

Correlation Between Soil Organic Carbon and Soil Colour Using NIX Sensor

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BACKGROUND

Soil organic carbon is one of the most important soil properties within Western Canada. Normally being done with traditional lab methods it is important we develop a new way that is more time and cost effective.

A NIX sensor is digital sensing equipment that records the reflectance of colour properties, as well as visible spectroscopy wavelengths to understand the true colour being evaluated.

Being able to classify soil properties like soil organic carbon using inexpensive and effective tools we can better understand overall soil health, and how to better our soils in the future.

METHODS

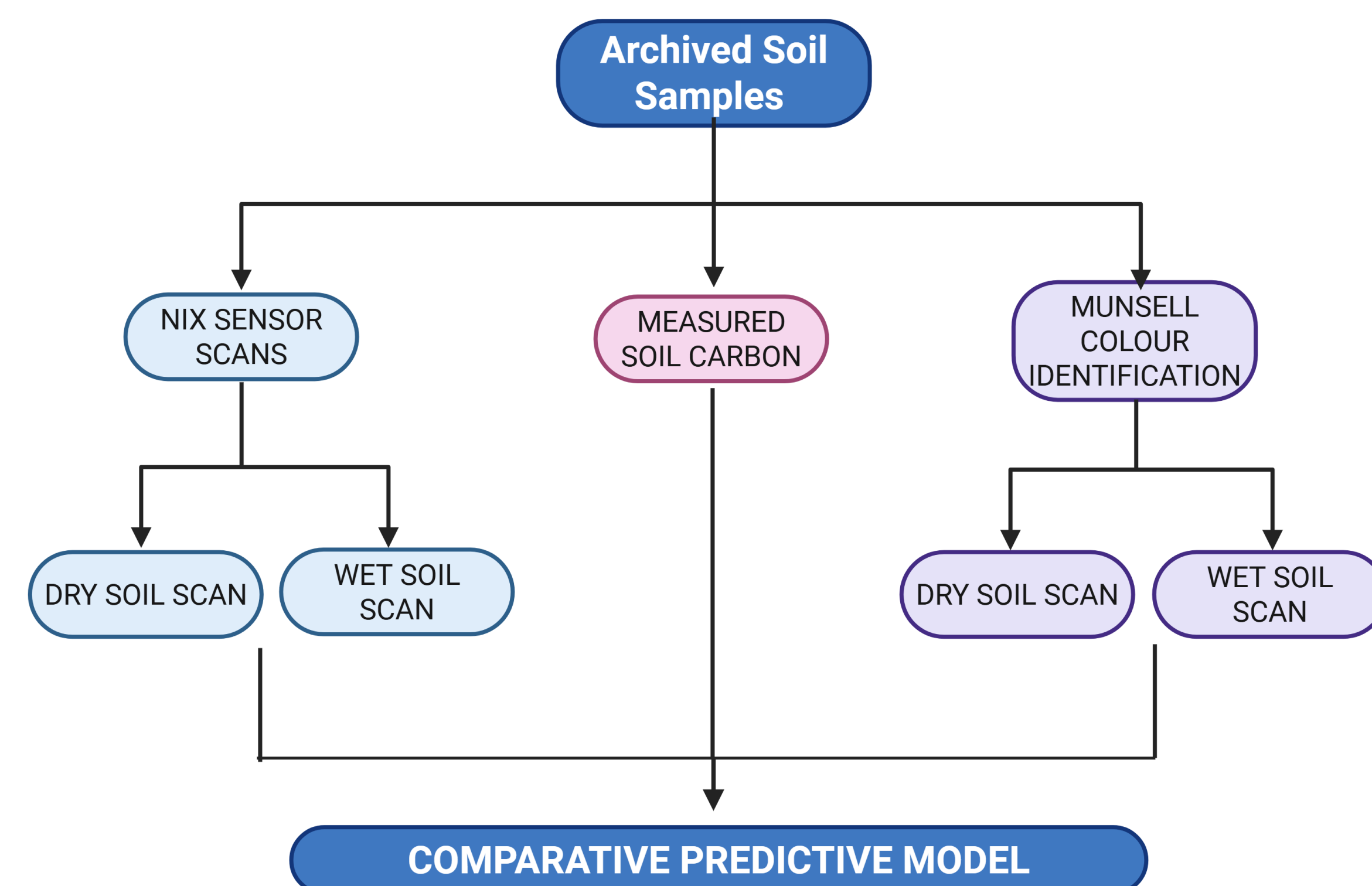


Figure 1. Flow chart representing the steps taken to analyze 123 samples spread across 3 soil zones in order to create a comparative predictive model.

