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Canada

Animal Manure Production and Agricultural Land Reuse: Values, Issues & Perspectives

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Agriculture & Agri-Food Canada, Harrow, ON

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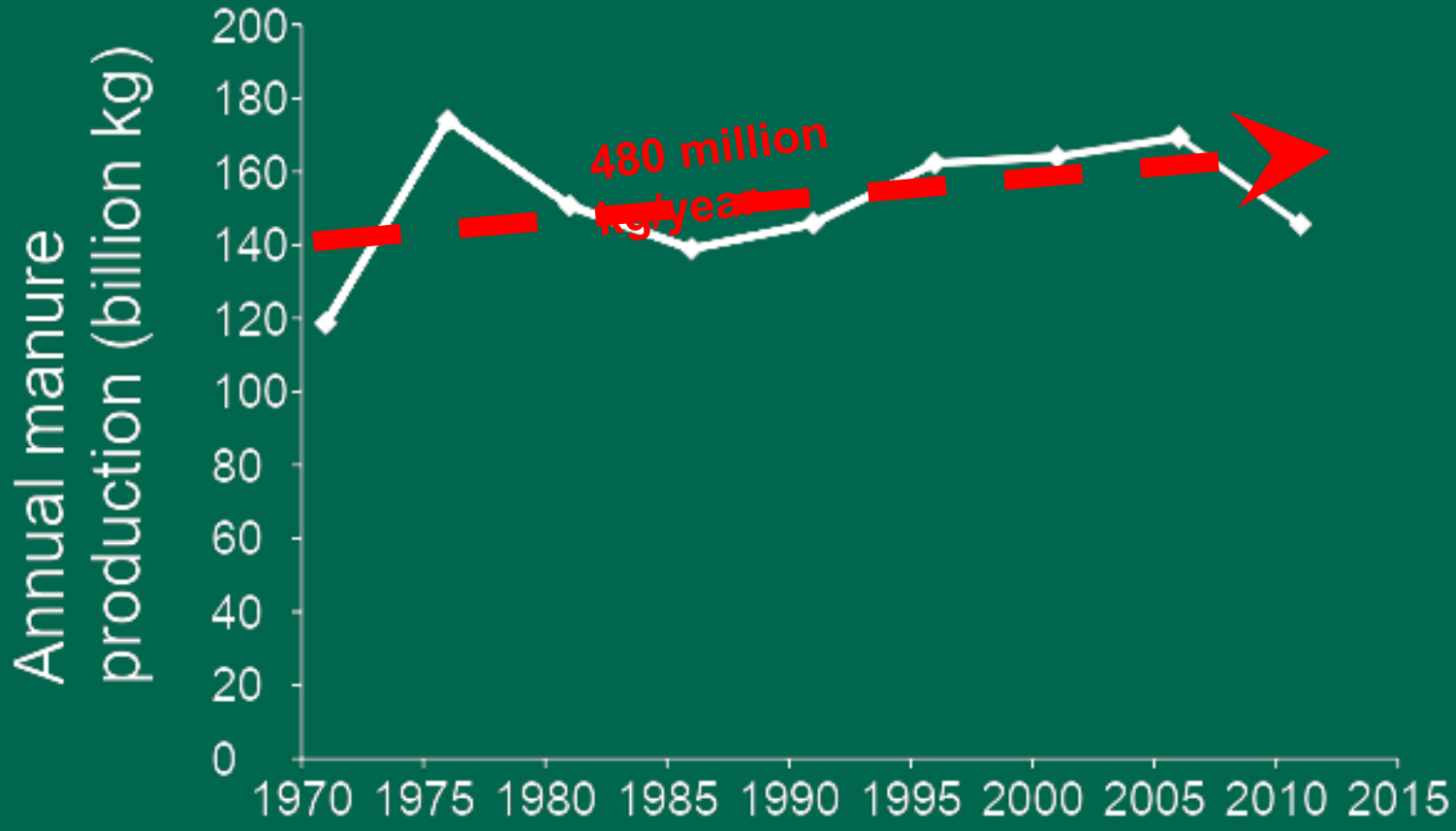
Animal manure production in Canada

