

Modeling Seasonal Risk of Deep Drainage for Different Regions of Ontario: Implications for Source Protection Guideline Development

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Funding Sources

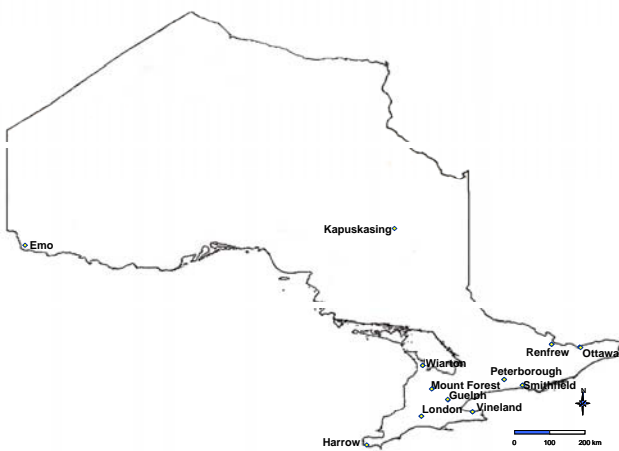
- Canadian Water Network, University of Waterloo, Waterloo, Ontario
- Ontario Ministry of Agriculture, Food and Rural Affairs

Background

- Risk of seasonal drainage is directly correlated with risk of groundwater contamination.
- When does drainage of water from soil most frequently occur?
- Drainage risk must be considered when developing source water protection strategies.

Methods

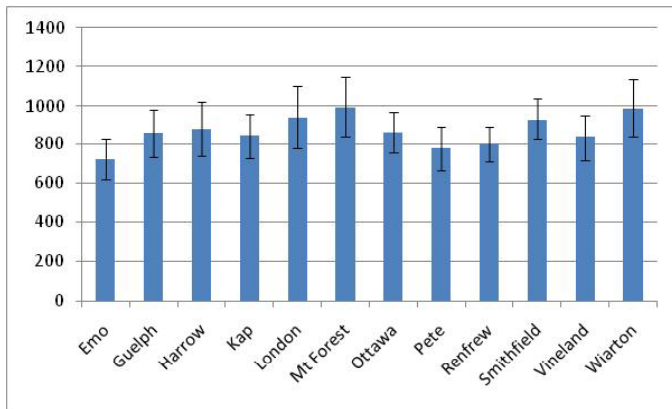
- Examine 12 sites in Ontario, Canada using DRAINMOD 6.0.
- Include a wide range of soil types, climatic regions, all under corn crop.
- Southern Ontario has same latitude as Northern California.
- Northern Ontario has same latitude as Southern Alaska.



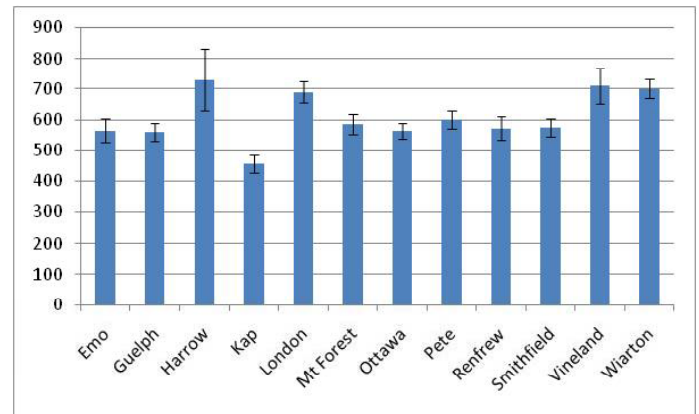
Soils at 12 Ontario Sites

- Emo: clay
- Guelph: loam
- Harrow: clay loam
- Kapuskasing: silty clay loam
- London: silt loam
- Mt. Forest: silt loam
- Ottawa: clay loam
- Peterborough: loam
- Renfrew: silty clay
- Smithfield: sand
- Vineland: clay
- Warton: silt loam

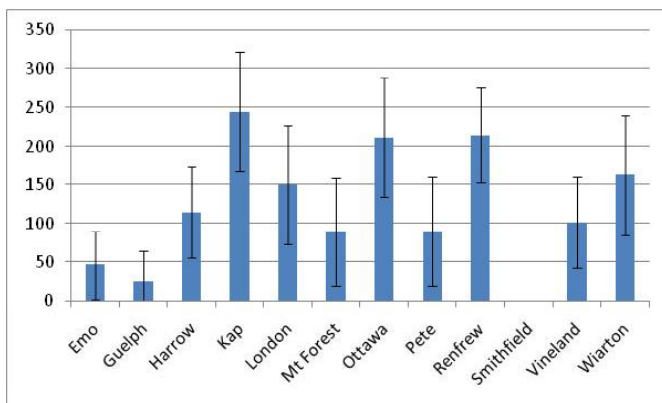
Average Annual Precipitation (mm)



