The main objective of the study was to develop a mapping tool to assess the extent and severity of soil compaction and degradation within Missisquoi bay watershed. The developers used remote sensing technology to link locational portraits of surface drainage condition, excess moisture, crop development and yield, and ultimately projected soil health indices on 50,000 ha of corn and soybean fields.

Surface drainage gradients were projected through topographic indices developed from a high-resolution (1.0 m) digital terrain model (DTM) derived from LiDAR data. . The Topographic Position Index (TPI), which discriminate emission from accumulation zones, demonstrated the best explanatory power for soil moisture patterns revealed by spring multi-spectral images (NDWI).

Multi-spectral indices of soil wetness (NDWI) were selected over radar indices (SSM) to better explain corn and soybean canopies (NDVI indices). A multi-year spatial gradient of soil moisture was developed following the normalization of annual NDWI indices for the 2017-2023 period, and the estimation of their median values.

Similarly, annual crop development indices (NDVI) for the 2017-2023 early July periods were normalized and median values determined using separate procedures for grain corn and soybean, providing an homogeneous distribution indices, independent of crop type.

A final classification of soil health zones was obtained through deep learning regression and object-oriented classification of overall data set. Regression models were developed to explain crop development indices from soil moisture and topographic indices. Following this selection process, a spatial segmentation of NDVI, NDWI and TPI indices was obtained following an Object-Based Image Analysis (OBIA) method. Seven OBIA classes were finally selected as soil health indices, following a grouping procedure.

A study component relating monitored corn yields to crop development indices further provided an evidence-based validation of the methodology. NDVI indices explained end-of-season grain corn yields following a simple linear regression method on 49 cultivated fields in 2022 and 2023 (1,015 ha), resulting in an average model's adjustment (R^2) indicators of 0.74.

Together with the development of the GIS toolkit, an on-farm action-research network has been coordinated by OBVBM staff, where participating farm managers provided management data to support the development and validation of the GIS deliverables.