- Total amount: 146 million tonnes

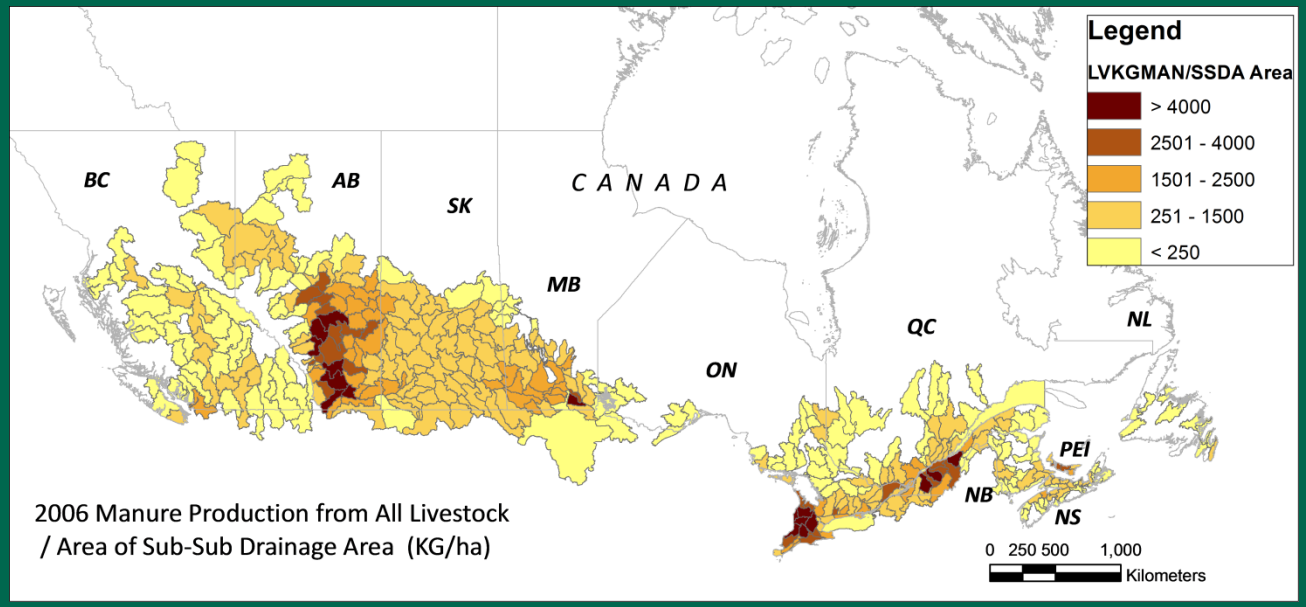


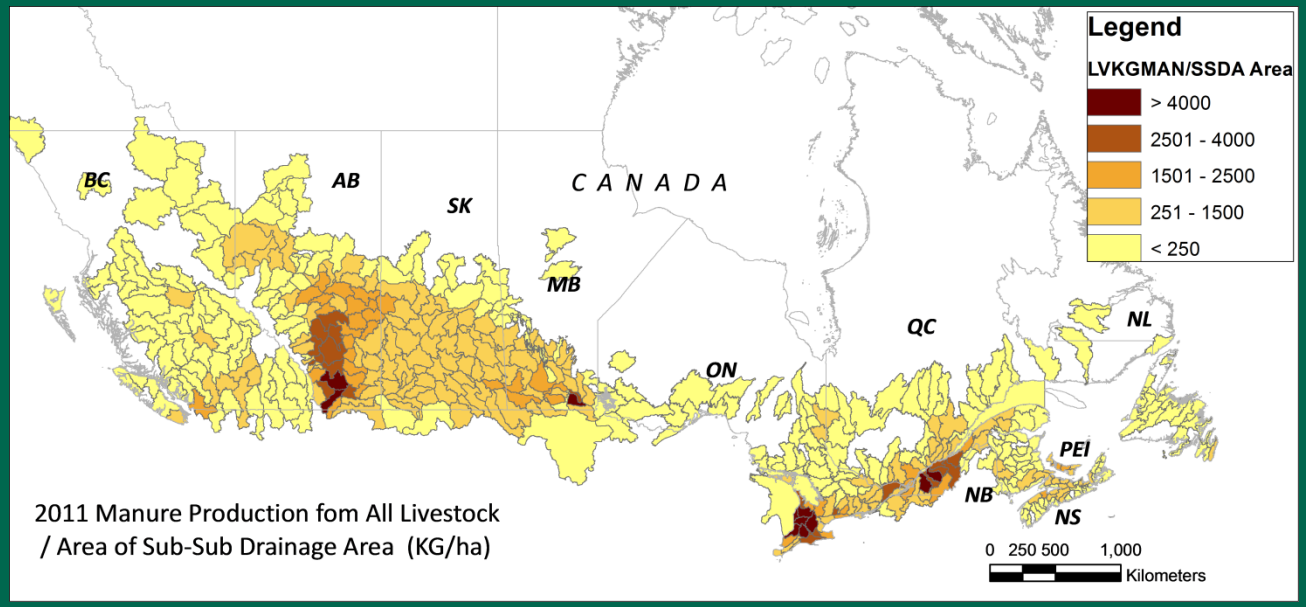
Data source: StatsCan, 2011

Annual fertilizer nutrient consumption vs. manure nutrient production in Canada (million kg, 2011)

