Biosolids Phosphorus Plant Availability Modeling

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Northeast Residuals And Biosolids Symposium
Boston, October 2015

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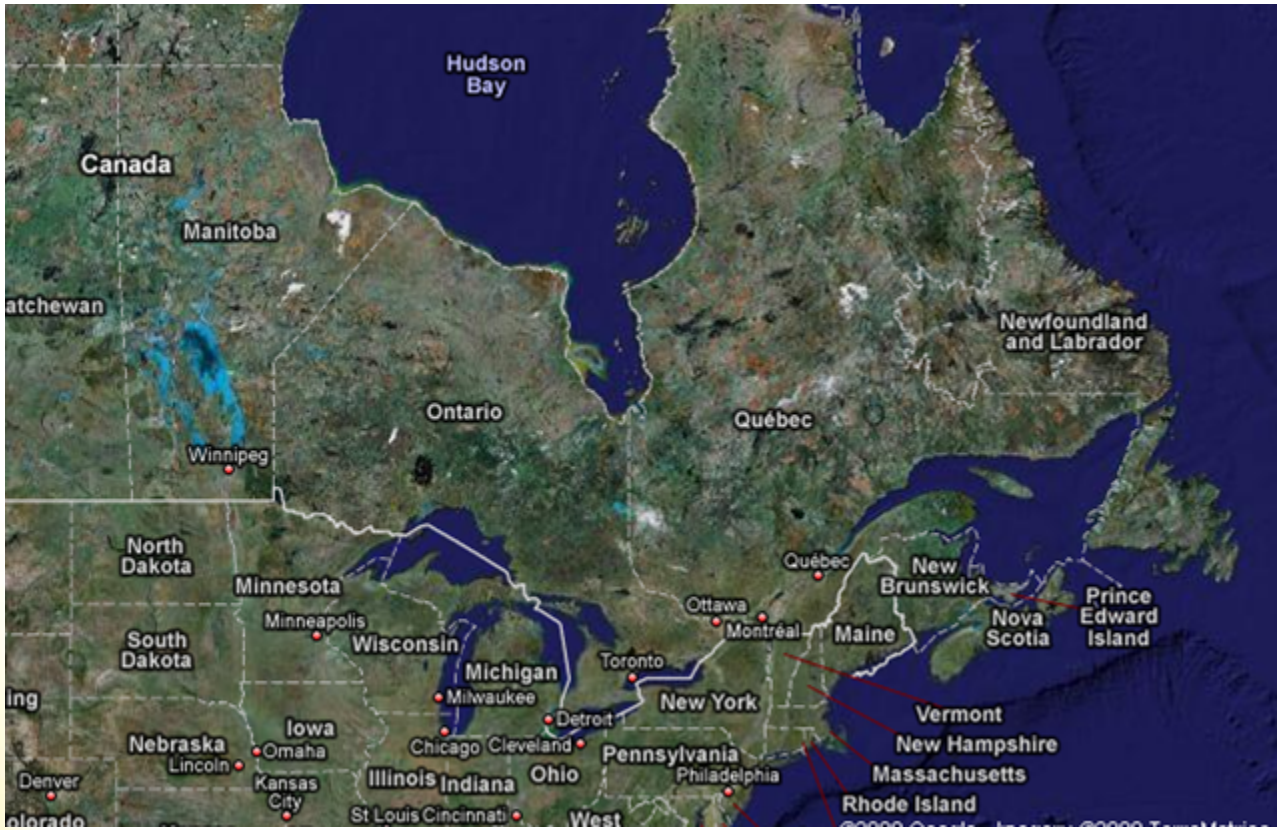
Outline

