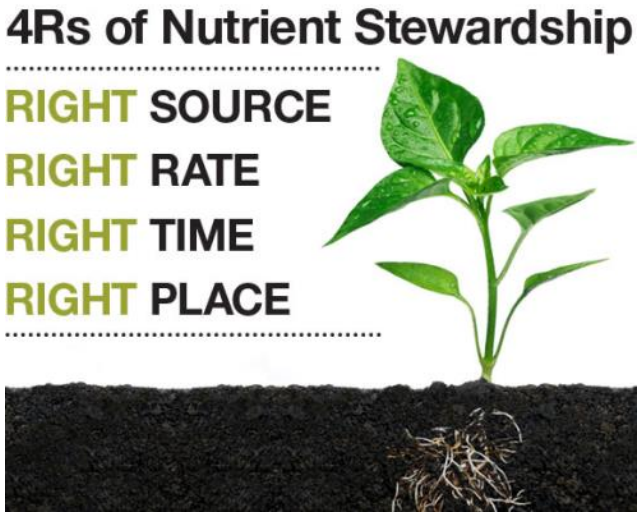
Reducing Phosphorus Loss to Lake Erie:
Application & Timing of Nutrients

Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)

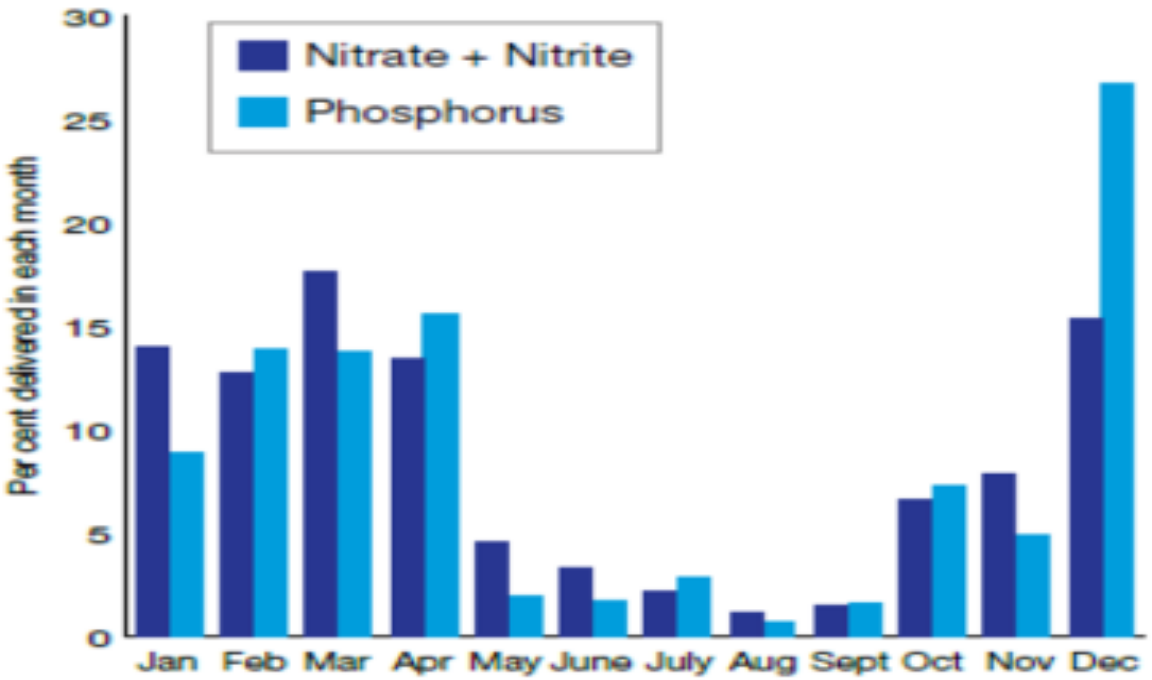
Great Lakes Commission – Joint Action Plan

- The Great Lakes Commission's Joint Action Plan for Lake Erie outlines 9 key actions to address urban and rural sources of phosphorus.
- For agriculture, these include 2 recommendations relating to nutrient application and timing:
  - Reduce nutrient applications on frozen or snow covered ground
  - Adopt "4Rs Nutrient Stewardship Certification program" or other comprehensive nutrient management programs