Nutrient	Manure nutrient production	Chemical fertilizer consumption	Equivelent %, manure/chemical fertilizer
N	889	2090	43
P (P_2O_5)	562	837	67
K (K_2O)	625	305	205

Geographical distribution of manure production in Canada

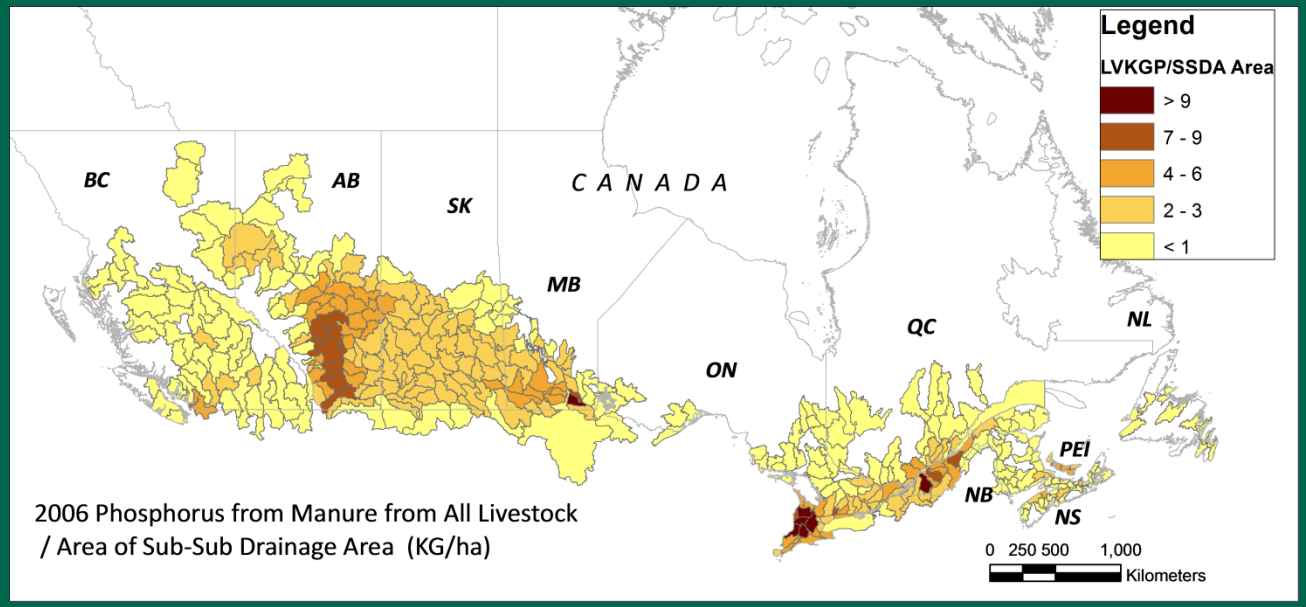


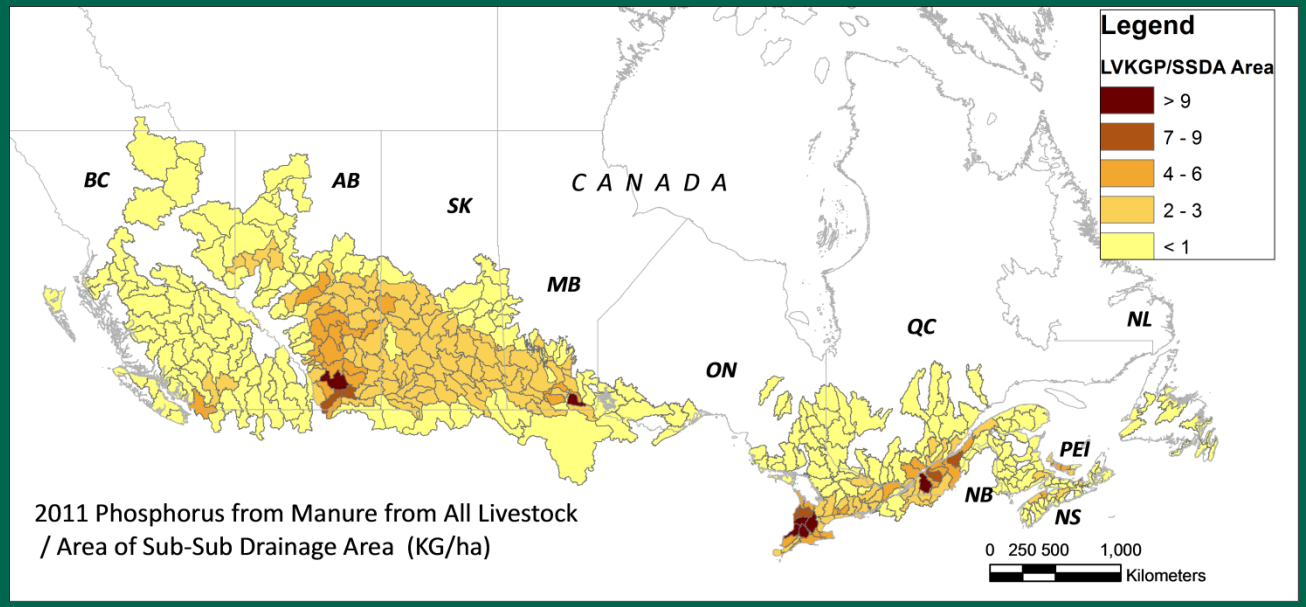