1. Overview
2. Methods
3. Results
4. Conclusions

1-Overview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Ontario
Québec
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Cleveland
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Pennsylvania
Lincoln
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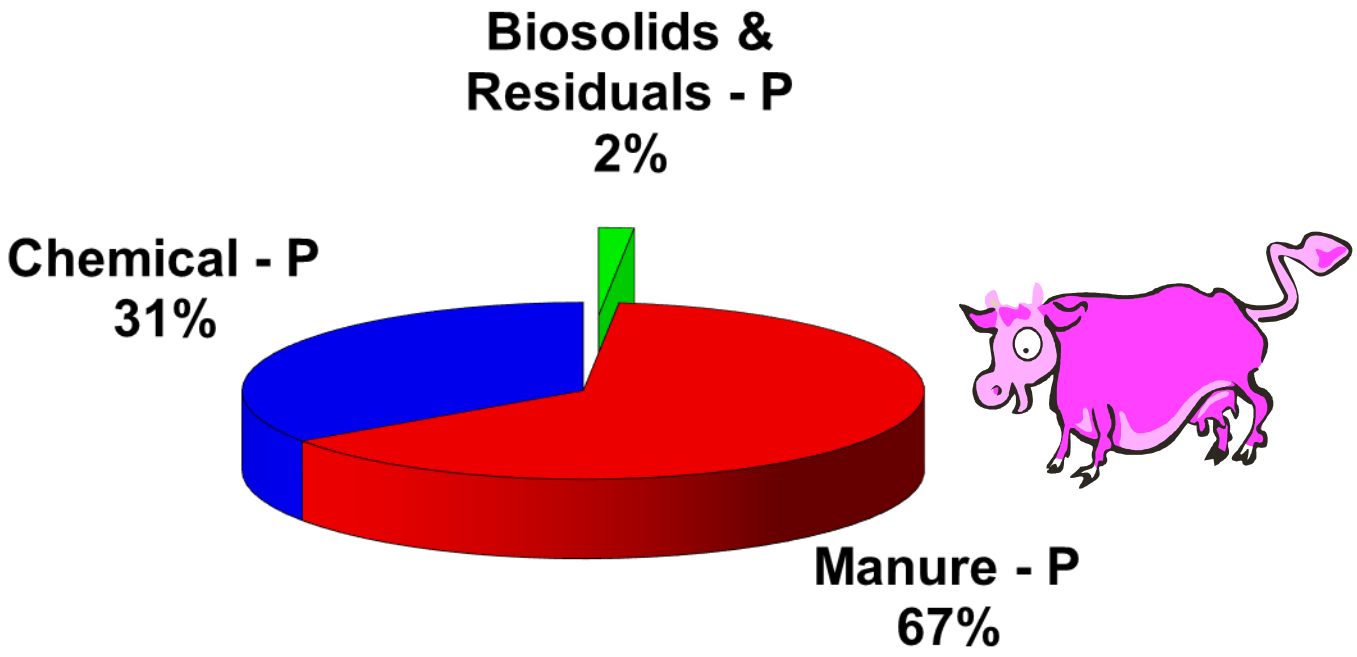
Indiana
Ohio
Philadelphia
Massachusetts
Denver
Kansas City
Rhode Island
St Louis
Cincinnati
West

