A watershed classification for the Canadian Prairies

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INTRODUCTION

- Our understanding of prairie watershed response to environmental change is based on a few research sites.
- The representativeness these responses to other regions within the Canadian Prairie is unknown, impeding extrapolation across the region.
- We compiled physio-geographic characteristics from across the prairie ecozone and classified watersheds using hierarchical clustering on principal components.

PURPOSE

Develop a framework to identify areas of similar physio-geographic characteristics and thus potential hydrologic behavior. This behavior will be modelled virtually ("virtual basins") and overlaid with relevant changes in climate and land use as informed by our user community.

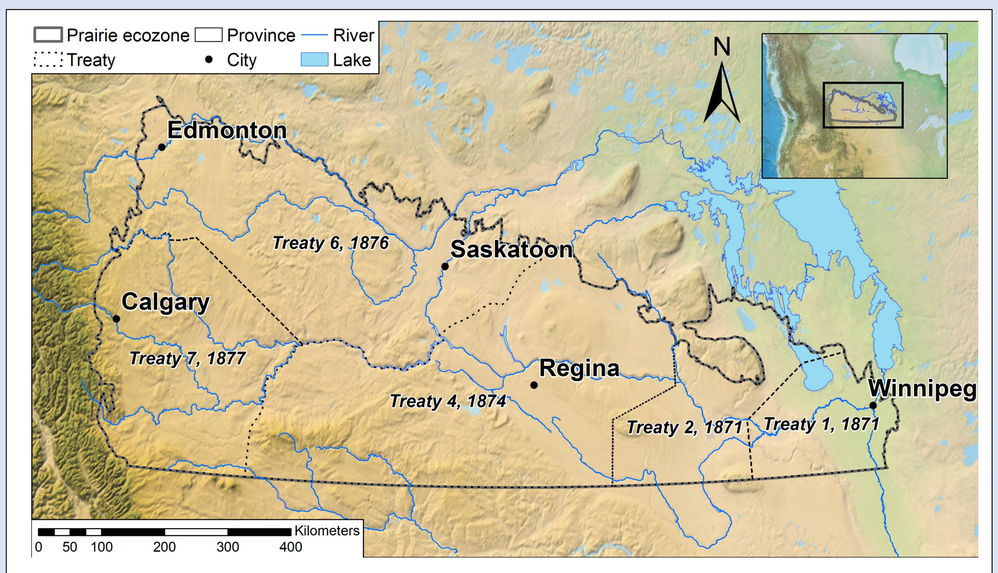

Figure 1: Map of classification focus area

Table 1: Variable groups included in watershed† cluster analysis assigned.

Variable
Climate (MAP, PET)
Area, dimensional shape factor
Elevation
Fraction of land below outlet
Slope (mean, CV)
Surficial geology
Surface landform
Soil texture
Soil zone
Non-contributing area fraction
River incidence
Wetland fraction
Number water bodies
Largest pond parameters (total water volume within, location to outlet)
Size distribution parameters (ξ, β)
Till practice
Land cover

† Watershed delineations are from the HydroSHEDs data product (Lehner, B., Grill G. 2013. Global river hydrography and network routing: baseline data and new approaches to study the world's large river systems. *Hydrological Processes*, 27(15): 2171–2186. Data is available at www.hydrosheds.org).