Non Growing Season P Loss

Majority of nutrient export in non-growing season:



MOECC Water Quality in Ontario 2012 Report

- Highest risk period for Phosphorus loss from agriculture is in the non-growing season (Nov – April)
- Intense rainfall events during this period are increasing with climate change
- Over 80% of Phosphorus loss can occur in this period

Purpose

To provide an overview of:

(1) Best available science on Phosphorus loss

(2) Current application practices and Rules in Ontario

(3) Current application Rules in other Jurisdictions

To help inform discussions on possible actions

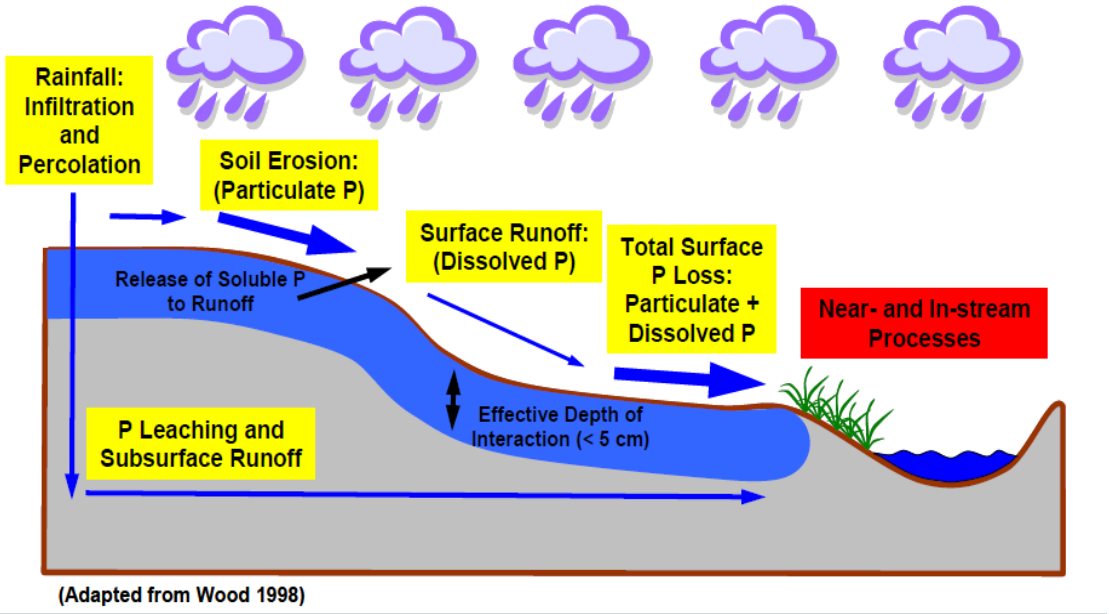
P Sources in Agriculture

- **Manure** (organic)
  - Manure supplies more Nitrogen than P.
  - Farmers use “nutrient balancing” to match manure application rates to crop needs – cannot balance on both N and P
- **Fertilizer** (inorganic)
  - Fertilizer use in the Great Lakes region has decreased in the last ten years, yet concentrations of soluble P in the Lakes has increased.
- **Non-Agricultural Source Materials (NASM)** (organic)
  - NASM includes materials such as leaf and yard waste, fruit and vegetable peels, food processing waste, pulp and paper biosolids and sewage biosolids.
- **Greenhouse Nutrient Feedwater (GNF)** (mostly inorganic)
  - Phosphates are already in dissolved form.
  - P concentration will vary greatly from on operation to another (usually quite low).

