

Watershed classification for the Canadian Prairies

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INTRODUCTION

- Our understanding of watershed response to environmental change in the Canadian Prairies is based on a few research sites. The representativeness of these responses to other regions is unknown.
- Watershed classification can address this challenge. However, a comprehensive approach has not occurred in the Prairies, and studies often only focus on hydrological response.
- We compiled physio-geographic characteristics from across the Prairies ecozone and classified watersheds using hierarchical clustering on principal components.

PURPOSE

Develop a typological framework to identify areas with similar physio-geographic characteristics and thus potential hydrologic behavior. The approach should also incorporate features to address additional questions of environmental change, such as those related to water quality and ecology.

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

Variable
Precipitation and potential evapotranspiration
Area, dimensional shape factor
Elevation
Fraction of land below outlet
Slope (mean, CV)
Surficial geology
Surface landform
Soil texture class
Soil zone
Non-effective area fraction
Stream incidence
Wetland fraction
Wetland density
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).

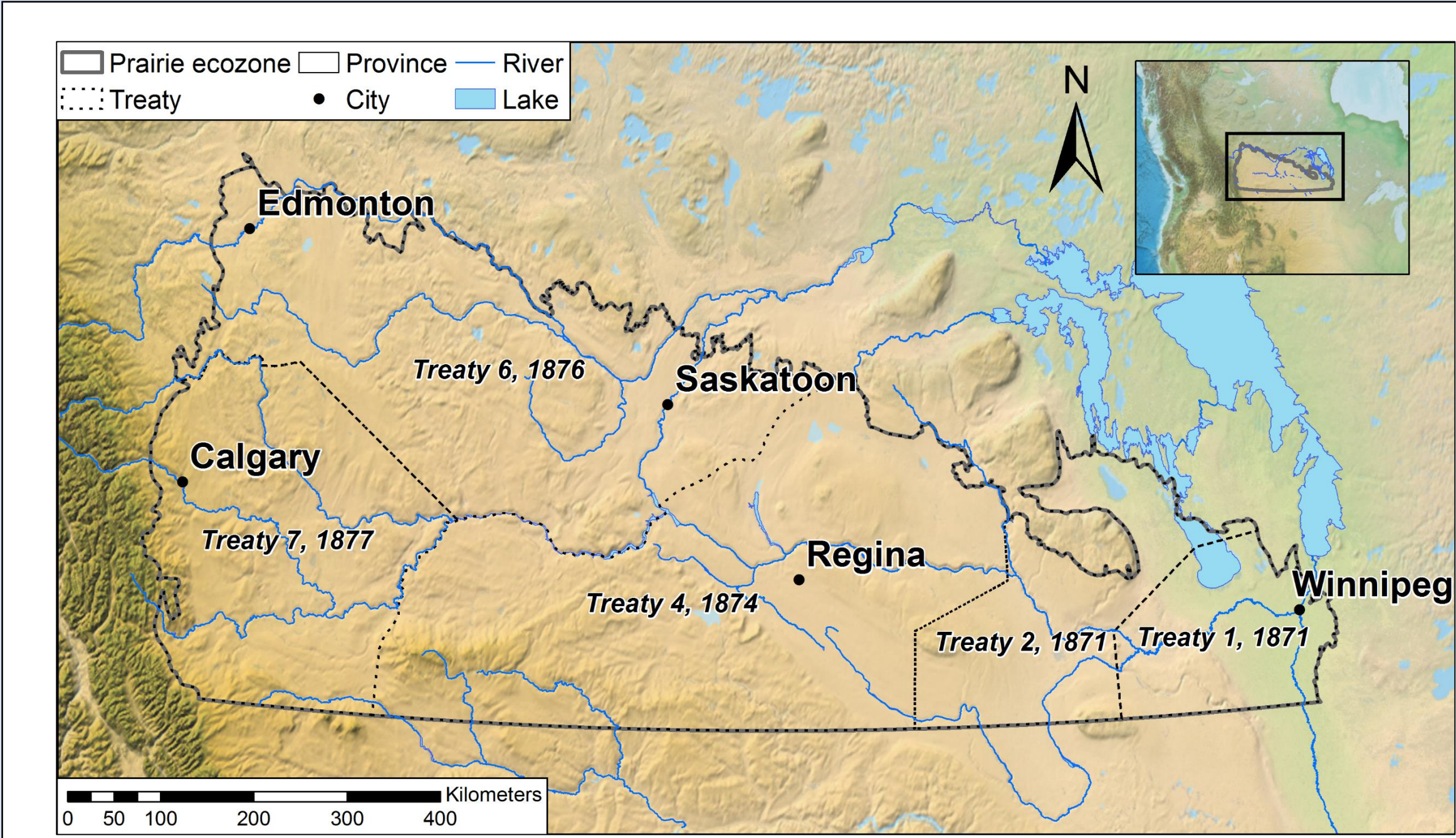


Figure 1: Map of classification focus area

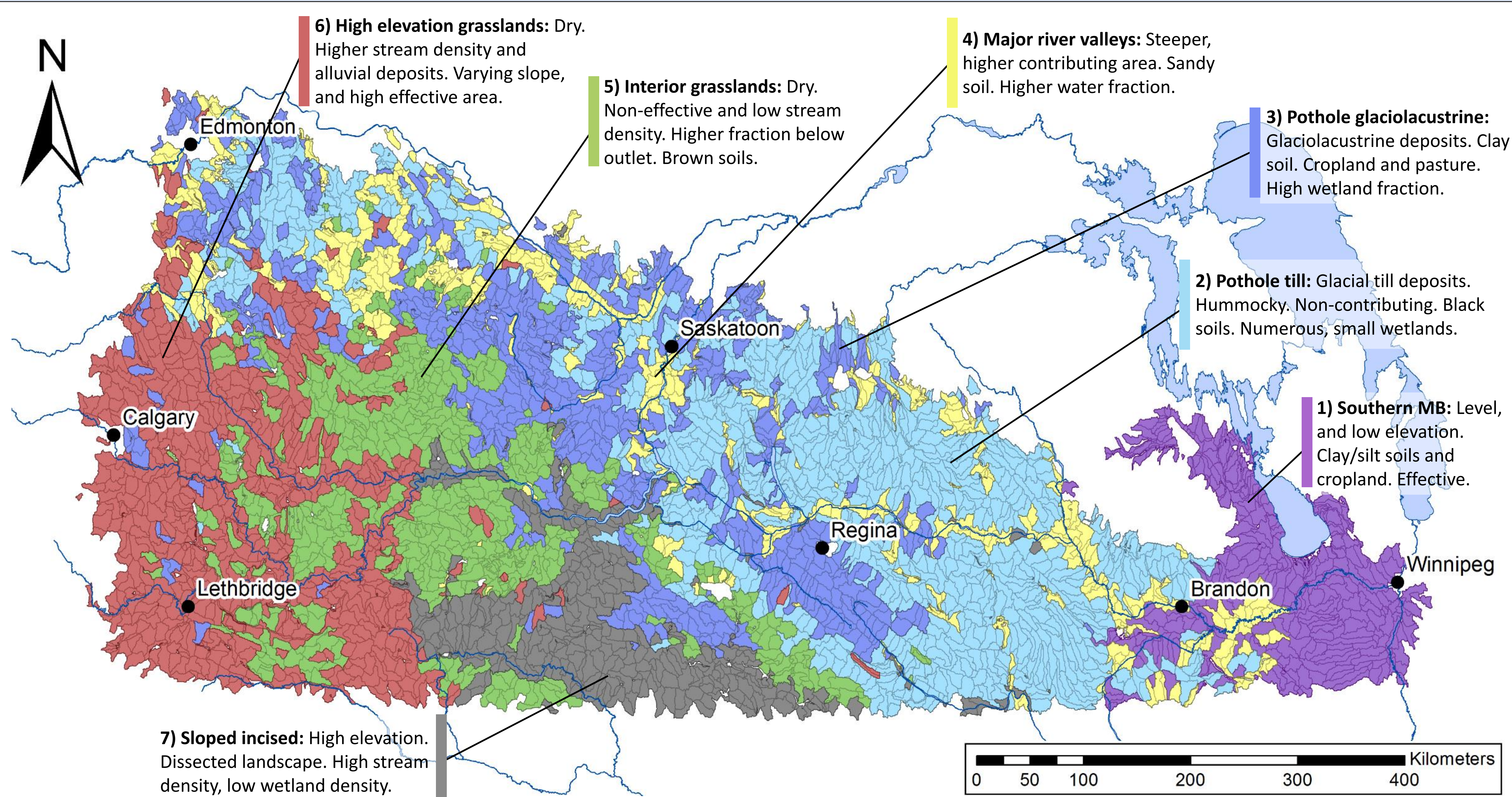


Figure 2: Prairie watershed classification. Pull-out boxes describe an overview of defining characteristics of the class. Variables used in the cluster analysis are shown in Table 1.

