:

Comment:

Farm: Farm A

Delete this Field
Add Another Field
Copy Field
Split Field into Sections

Location | Properties | Soil Test | Field Inputs

Cropping Year: Fall 2012 - Fall 2013

Nitrogen Index (2)
Phosphorus Index (13.5)
Economic Summary
Trace Elements Summary

Display Options
- [x] Display Field Input Details
- View field for plan duration
- [ ] Display Multiple Cropping Years

Add Crop or Cropping Year | Add Grazing | Add Material Application | Add Fertilizer Application

Field Input Description	Agronomic (kg/ha) N	Agronomic (kg/ha) P2O5	Agronomic (kg/ha) K2O	Crop Removal (kg/ha) N	Crop Removal (kg/ha) P2O5	Crop Removal (kg/ha) K2O
Corn, grain @ 150 bu/ac Planted: May 1, 2013 Harvested: October 1, 2013	-132	-18	-27	-124	-63	-44
Fert App 1 May 1, 2013 11-52-0 @ 150 lb/ac Total Applied: 7500 lb	16	78	0	16	78	0
Fert App 2 May 1, 2013 46-0-0 @ 300 lb/ac Total Applied: 15000 lb	138	0	0	138	0	0
Nutrient Balance September 1, 2012 - September 30, 201	22	60	-27	30	14	-44

Planned Material Application Frequency: Every Year

File: Untitled

NMAN 3.2.0.23

Environmental Farm Plan

Right actions in the right places

Environmental stewardship through responsible agricultural nutrient management

- **Infosheet 16 - Nutrient Management in Growing Crops**

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EFP 16 (2005 version)

1. Timing and number of soil samples
2. Record keeping
3. Amount of nutrient
4. Adjustment for legume or cover crop
5. Adjustment for manure or biosolids
6. Application system – inorganic sources
7. Application system – organic sources
8. Timing of nitrogen application
9. Nutrient loading during the rotation
10. Potential for nutrient losses through leaching of runoff