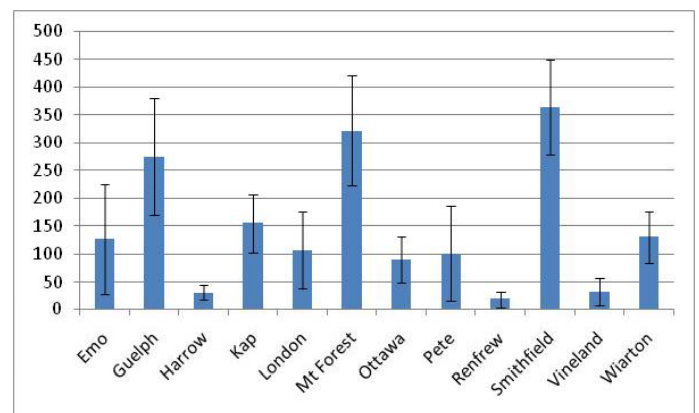
Average Annual Evapotranspiration (mm)



Average Annual Runoff (mm)



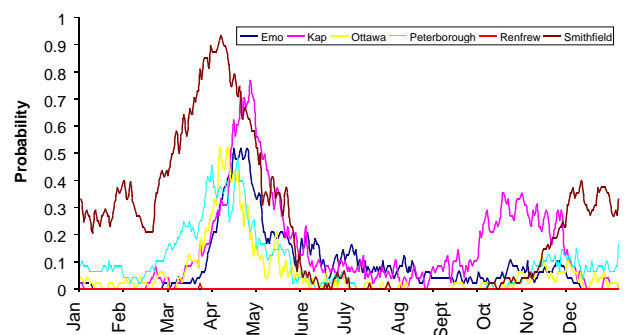
Average Annual Drainage (mm)



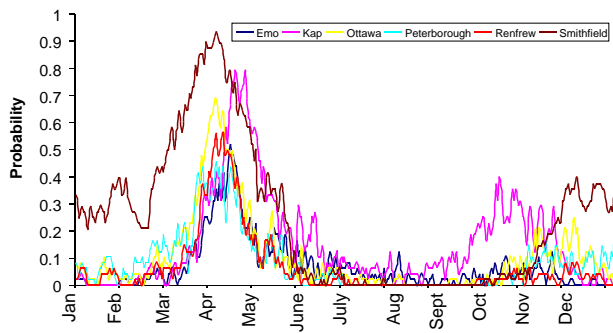
Summary of Average Annual Data

- Some variability in Precipitation and Evapotranspiration.
- Substantial region-to-region and between-year variability in Drainage and Runoff.
- Should be considered when developing source water protection strategies for a large region.

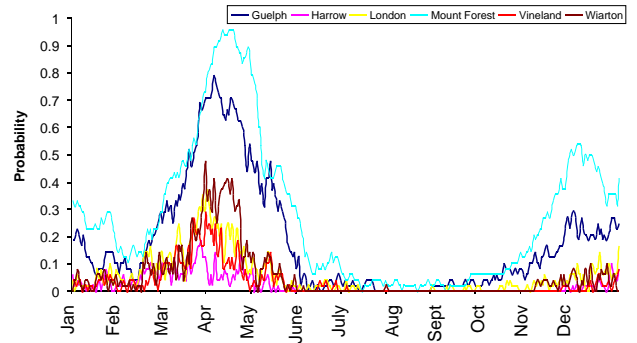
1.0 mm/day Drainage Probability: N and E Sites



1.0 mm/day Drainage Probability: N and E Sites All Sand



1.0 mm/day Drainage Probability: SW Sites



Summary

For most locations and soil types, drainage primarily occurs in March and April associated with snowmelt and high soil moisture contents.

Two regions with greatest probability of 1 mm/day drainage had the greatest amount of snowfall (0.96, Apr. 11 & 16) and the sandy soil (0.94, Apr. 6).

Summary

- Some regions have peak risk as low as 0.17 and most regions have peak risk less than 0.5. Although soil texture does influence DD probability, it appears that climatic differences between regions have an even greater impact.

Key Consequences of this Research

- Policy on source water protection in relation to the amount and timing of DD should not be developed at a Province-wide scale across Ontario.
- Including regional climatic variability and to a lesser extent different soil textures, should be considered when developing source water protection strategies.