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Canada

Harmonizing algorithms for estimating P loss at different spatial scales

Keith Reid, Kimberley Schneider and Pamela Joosse
Agriculture and Agri Food Canada
Guelph, Ontario

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Outline

- What scales are important for P loss?
- P loss and transport mechanisms
  - Lab and plot scale
  - Field scale
  - Watershed scale
- What should change, what should stay the same

What Scale is relevant to P mitigation?

- Soil Research: Lab bench to field plot
  - Tight controls on variability; replicated treatments
- Land Management: Field to farm scale
  - Conflicting factors in management decisions
- Hydrology: Watershed (small to continental)
  - Limited controls on variability, modeling of data
- Policy: County to National scale
  - No controls on variability, no replication

What Scale are we currently working at?

- Update to the Ontario P Index
  - Field Scale
  - Based on data provided by individual land managers
- Update to the Indicator of Risk of Water Quality by Phosphorus (IROWC-P)
  - Regional (Soil Landscape of Canada polygon) to national scale
  - Based on interpolated data from census and surveys

Overall Goals of both projects

- Accurate characterization of risk of P losses
- “directionally and magnitudinally correct”
  - Provides the correct relative ranking of risk
- Modest input requirements and computationally efficient
- Sensitive to changes in management
- Outputs easily understandable

Parallel Structures

- Both are using a Component P index approach
  - Source X Transport for each component
  - Dissolved and particulate P calculated separately, and then summed
  - PP losses estimated from soil erosion
  - DP losses from soil estimated from STP
  - DP losses from applied fertilizer and manure estimated from rate, solubility, timing and placement
  - Accounting for both surface and tile flow

Opportunities and Challenges

P Index

- Calculations based on actual soil types, STP values, application rates and P management
  - Land managers may not always have capacity to accurately estimate soil texture, or slope length and steepness
  - Depends on individual to perform calculations

IROWC-P

- Calculations based on estimated average soil types, STP values, application rates and P management
  - Actual values for STP not available, so estimated from cumulative P balance
  - Very limited data on P application timing and method
  - Rate estimated from Fertilizer sales and livestock numbers

Calibration and Validation

P Index

- Ideally, should be edge of field but very few monitoring sites at this scale
- Small watershed would be appropriate, IF:
  - Land use, STP and P management data available for all fields
  - Merged values from each field need to account for contributing area (not simple weighted average)

IROWC P

Averages or Extremes?