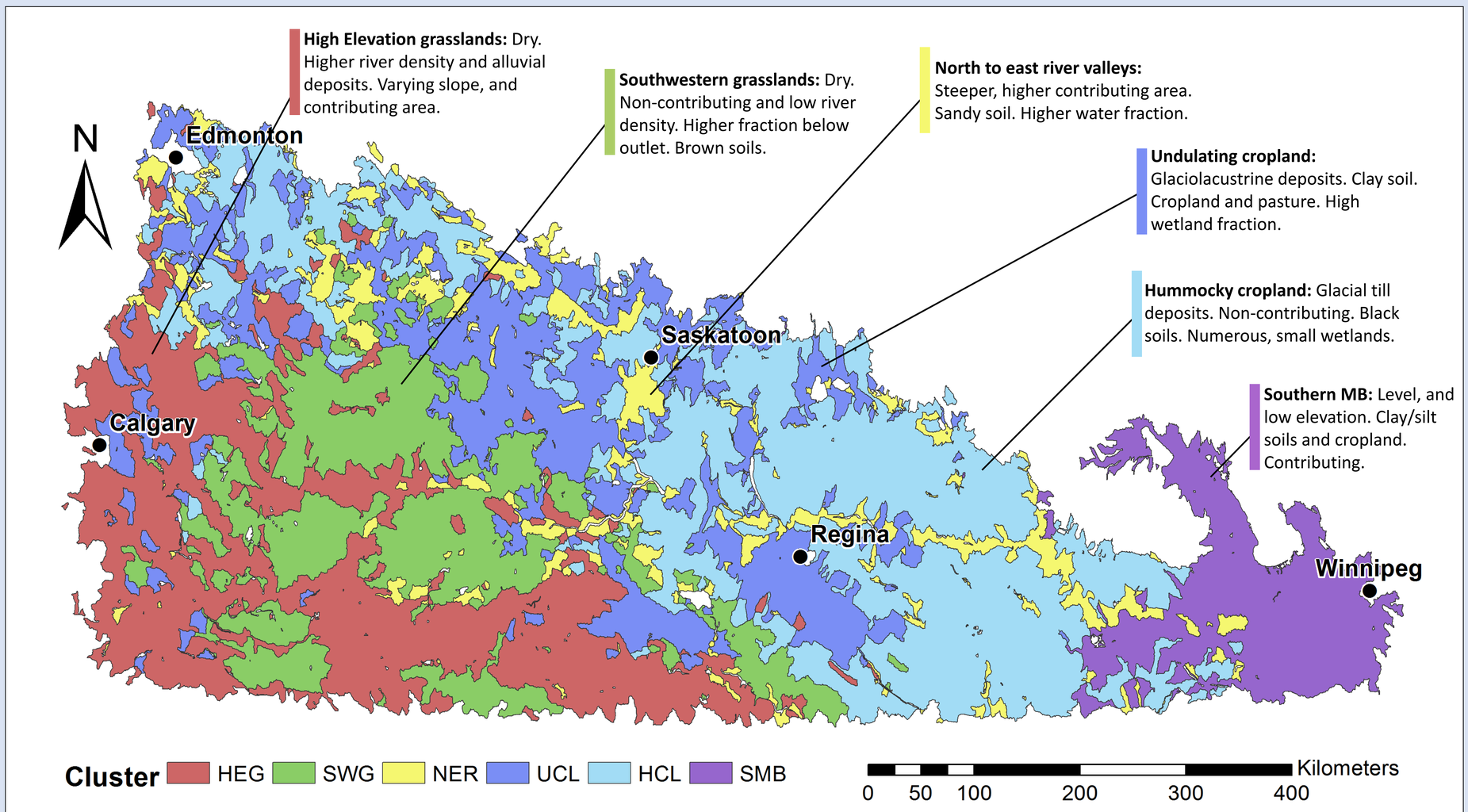

Figure 2: Prairie watershed classification. Pull-out boxes describe an overview of defining characteristics of the class. Variables used in the cluster analysis are shown in Table 1.