StatsCan, 2006, 2011

Mapping credited to: B. Daneshfar

Geographical distribution of manure phosphorus production in Canada



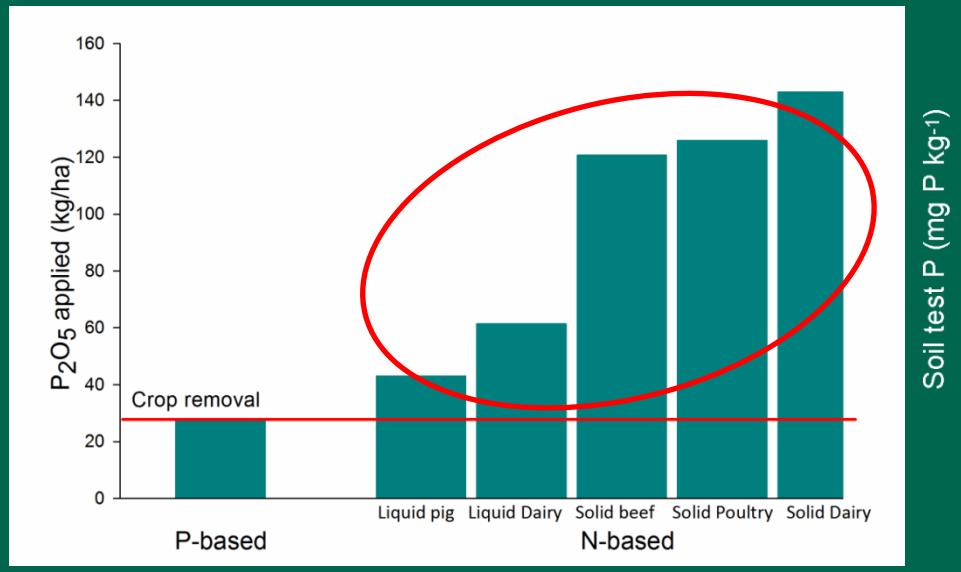


StatsCan, 2006, 2011

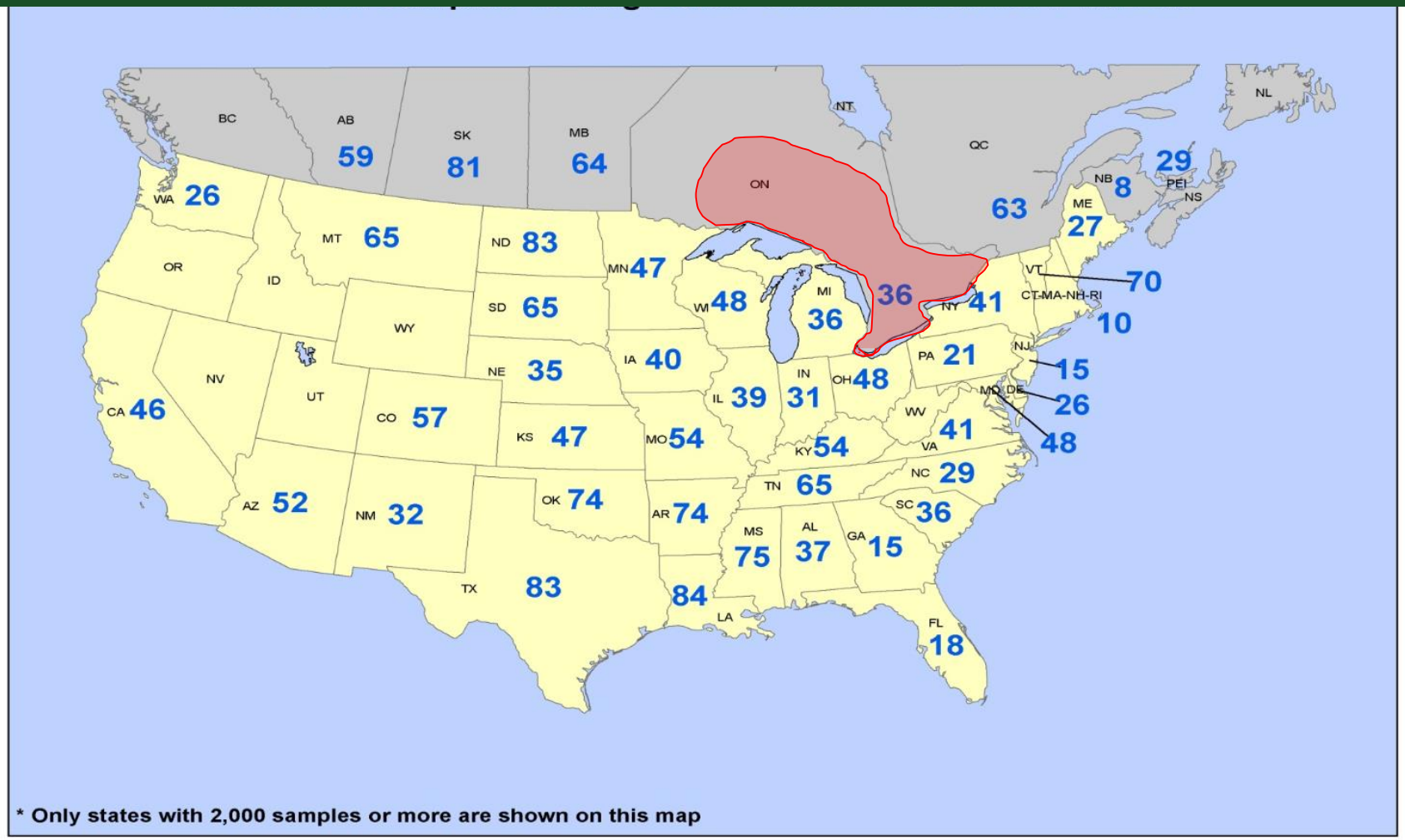
Mapping credited to: B. Daneshfar

N-based manure application causes excessive P addition

Manure types	Ratios of N/P in applied manure	Crop types	Ratios of N/P removed by crops
Solid beef	1.39	Corn grain	4.36
Solid dairy	1.17	Soybean grain	10.50
Liquid dairy	2.74	Wheat (spring) grain	6.03
Solid poultry	1.34	Wheat (winter) grain	5.44
Liquid pig	3.91	Barley grain	5.80
		Canola grain	4.58
		Oat grain	6.25