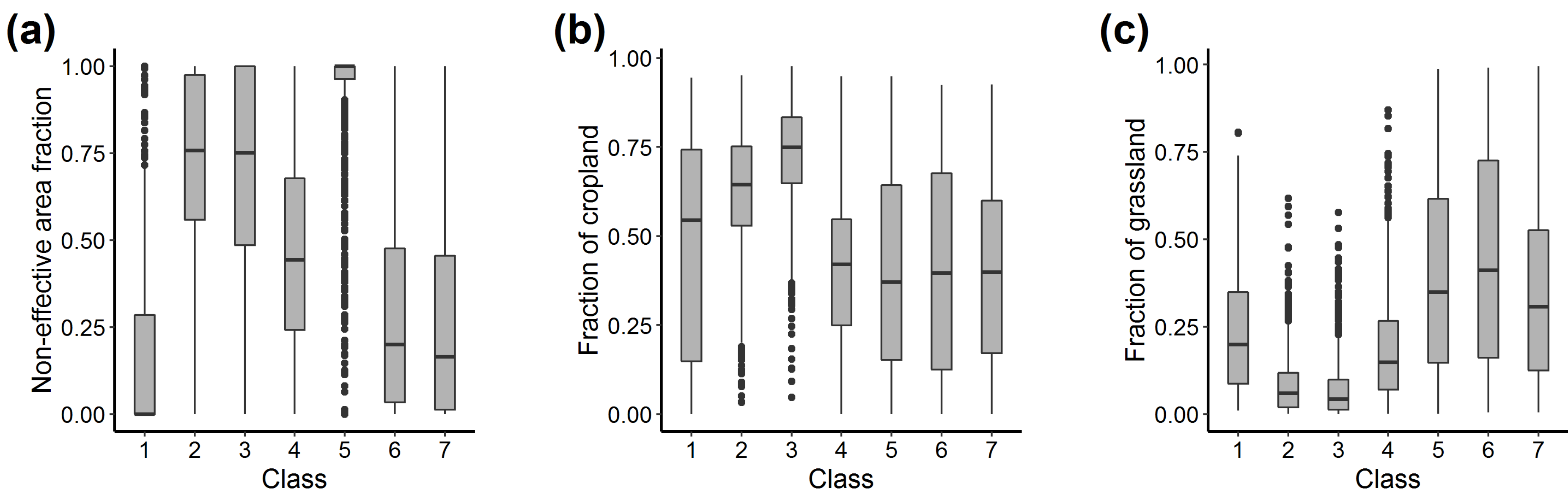


Figure 3: Box plots of select variables by watershed cluster.

CONCLUDING REMARKS

- Seven classes were identified. Defining variables included climate, elevation, surficial geology, proportion of effective areas, and wetland density
- Classification regionalizes watersheds according to different sets of variables and number of clusters, allowing for flexibility in application (e.g., hydrological modeling).
- Cluster analyses inform parameters for virtual basin hydrological modeling.
 - Land use and climate scenarios will be applied to the generalized “behavior” of each cluster.
- Future iterations of the classification will incorporate data generated by the Prairie Water project to consider questions from other research themes, including those related to water quality and human dimensions.