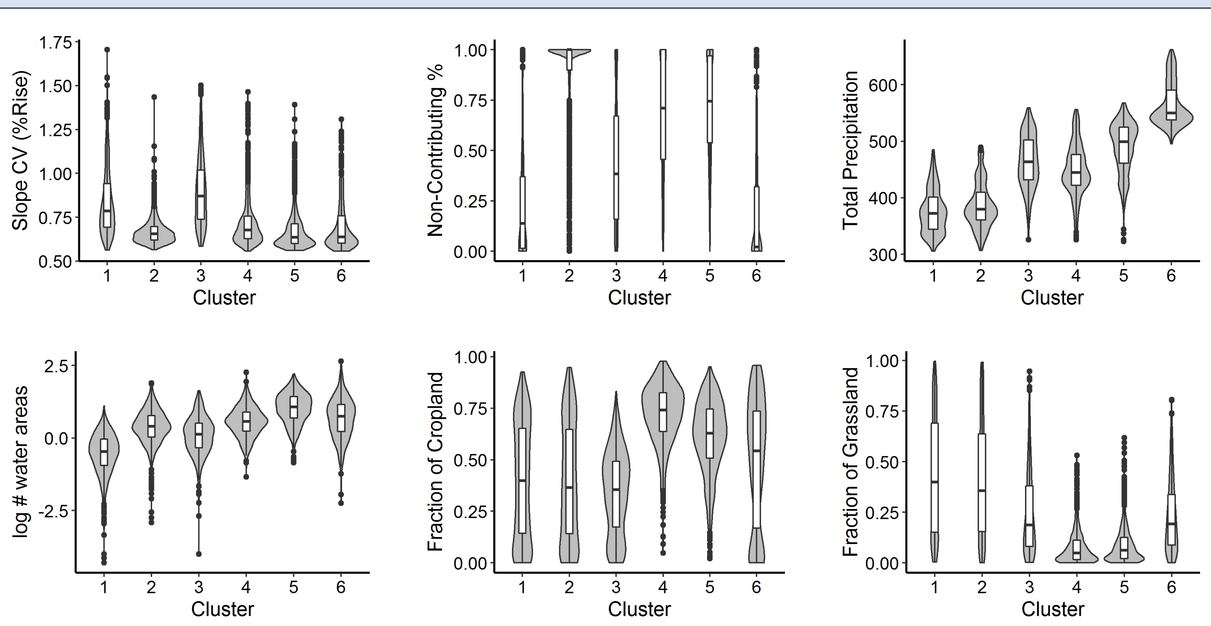

Figure 3: Violin and box plots of select variables by watershed cluster.

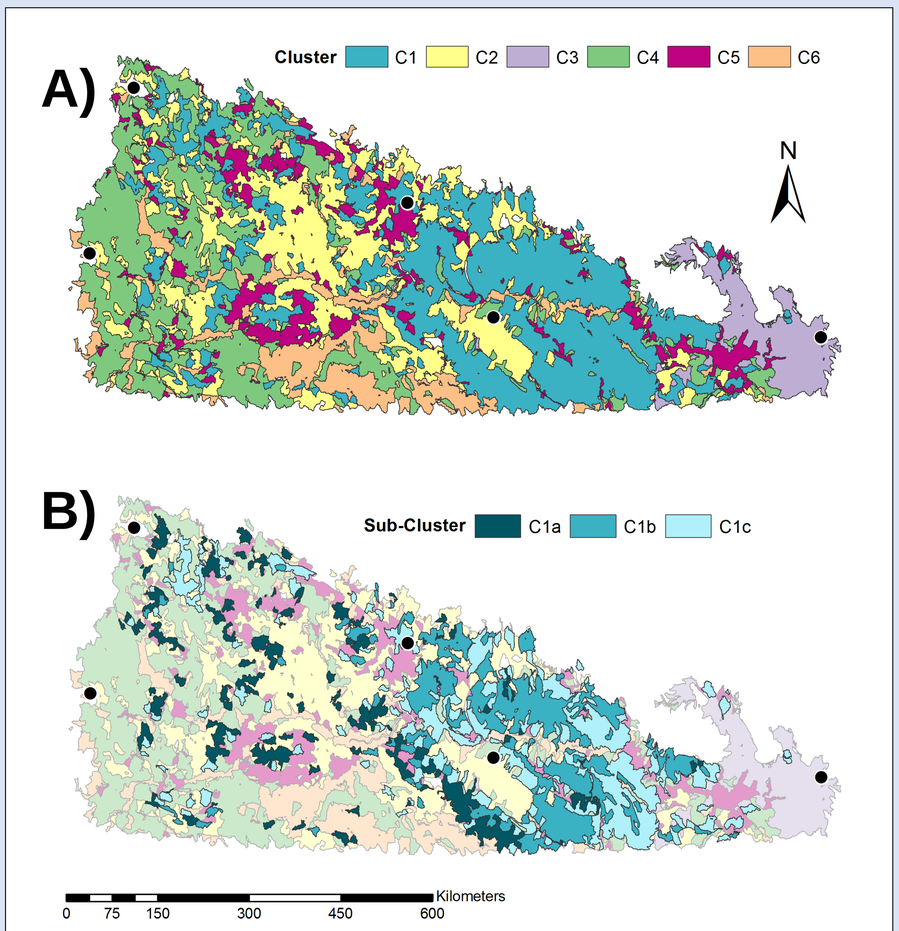

Figure 4: Cluster analysis based on geomorphological parameters. Region-wide analysis (A) and secondary analysis on C1 (B).

CONCLUDING REMARKS

- Classification regionalizes watersheds according to different sets of variables and number of clusters.
- Cluster analyses will inform parameters for virtual basin hydrological modeling.
  - Land use and climate scenarios will be applied to the generalized "behavior" of each cluster.
- Data generated by the Prairie Water project will be incorporated in future versions to consider questions from other research themes, including those related to water quality and human dimensions.