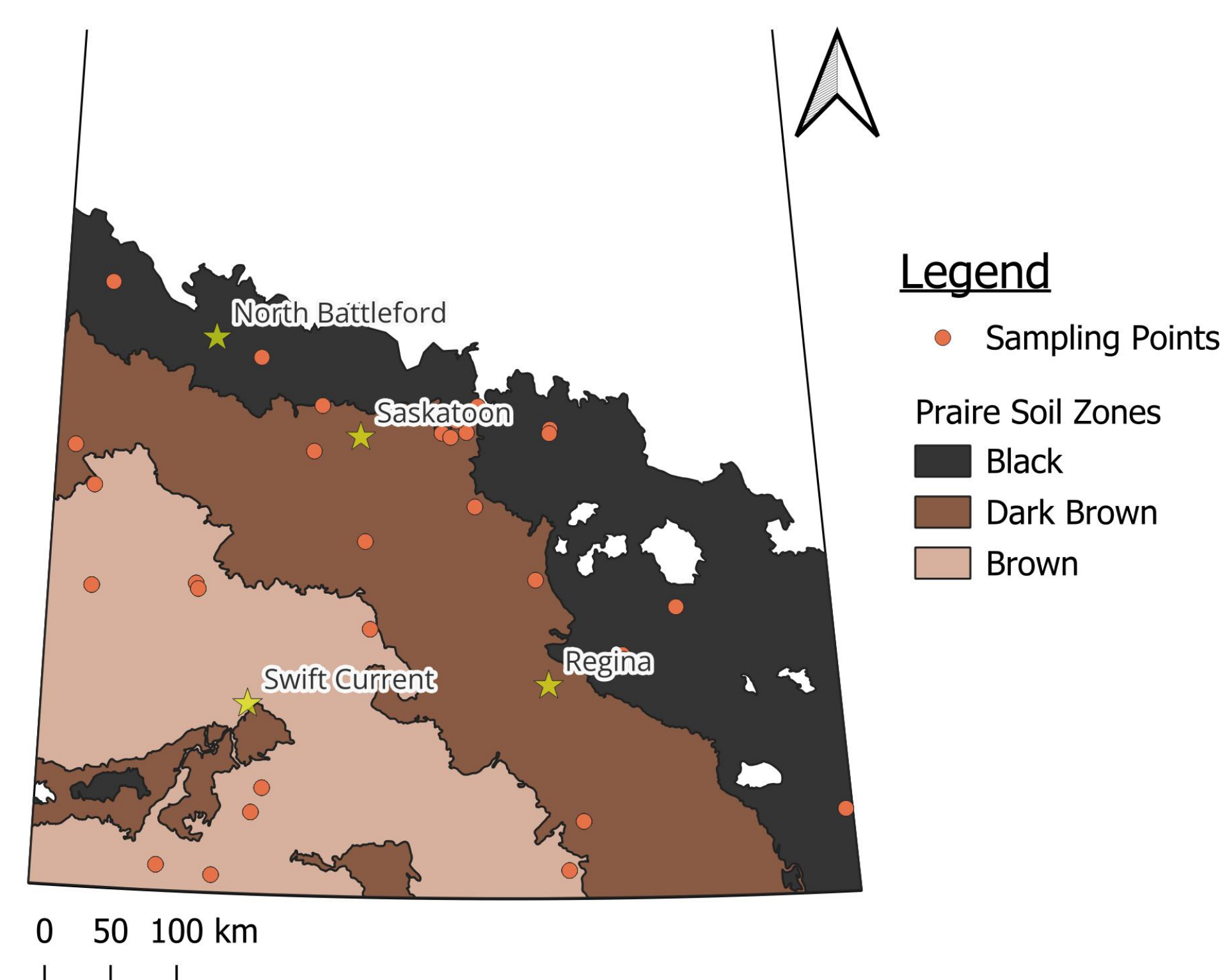


Figure 2. The Canadian Prairie Soil Zones, focusing on southern Saskatchewan that represent distinct climate regimes. The sample locations used for predicting soil organic carbon are indicated with orange circles.



Figure 3. Munsell guide opened to page 10YR and NIX Spectro 2 sensor on top of various soil sample vials.