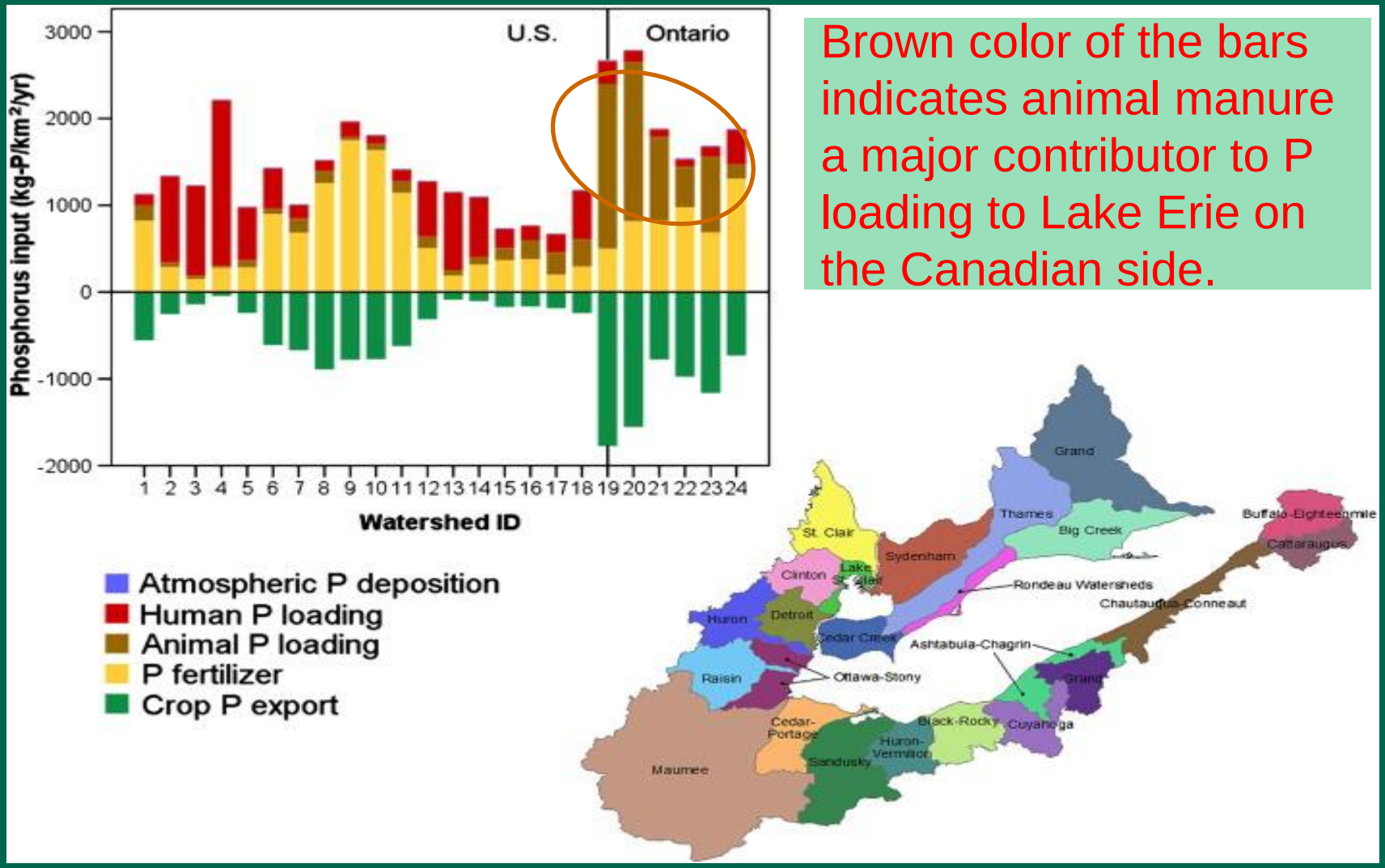


Percent of soil samples testing below critical levels for P, & no P addition is recommended in 2015.



Source: IPNI

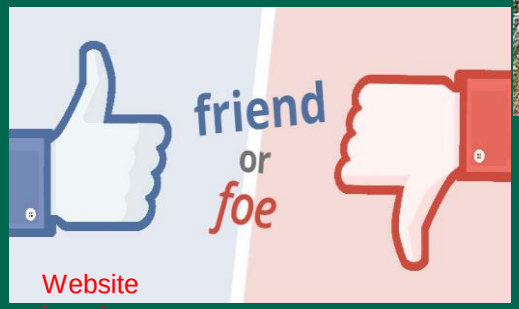
Inputs and outputs of total P for 24 Lake Erie watersheds during 2002. Source: Han et al. 2012



Organic by-products: waste or wealth?

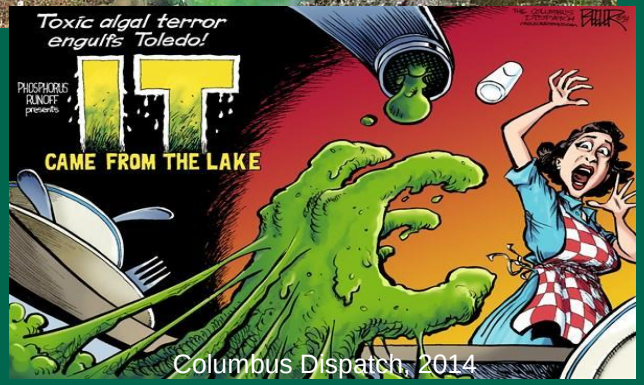
- Valuable resources, if properly used:
  - ✓ Nutrients, P, N, K, Ca, Mg, S, micro-nutrients
  - ✓ Particularly P, a non-renewable resource
  - ✓ Organic C

Manure, etc



Website imagine

NASA, Oct. 2011



Columbus Dispatch, 2014

- Can cause degradation of surface water quality, if lost to lakes, rivers, etc.

