

Evaluation of the soil drivers of cropland marginality in the Canadian Prairies



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Background

As the global need for agricultural production increases, so does the use of marginal land for cultivation. Under annual cropping, marginal lands are often associated with economic losses and increased risk of soil degradation.

The distribution patterns of drivers of marginality within cropland are not well understood. Understanding the variability of these drivers is essential for making informed management decisions.

This study aims to improve our understanding of soil drivers of marginality (salinity, sodicity, water content, erosion, compaction) and their distribution patterns within cropped fields in the Canadian Prairies.

Methods

Nine fields' sampled across the Canadian Prairies in 2025 (Fig. 1)

Transects were used to sample from the marginal area into the crop (Fig. 2)

Classification cores and analysis cores were taken at each sample location

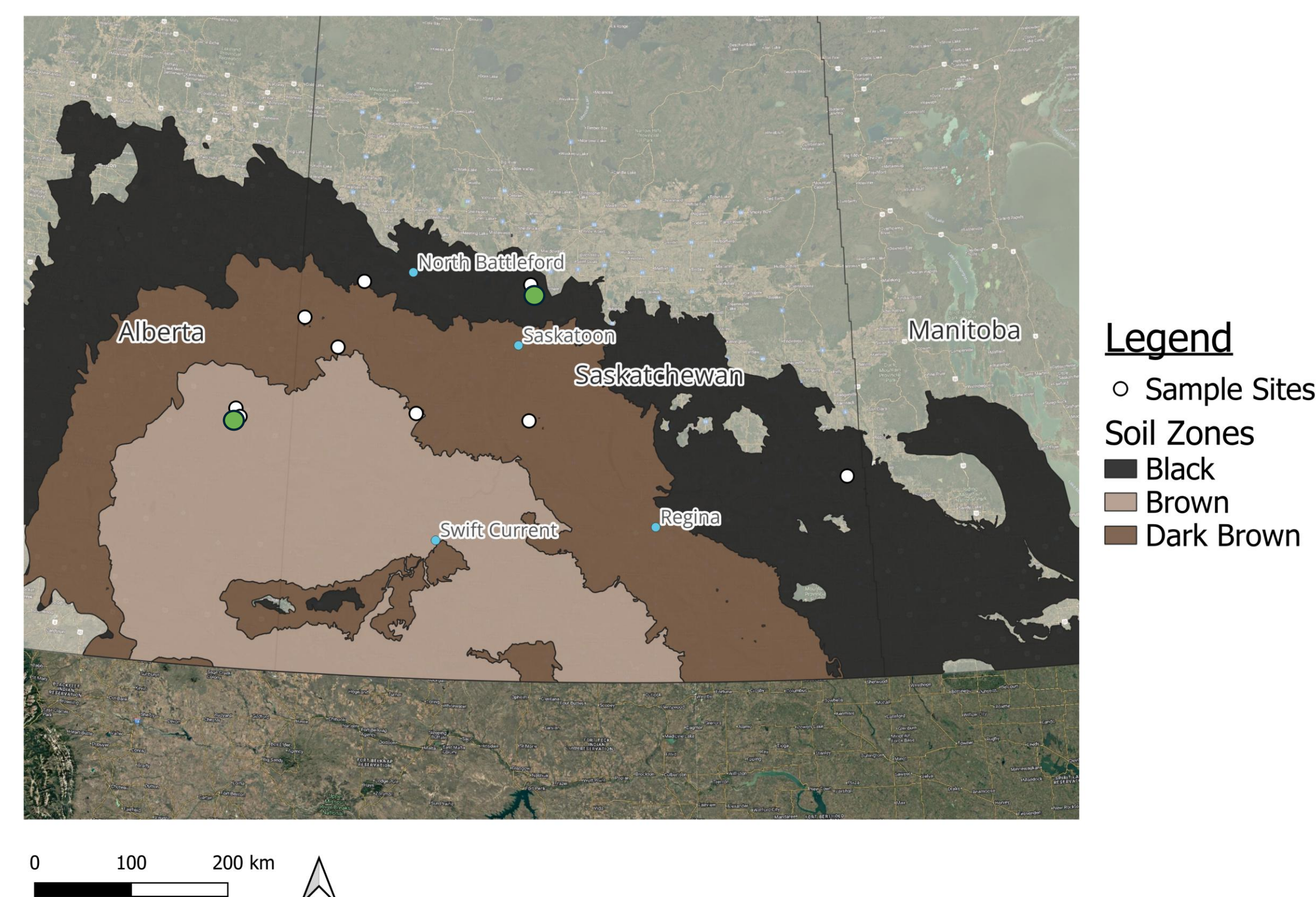


Figure 1. Nine marginal soil sample sites across Alberta and Saskatchewan, equally distributed across the Brown, Dark Brown, and Black soil zones. Two sites are in Alberta, seven are in Saskatchewan. Green dots indicate the sites examined in Fig. 3