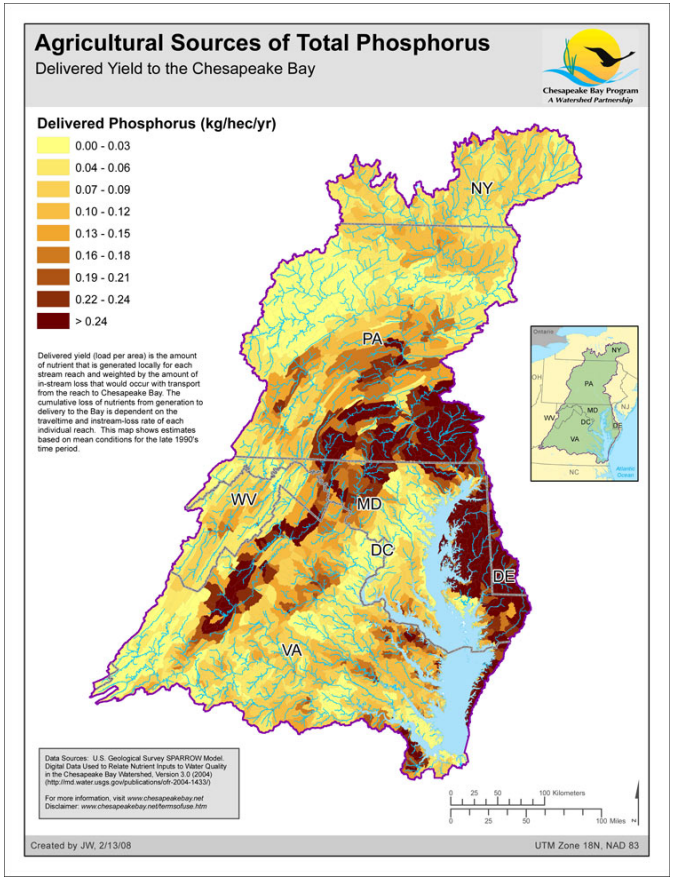
Main types of residuals used in Québec

Phosphorus sources in agriculture in Quebec - 2012



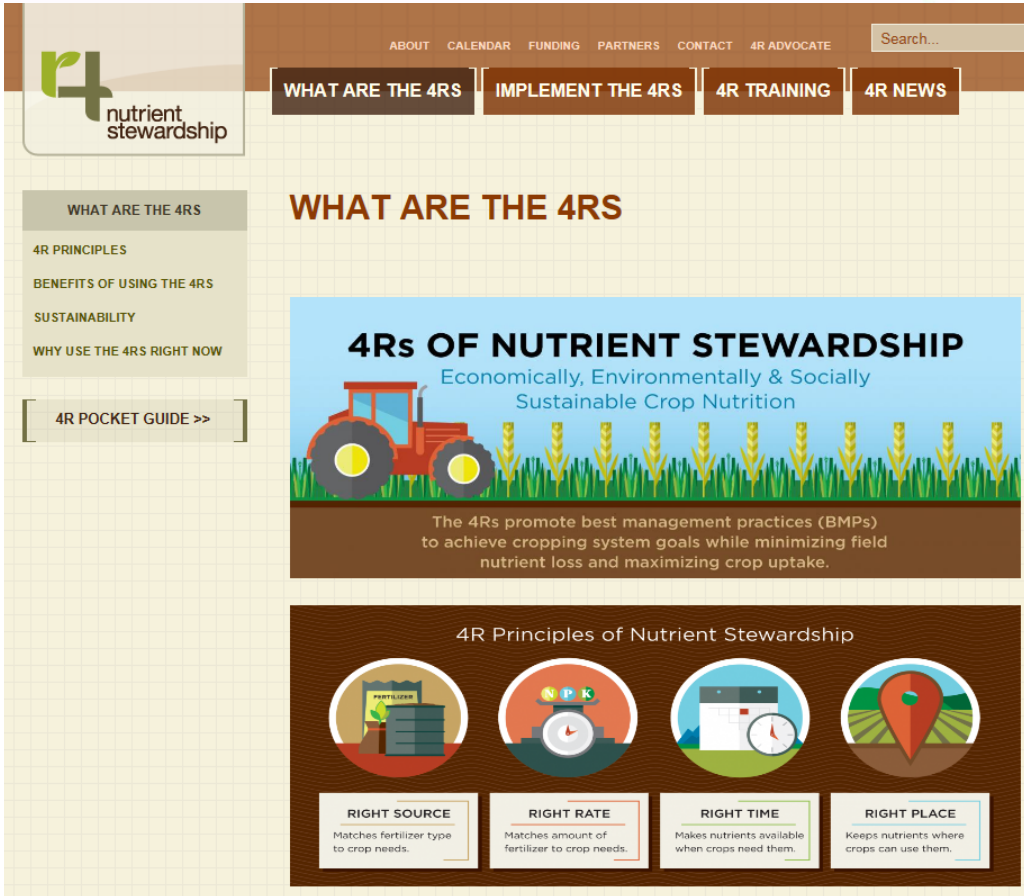
Phosphorus – a duality

- Nutrient
- Pollutant
  - Rivers
  - Estuaries



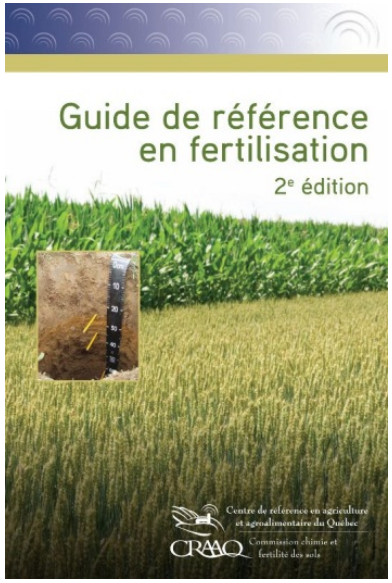
Sustainable P fertilization

http://www.nutrientstewardship.com/what-are-4rs



«Right rate» - Québec approach

- Regulation
  - P quota/ farm
- Guidelines
- P rates
  - Crop needs
  - Soil P tests (Mehlich 3)
    - P/Al index
  - Availability in fertilizers
- Chemical fertilizers
  - Available phosphorus
    - AOAC 993.31
- Manure, Biosolids & Residuals
  - Total P x % availability…
    - …as compared to chemical fertilizers