Note that organic sources of phosphorus are mineralized into inorganic sources. Inorganic phosphorus reacts with soils through chemical reactions and “binds” to soil particles (less likely to leach once bound)

Understanding P in Agricultural Runoff

- Soil P is highest at surface
- P loss varies with soil type, erosion and nutrient management
- Wind and Water cause surface erosion
- Both forms of P are lost at surface and sub-surface



Risk of erosion and runoff increases with:

- slope
- low infiltration rates
- compacted soils
- frozen soils
- low crop/residue cover
- intense rainfall / snowmelt

- Tile drainage extensive in Great Lakes Region
- Need BMPs that address P in both surface and subsurface runoff

P-Containing Materials and Winter Application

Risk Factors:

- When soil is frozen there is no opportunity for infiltration
- Nutrients on the soil surface will move with surface water
- Soil with low aggregate stability will move with surface water
- Snow melt often occurs with rainfall

Winter rain events result in high surface runoff

- Research shows that the greatest risk of runoff and nutrient loss is when application occurs within 72 hours of a rainfall or snowmelt conditions

Winter Application – Current Practice

Despite efforts emphasizing problems with applying nutrients in the winter there is evidence that the practice still occurs

- MOECC compliance officers indicate that roughly 25 formal public complaints are filed in the province annually with respect to winter application;
- 2011 Canadian Farm Environmental Management Survey (FEMS) estimates that 12% of solid manure and 3% of liquid manure is applied in the winter months in Ontario (slightly higher percentages in Lake Erie Ecoregion); and
- Winter spreading is very visible and damages the view of agriculture to the public. It threatens the environmental public trust of the farm community.

Why Are Farmers Still Winter Spreading?

1. It's not "illegal" to apply in the winter
2. All operations are not required to have over-winter manure storage capacity
3. Crop rotation on land base not "conducive" to fall application (e.g. continuous corn);
4. Weather/climate conditions (e.g. wet fall, late harvest, early winter conditions);
5. Producer desire to minimize spring field compaction (large/heavy equipment)
6. Producer convenience/capacity considerations (spring period is very busy with focus on crop planting within small optimal "windows")
7. They don't see it as a problem on their operation

Current Winter Spreading Restrictions under NMA

Prescribed Material	Application Conditions	Allowed?	Restrictions
Any NASM containing sewage biosolids	Dec. 1 – Mar. 31 OR frozen/snow-covered soil	No	
Other NASM's	Dec. 1 – Mar. 31 OR frozen/snow-covered	Yes	• Land cannot be "vulnerable" • Must be injected or incorporated within certain time frame depending on whether liquid or solid material • Minimum setbacks to surface water based on land slope and risk category of NASM material
GNF	frozen/snow-covered soil	No	
GNF	Dec. 1 – Mar. 31	Yes	• Land cannot be "vulnerable" • Must be an "emergency" making land application necessary with no other options • Must be injected or incorporated same day OR surface applied to living crop/minimum residue cover • Minimum setbacks to surface water based on land slope • Application rate cannot exceed 17 kg/ha of PAN
ASM (farm phased-in to NMP requirement)	Dec. 1 – Mar. 31 OR frozen/snow-covered soil	Yes	• Land cannot be "vulnerable" • Must be injected or incorporated within certain time frame depending on whether liquid or solid material • Minimum setbacks to surface water based on land slope and whether liquid or solid material
ASM (non-phased-in farm)	Dec. 1 – Mar. 31 OR frozen/snow-covered soil	Yes	• No restrictions
Commercial Fertilizer	Dec. 1 – Mar. 31 OR frozen/snow-covered soil	Yes	• No restrictions