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Reporting 4R Performance

4R nutrient stewardship

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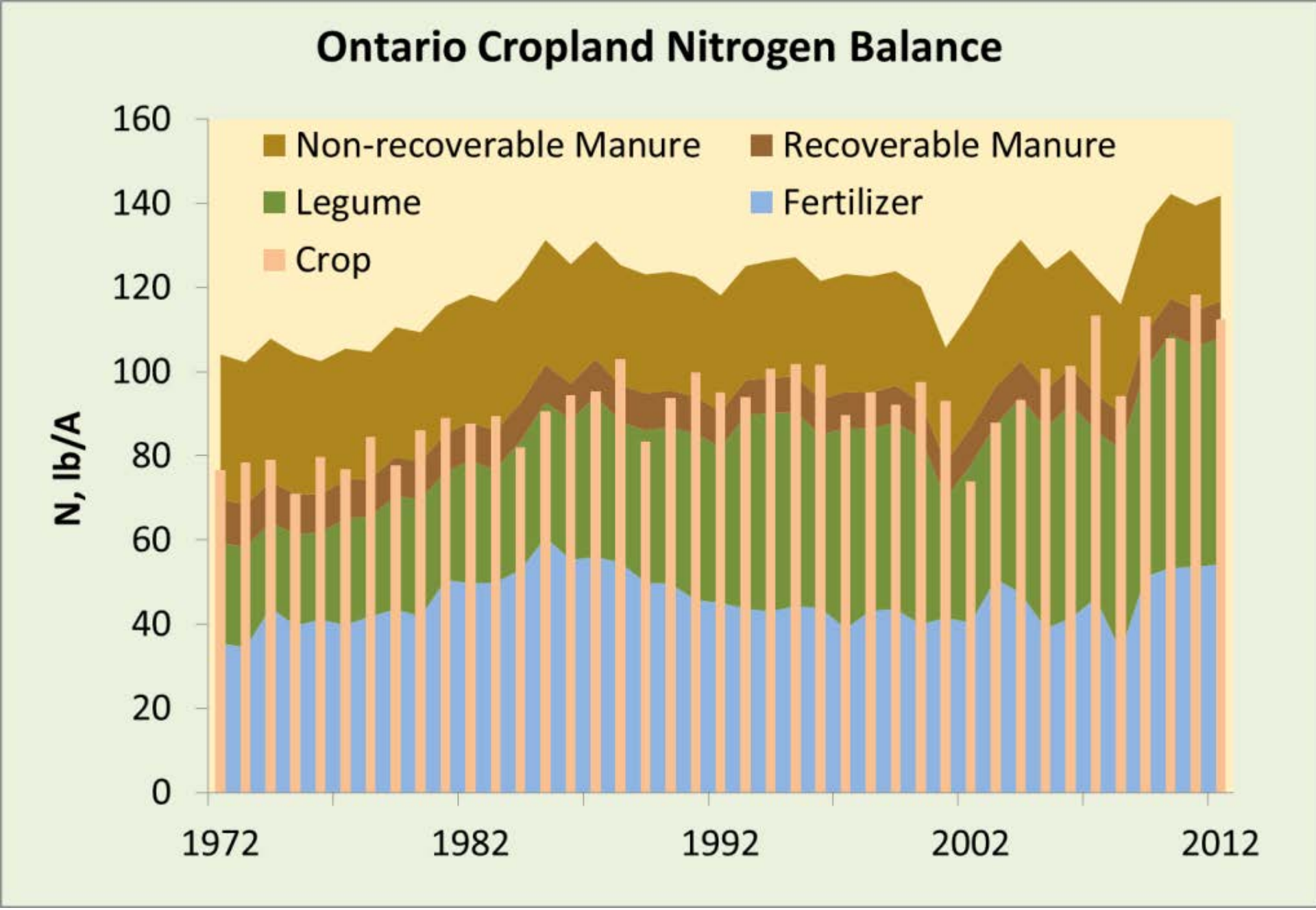
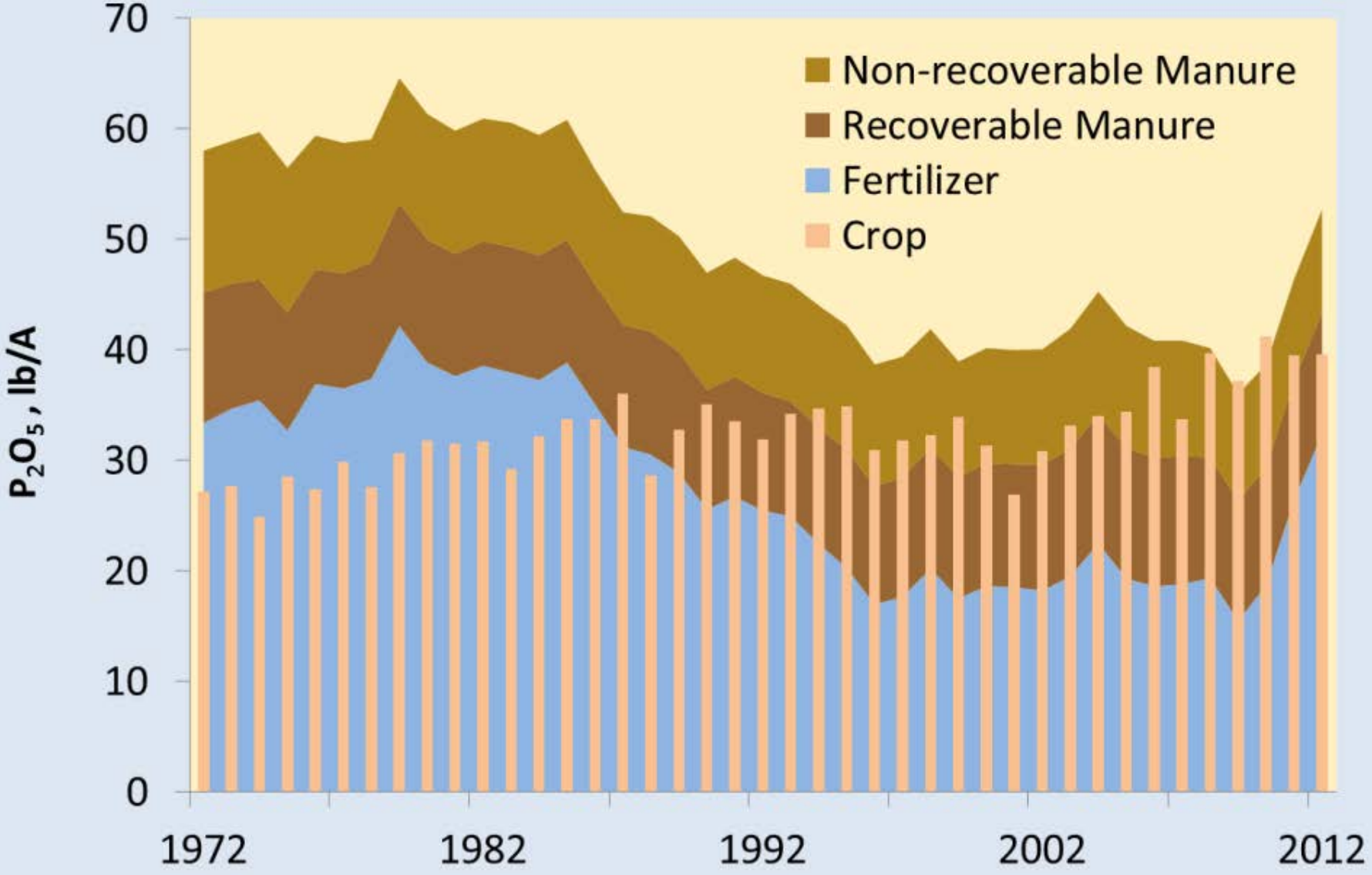