What is the actual P availability of phosphorus according to biosolids type?

- Québec MOE equation (current)
  - Max 80% - as compared to chemical fertilizers
  - Linear relationship
    - with Al + Fe
- Need to upgrade the equation
- Meta-analysis

2- Methods

- Scientific publications
  - 15 Peer reviewed
- 8 regions around the world
  - US, UK, France, etc.
- Mainly greenhouse trials
- Variety of crops
- Variety of biosolids types
  - Al/Fe content
- Compared with
  - No P fertilizer
  - Chemical P fertilizer

Data collection…

Data represented graphically in literature

DataThief III

Data represented in tables in literature

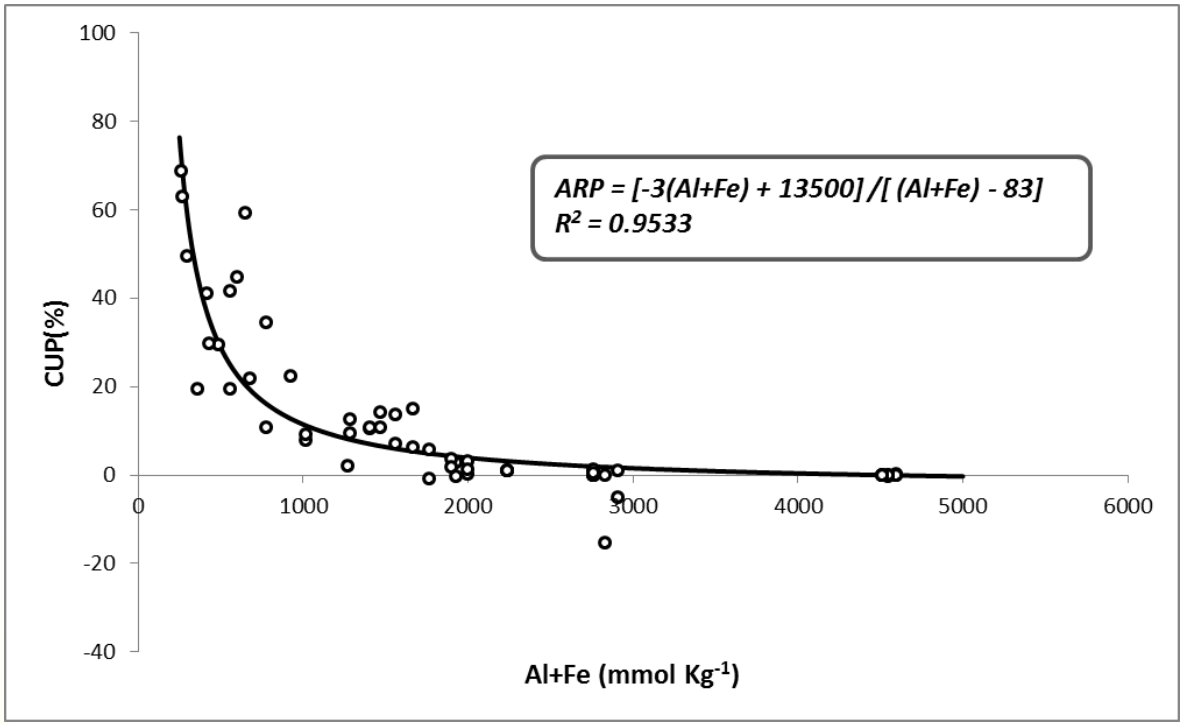
Calculate ARP and RPA from available data