Manure P recycling: challenges & opportunities

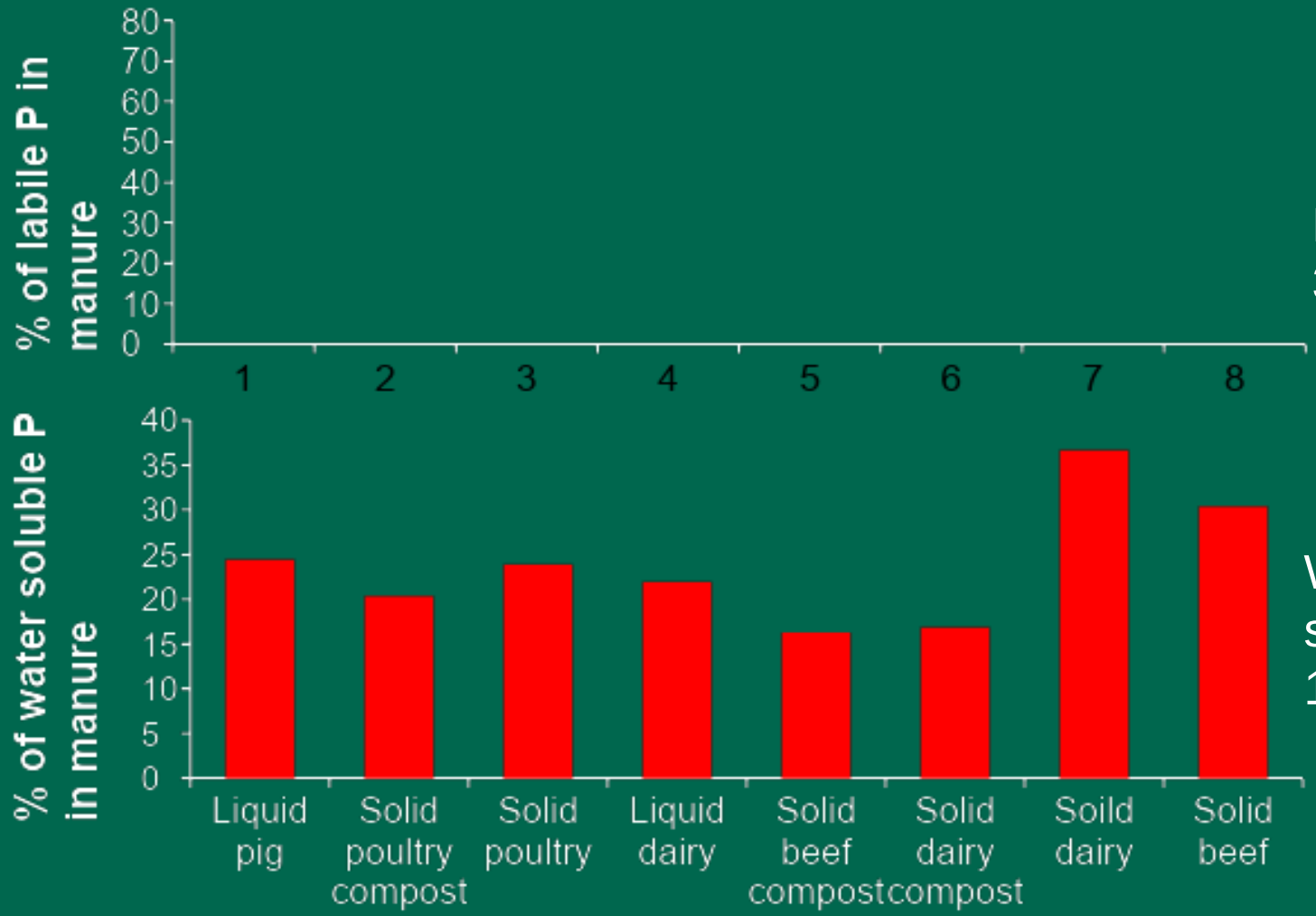
- Challenges
  - ✓ The lands on the farms/regions where manures are produced are often high in soil test P, and further application is prohibited
  - ✓ Manure production and crop needs are often not synchronized
  - ✓ Large volume, shortage in storing space, high transportation costs
  - ✓ Noxious odors
  - ✓ Pathogens

Manure P recycling: challenges & opportunities

- Opportunities
  - ✓ Large proportion of ag. lands are still low in soil test P, and crops need continuous sufficient P supply
  - ✓ Contribution of soils to P loadings in surface water resource follows a 20-80 rule
  - ✓ Multi-value and integrated function of manures in crop production and in improvement of soil quality and health
  - ✓ Nutrients, P in particular, inmanures are highly bioavailable

Manure P that is bio-available and/or subject to loss to water resource (Canadian data)