Ontario Cropland Nitrogen Balance
Non-recoverable Manure
Recoverable Manure
Legume
Fertilizer
Crop
N, lb/A
160
140
120
100
80
60
40
20
0
1972
1982
1992
2002
2012

Ontario Cropland Phosphorus Balance



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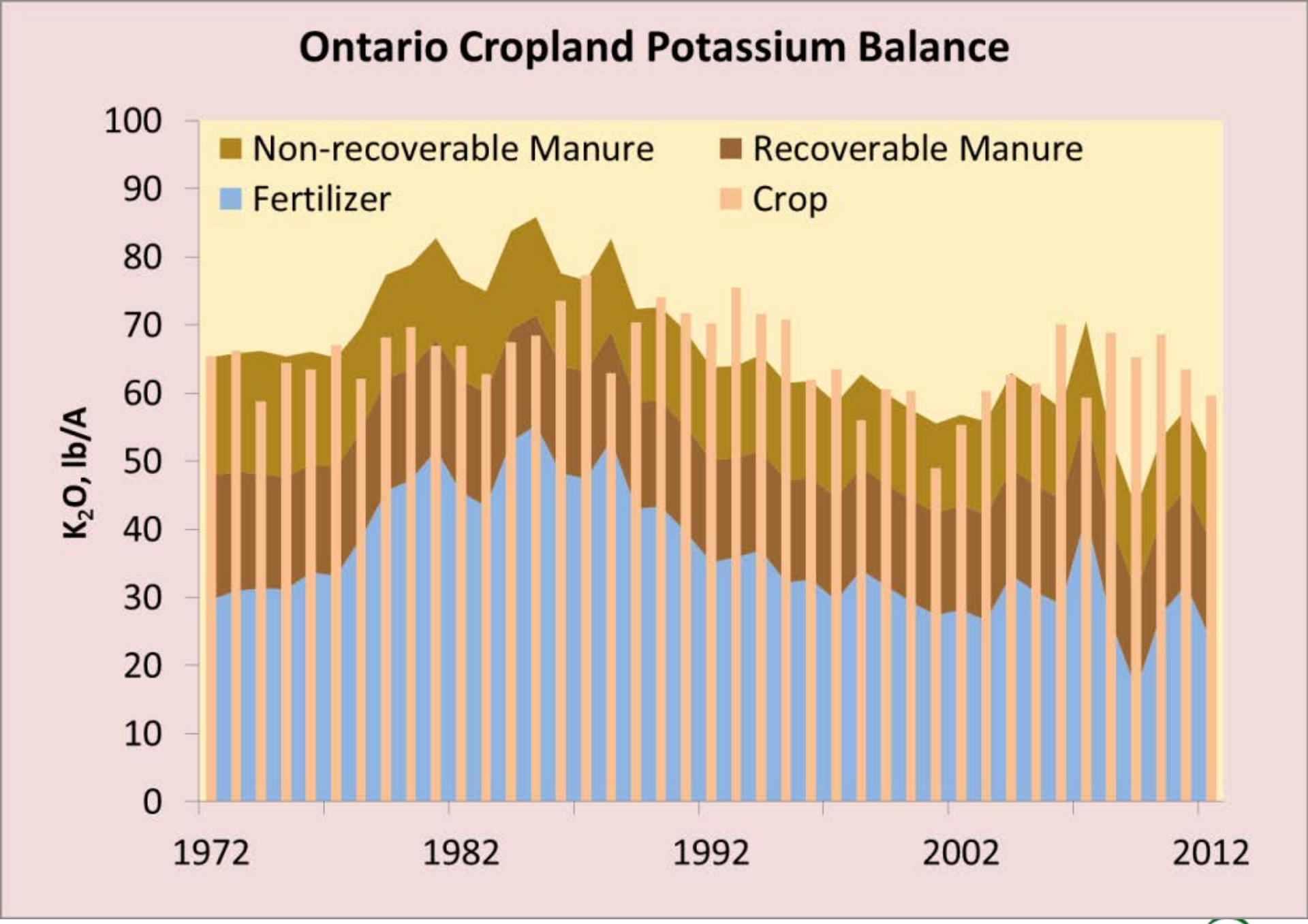
Ontario Cropland Potassium Balance
Non-recoverable Manure
Recoverable Manure
Fertilizer
Crop
K_2O, lb/A
100
90
80
70
60
50
40
30
20
10
0
1972
1982
1992
2002
2012