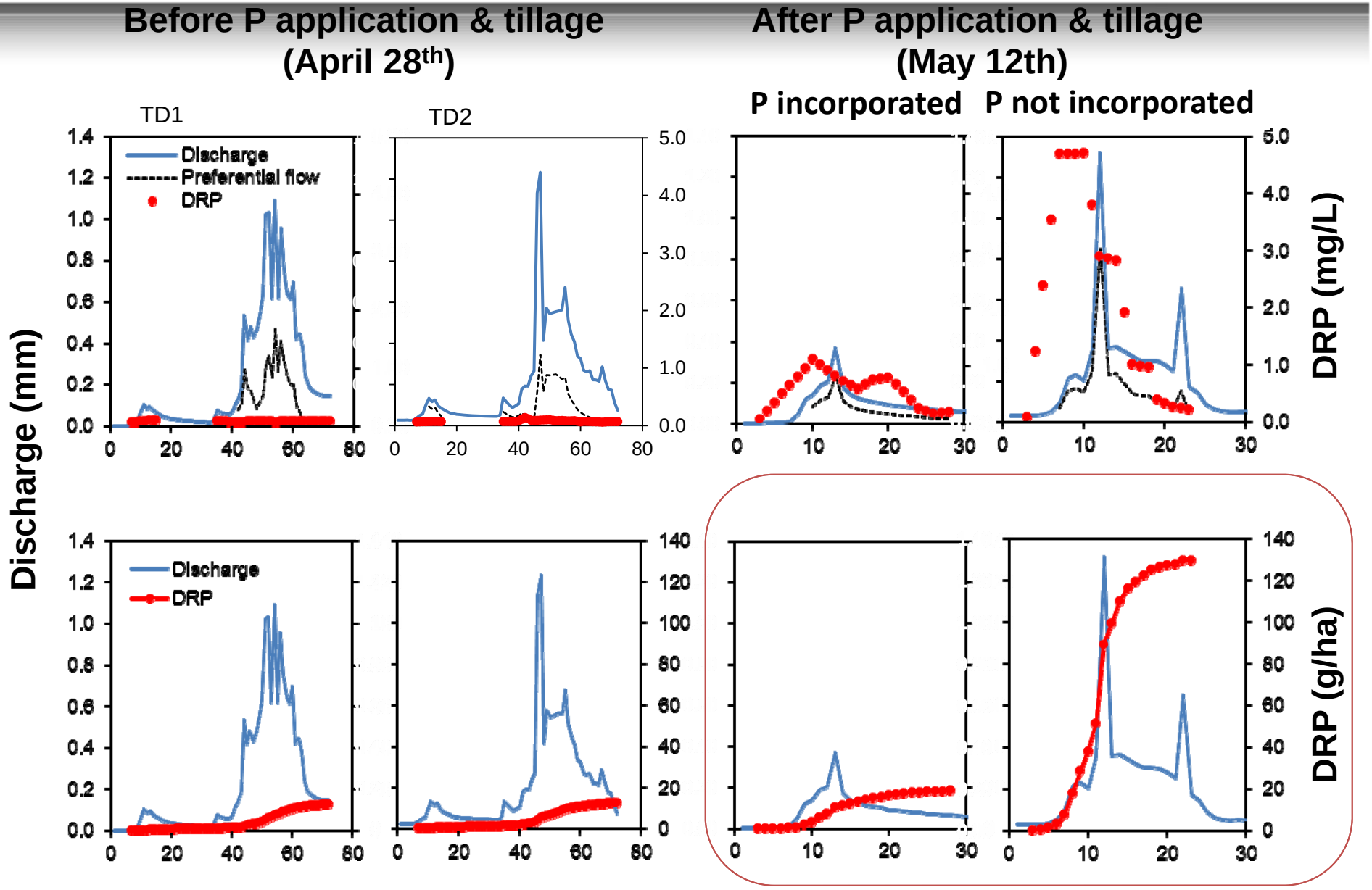
Watershed Legacy P?

Residue Management

Rural living Canada

GoCorn.net

Corn and Soybean Digest



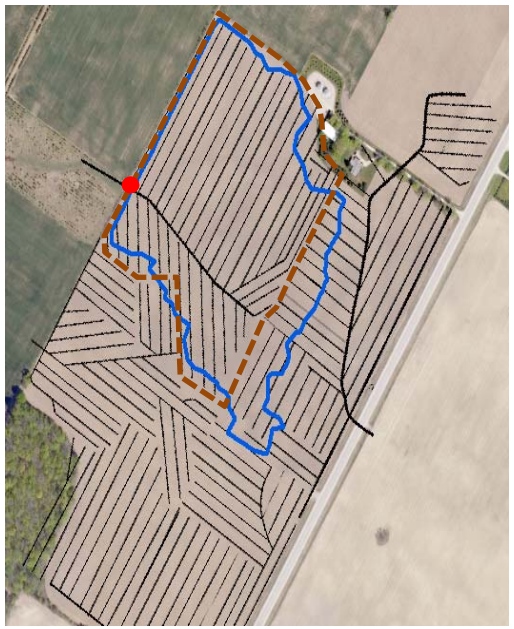
Incorporating P reduced DRP loss from 130 g/ha to 18 g/ha

Williams and King, USDA-ARS, Columbus, Ohio

REDUCE RUNOFF VOLUMES

Runoff capture:

Avg. Runoff = 331 mm



Consider a 8 ha (20 acre) field

- Annual precipitation ~ 900 mm
- Annual ET ~ 525 mm
- Deep drainage ~ 50 mm
- Runoff ~ 325 mm
- 50% to 70% drains off in NGS

STORAGE SIZE NEEDED – 80% of ALL NGS
RUNOFF CAPTURED (i.e. 0.8 *0.6*325 = 156 mm
4 m deep rectangular pond (2:1 side slopes)
107 m X 107 m (1.1 ha surface area)!

Questions and Discussion