Current rules in Other Jurisdiction

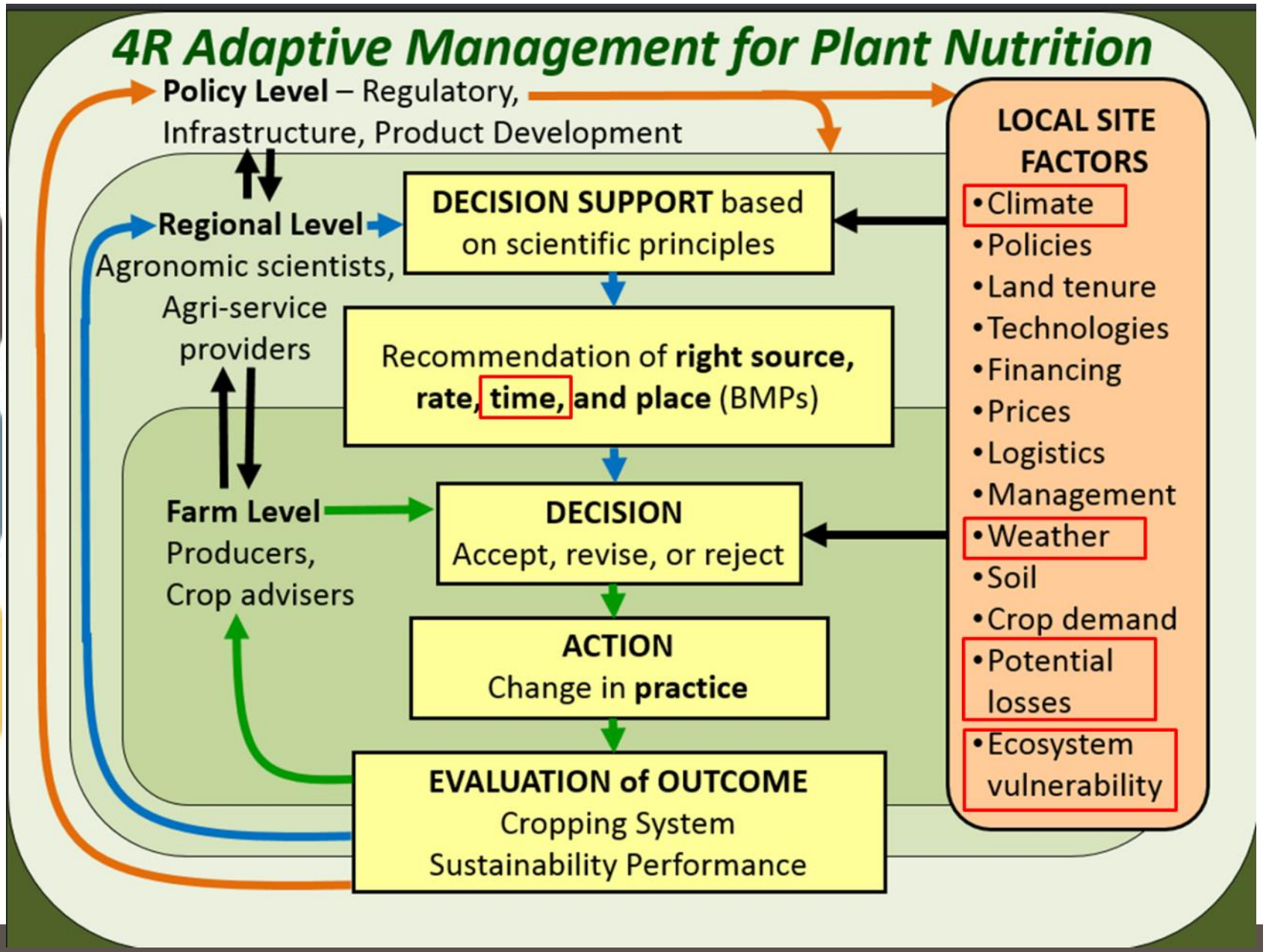
Ohio: No person in the western Lake Erie basin may surface apply **manure** or **commercial fertilizer** on frozen or snow-covered ground, or when top two inches of soil are saturated or when weather forecast is greater than 50% chance of precipitation exceeding one inch in a 12 hour period.

- Exceptions to above if manure or fertilizer is injected, incorporated within 24 hours, applied to a living crop; or, in an emergency, director provides written consent and application is in accordance with technical standard.
- Any person, including farmers and commercial applicators, that apply manure and fertilizer must be certified by the state.

Wisconsin, Indiana, Vermont, Quebec and Manitoba all have restrictions on winter spreading in regulation

- No application on frozen or snow covered ground without injection or incorporation.
- In some jurisdictions, the restriction only applies to large livestock operations.
- Some have restricted dates for application, within the range of October – April.

4R Stewardship



Summary

Phosphorus applied in the non-growing season has high potential for loss to the environment

There are operations in Ontario that apply P in the non-growing season

In Ontario, the winter spreading restrictions for manure in do not widely apply (Large farms with NMPs) and there are no restrictions on fertilizers

Application in the non-growing season is not the “Right Time” under the 4R stewardship approach

Other Jurisdiction have taken actions to restrict application of P in the non-growing season