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INTERNATIONAL PLANT NUTRITION INSTITUTE

December 2012

Reducing Loss of Fertilizer Phosphorus to Lake Erie with the 4Rs

Algal blooms in Lake Erie have been getting worse in the past few years. Phosphorus (P) has often been considered the nutrient controlling such blooms. The loads of dissolved P in the rivers draining into Lake Erie vary greatly year-to-year, but higher loads have become more frequent in recent years than in the mid-1990s. Agriculture is one of several sources of dissolved P.

This article outlines how crop producers in the Lake Erie watershed can reduce losses of P by adopting a 4R Nutrient Stewardship approach to guide their fertilizer application practices.

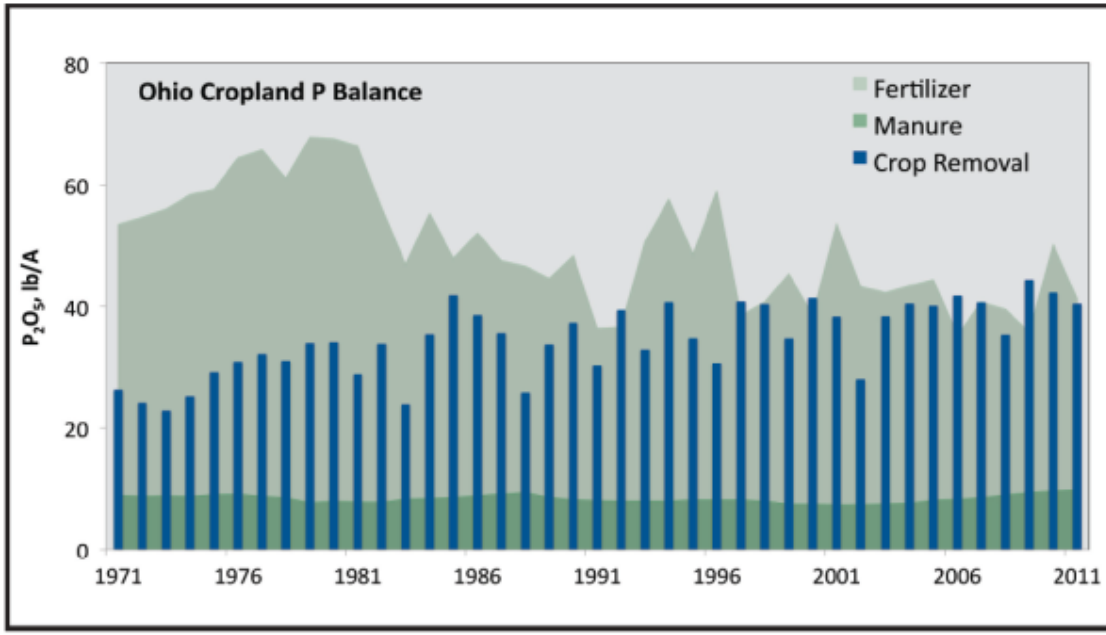

Figure 2. Phosphorus balance trend over time for Ohio cropland. *2011 fertilizer estimated.

Background

Much of the cropland of the Lake Erie watershed is found in Ohio, with smaller areas in Indiana, Michigan and Ontario

Summary

- Sustainability requires communication of responsible management.
- 4R Nutrient Stewardship provides a framework to improve sustainability
- 4R management of N requires attention to weather's impacts on
  - Crop demand
  - Soil supply
  - Losses
- 4R management of P requires a focus on Right Place
  - In the soil, not on the soil

4R nutrient stewardship

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Summary

1. The right source, rate, time and place for any nutrient application is the combination producing the most sustainable outcome for stakeholders.
2. Finding ways to better report performance will increase stakeholder confidence and help meet expectations for improvement in environmental and social impacts.