RESULTS

A Partial Least Square Regression Model was used to calculate the R^2 and RMSE values to create the comparative predictive model. The values used were from the wet soil test and had an R^2 of 0.78 and a RMSE of 0.61.

Results were calculated using both colour properties and spectral reflectance waves. Visibly noting the most important colour properties are X, Y, Density C, and Density Y. With the least important properties being sRGB R, and sRGB G.

NEXT STEPS

Further values can be tested to improve our predictive model including:

- Understanding other soil properties
- Other agricultural management practices

A larger data set would be required to evaluate the application further using more samples, across different climatic zones and practices.

IMPLICATIONS

The development of a tool to classify soil carbon using visible spectroscopy would be able to reduce the cost, labour, and time associated with understanding soil carbon within a field. These models are specifically relevant for the future of agronomy services as well as modern farming practices.

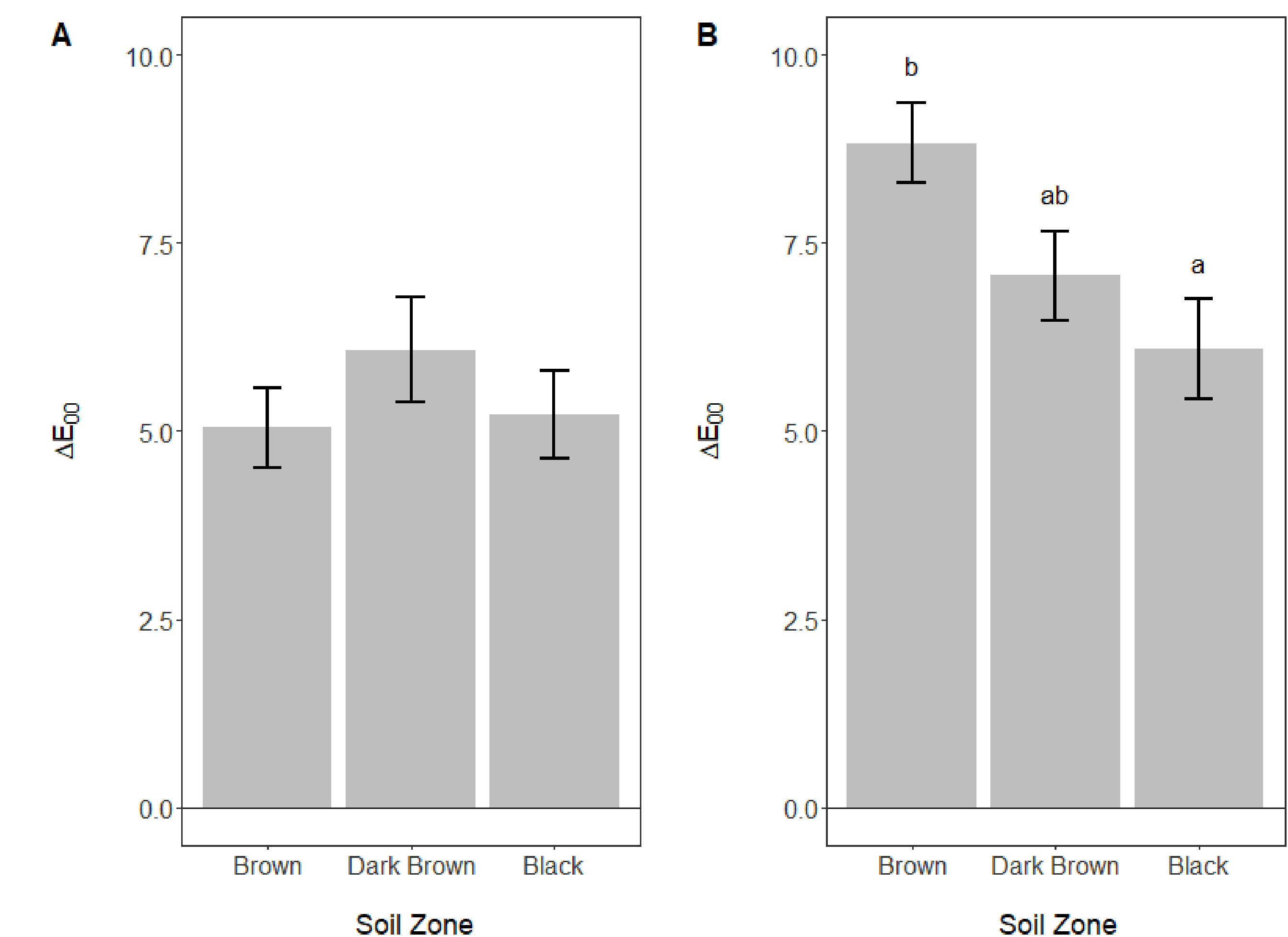


Figure 4. dE₀₀ Differences in colour for visual and NIX identification in both the wet (A) and dry (B) soil tests.