Integrate in model

3- Preliminary results

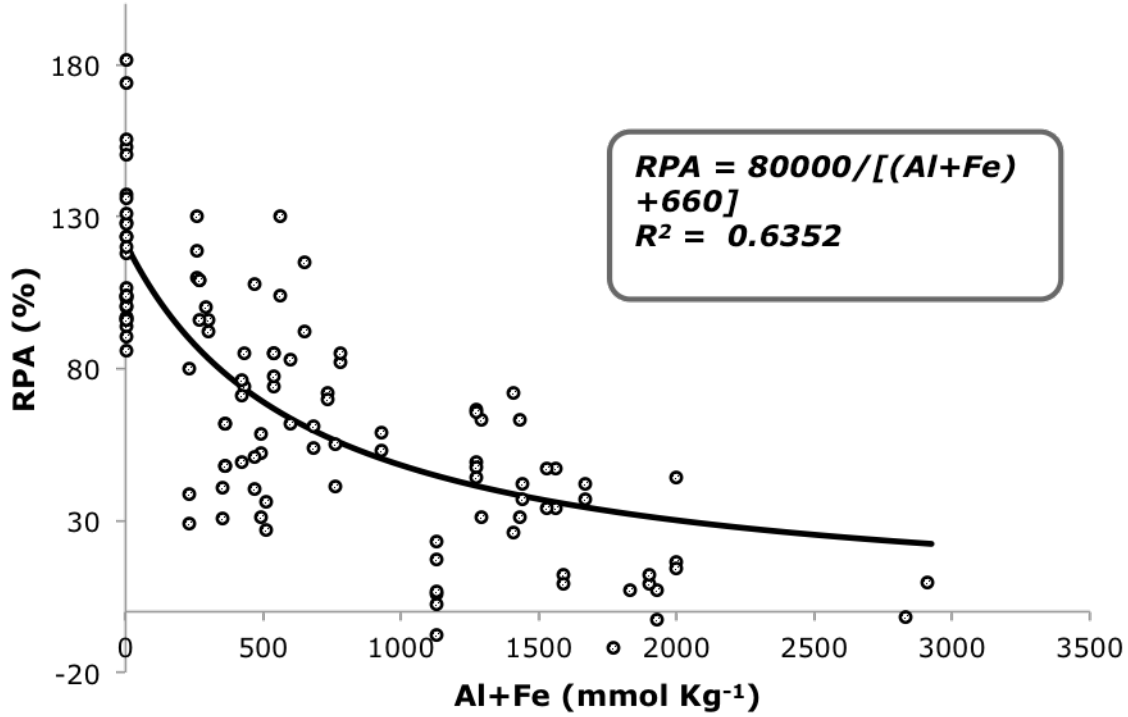
APR -76 values

$$\text{Apparent P recovery} = \left(\frac{Ptreatement - Pcontrol}{Papplied} \right) \times 100$$



Relative P availability vs chemical fertilizers (193 values)

$$\text{Relative P-availability} = \frac{APRbiosolid}{APRfertilizer} \times 100$$



4 – Conclusions

- P availability in biosolids typically ca be the same or even higher, as compared to chemical fertilizers
- P availability in biosolids strongly decreases with Al/Fe additions
- Other factors
- Impacts on Nitrogen management
- Scientific publication to come…

Québec MOE use of this work

- New guidelines – to come
- «Right product»
  - Max content in biosolids as of 2016
    - < 15 % Al + 0.5% Fe
    - Based on APR
- «Right rate»
  - % Relative P availability as compared to fertilizers
    - Much variability
    - Equation or categories?

Merci

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