4 nutrient stewardship

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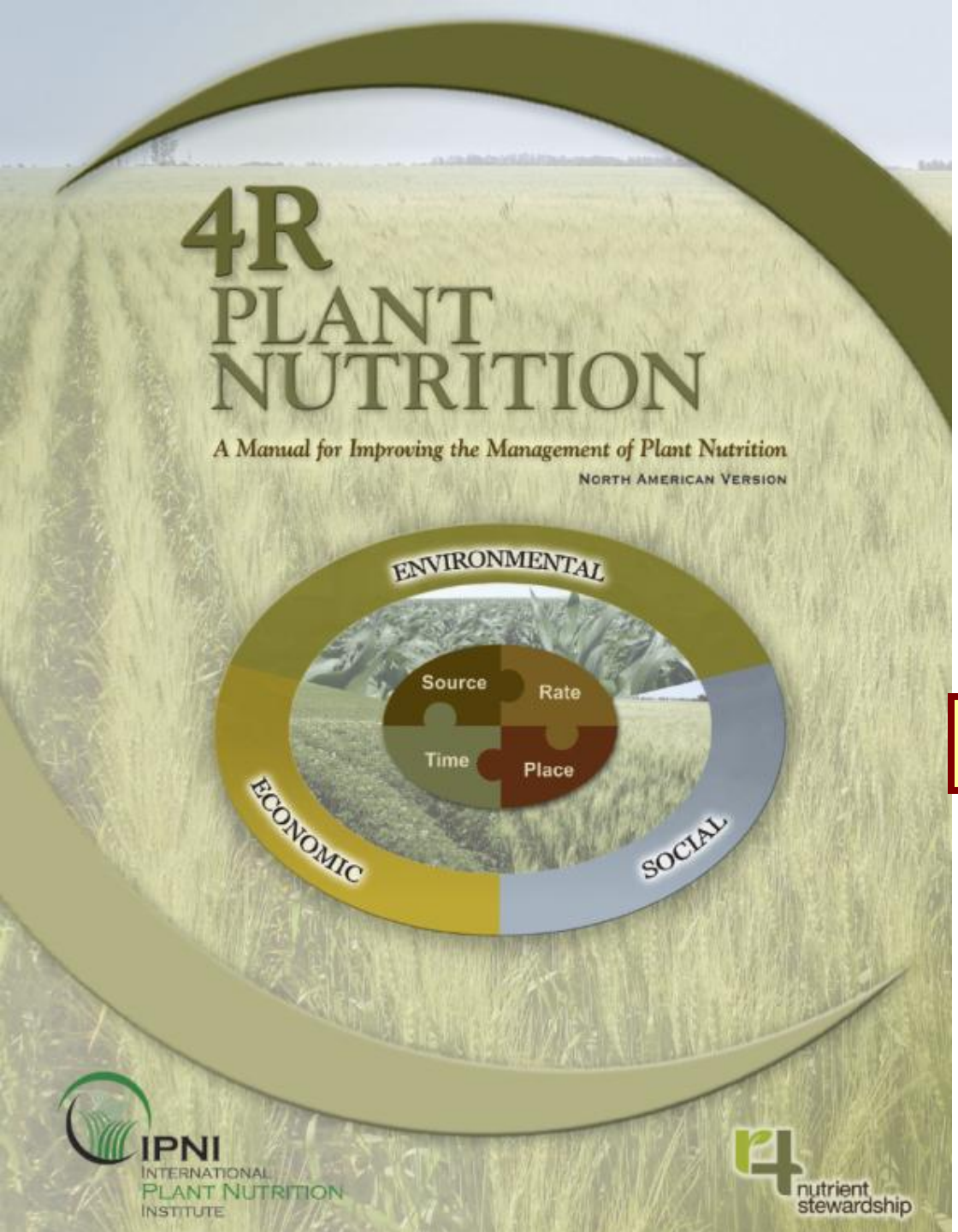
“4R-Consistent” Checklist

1. Balance economic, social, environmental areas.
2. Include BMPs addressing SRTP.
3. Provide site-specific recommendations.
4. Balance essential elements.
5. Assess nutrient requirements.
6. Consider all sources.
7. Comply with regulations.
8. Measure effectiveness of BMPs.
9. Use terminology consistent with 4R standards.
10. Document plans and implementation.

The Fertilizer Institute

4R nutrient stewardship



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