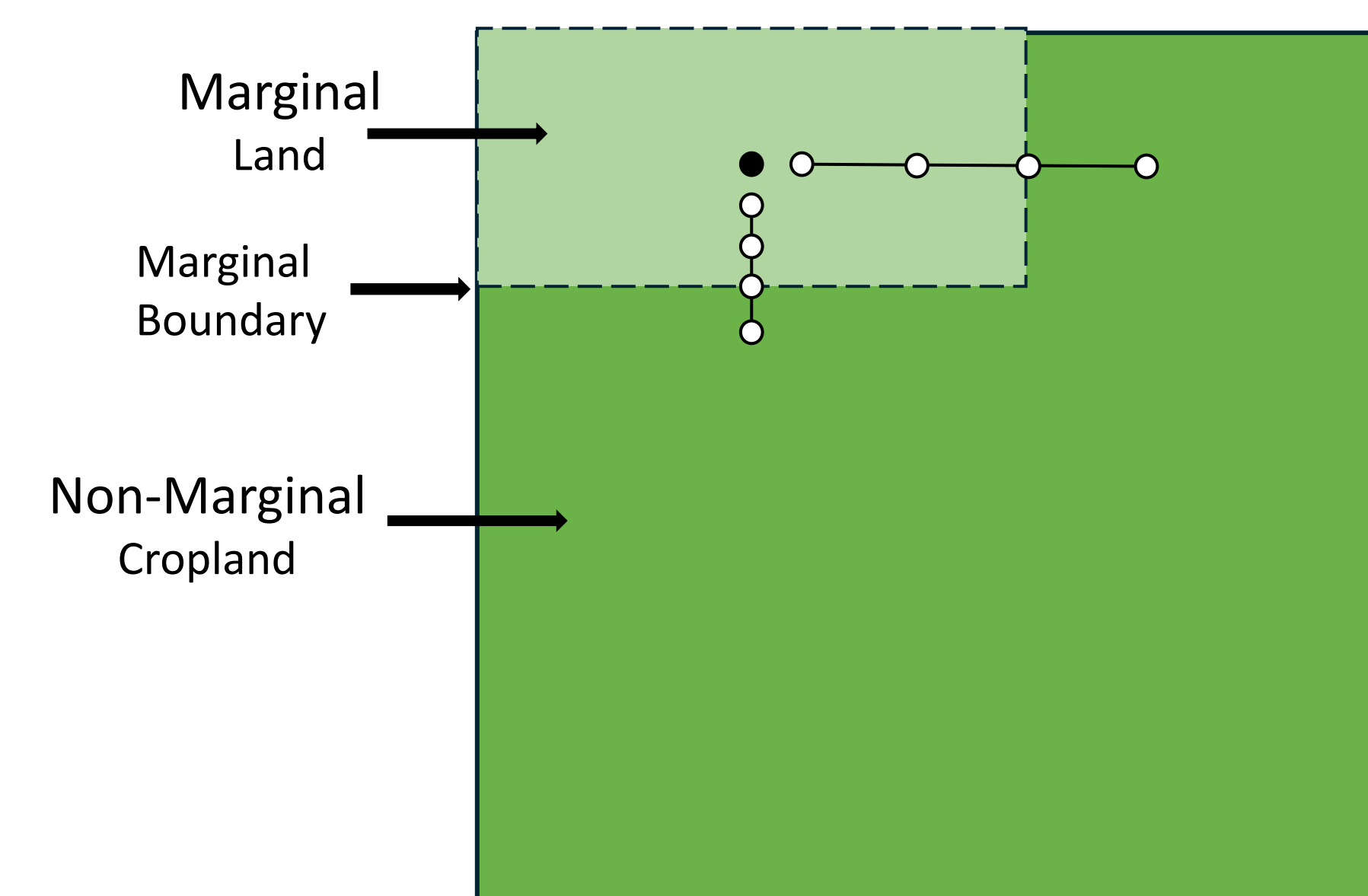


Figure 2. Two 4-point transects used at each site to sample from the center of the marginal area into the cropland. The black dot represents the center of the marginal area. The white dots represent the sample locations along the transects.