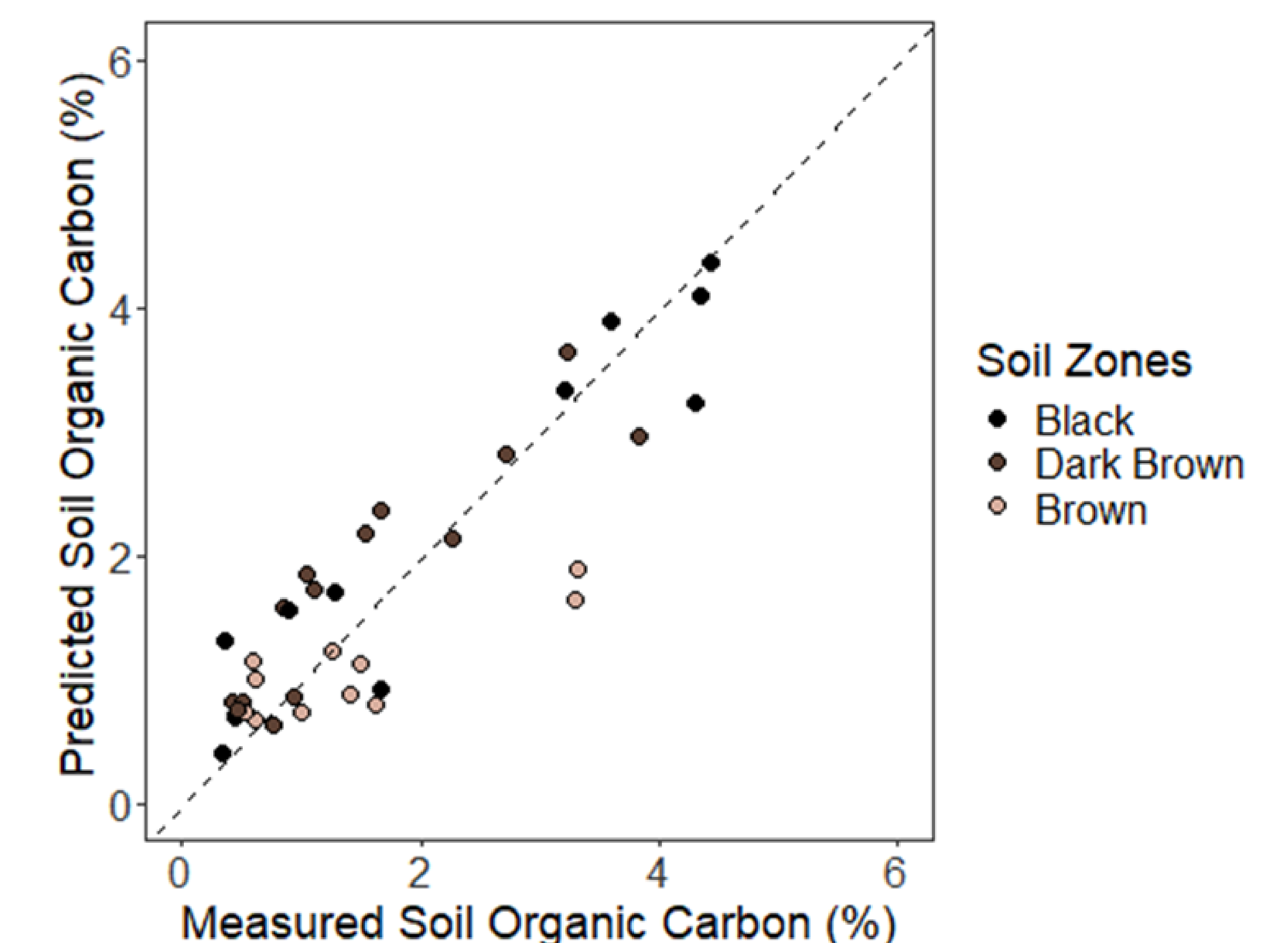


Figure 5. Model of predicted and measured soil organic carbon based on the best-performing predictive model.