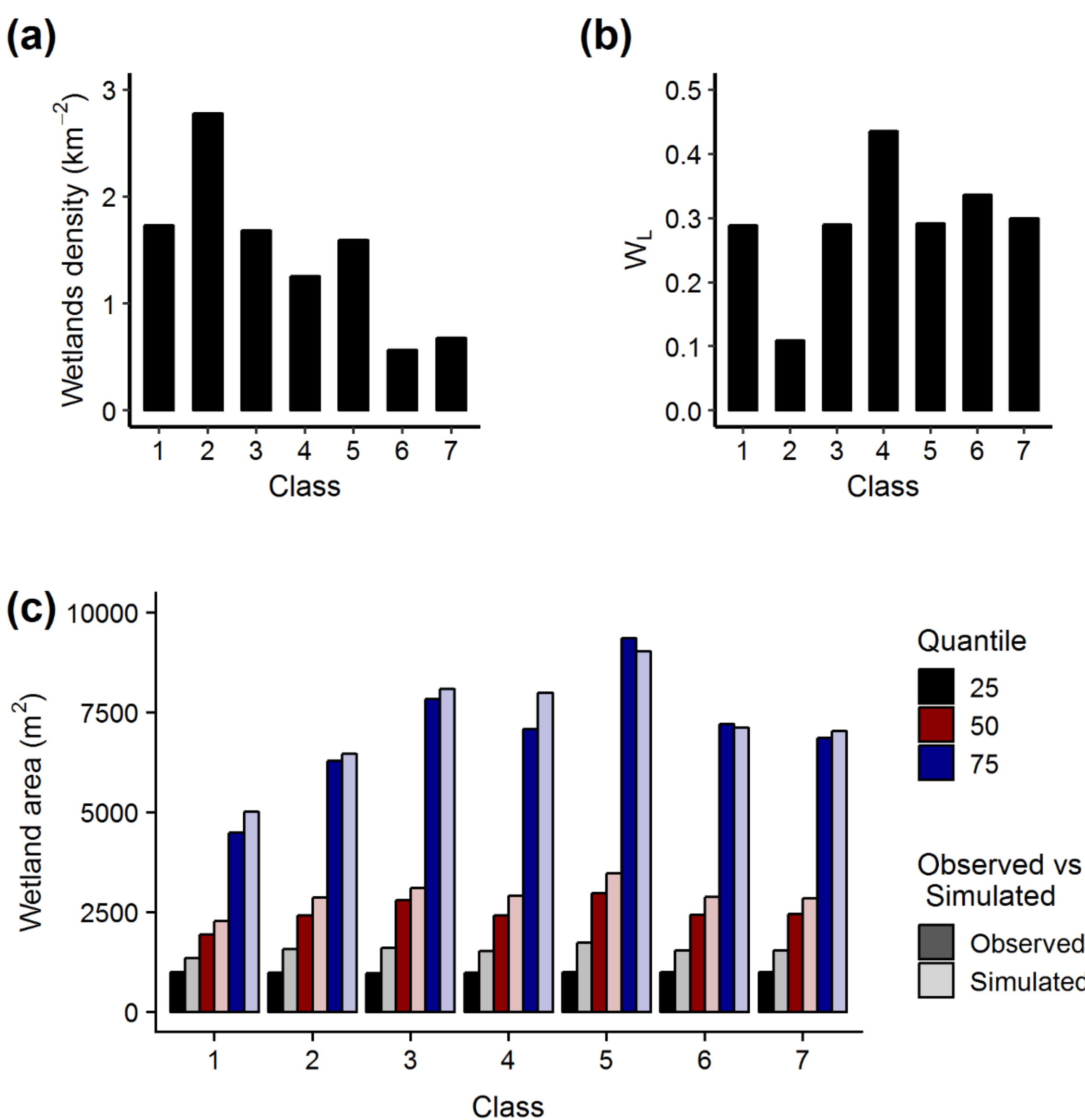


Figure 4: Wetland parameters by class, including (a) density and (b) total water area occupied by the largest pond (W_L). Quantiles of wetland area distributions, observed vs. simulated, are shown in Panel (c).