Results

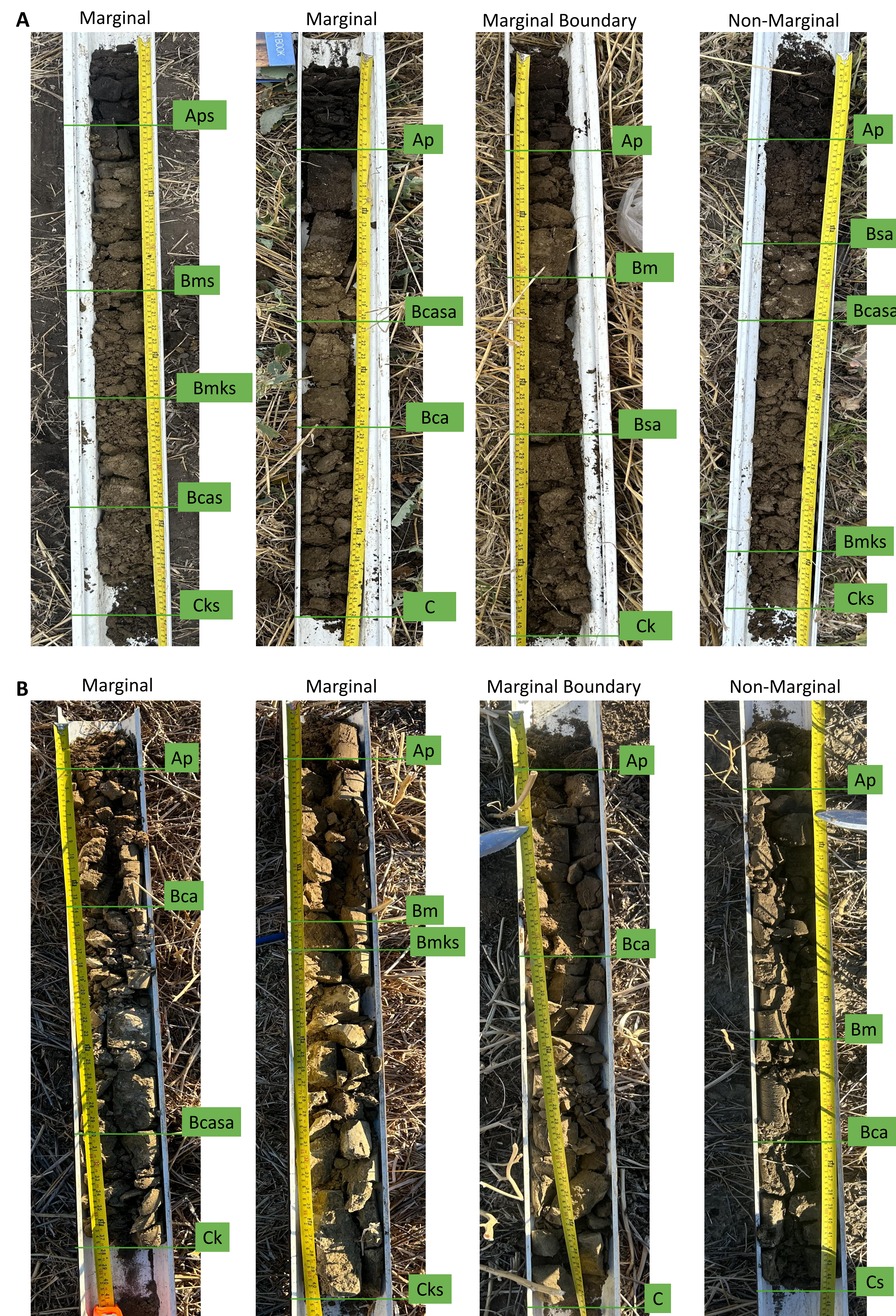


Figure 3. Soil cores collected along two transects: (A) Black soil zone in Saskatchewan and (B) Brown soil zone in Alberta. The transects show the changes in soil layer designations from the center of the marginal area into the non-marginal cropland. Green lines indicate layer boundaries, and green boxes show layer designations.

A Horizon	
p	Disturbed by human activity, cultivated
s	Salts present
B Horizon	
k	Effervescence (carbonates present)
ca	More effervescence than parent material
s	Salts present
sa	More salts than in the parent material
m	Slightly altered from parent material (colour and/or structure)
C Horizon	
k	Effervescence (carbonates present)
s	Salts present

Next Steps

Laboratory Analysis

- Exchangeable sodium percentage
- Sodium absorption ratio
- Electrical conductivity
- pH
- Organic carbon

Creation of digital maps showing the distribution of soil drivers of marginality



Figure 4. Soil containing coarse salts taken from non-marginal cropland in the Black soil zone.



Figure 5. Soil containing salt veins taken from marginal cropland in the Black soil zone

Acknowledgments

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