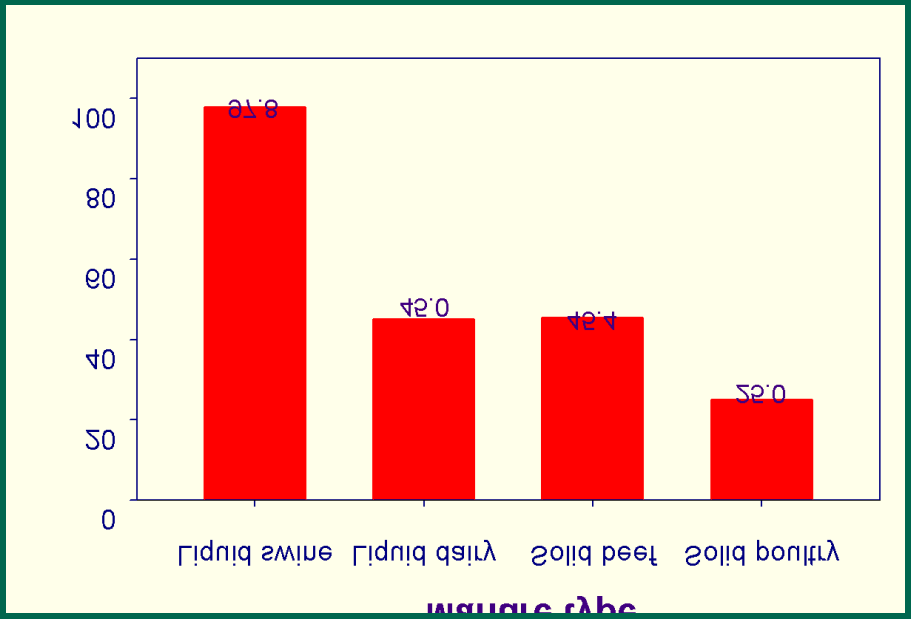
- Total P: 0.4-2.5%

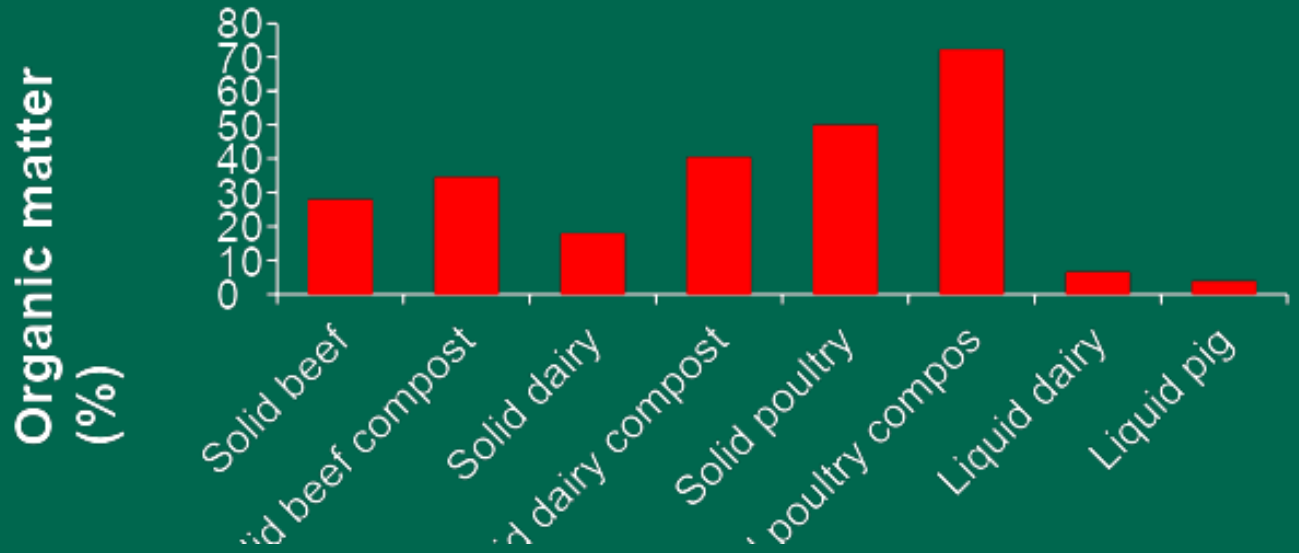


Labile P: 36-70%

Water soluble P: 16-37%

Manure P availability, indicated as P source coefficients (PSC), after application in soils of the Lake Erie watershed





Manure/compost organic matter content in Canada

Manure P recycling: some thoughts

- Agricultural reuse
  - ✓ Composting
  - ✓ Develop P-based BMPs, that also consider the other values of manures to increase soil production sustainability and resilience to climate change
  - ✓ Long-term studies are required
- Recovery to manufacture new fertilizers, such as struvite, and/or in combination with power generation, such methane production