# Defining Soil Health in the Digital Age: Using Machine Learning to Predict and Assess the Impact of Agricultural Practices on Soil Health Across Alberta

Good soil quality is fundamental for maintaining the economic productivity of Alberta's agriculture sector. Soil degradation is a problem that appears to affect nearly every part of Alberta to varying degrees. One of the factors that negatively impact soil quality is the lack of consistent, long-term soil testing. Despite over 100 years of measuring soil properties in Alberta, there is still little agreement on what distinguishes good soil. This project seeks to address how soil quality is measured, which characteristics need to be measured and which are most important for determining soil health. Advanced machine learning techniques are being used to integrate and analyze soil data along with information on agricultural practices to understand how soil quality, suitability, sustainability and best management practices change over time.

## FUNDING DETAILS

**RECIPIENT:**
University of Alberta
PI: Dr. Derek MacKenzie

**PARTNERS:**
Element Materials

**TOTAL BUDGET:**
$979,000

**AI FUNDING:**
$497,000

**PROJECT DATES:**
JAN 2022 – DEC 2023

**PROJECT TRL:**
Start: 3
End: 7

## APPLICATION

The project will develop an integrated, publicly accessible Database on Alberta Soil Health (DASH) to assess soil biodiversity response to agricultural management practices in soil systems and a Farm Data Capture System (FDCS) to consolidate soil management, agricultural practices and yield data from individual farmers and land users. It will also create a web-based application for Digital Integrated Resource Technology for Soil (DIRTS) for use by Alberta farmers, land users and managers to assess their soils and guide their actions to measure, maintain and improve their land's soil quality.

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## PROJECT GOALS

- Develop an integrated database on Alberta Soil Health (DASH) using Alberta-wide soil, land-use, crop yield and climate data.
- Add and integrate new soil biological data into DASH.
- Develop a Farm-specific Data Collection System (FDCS) to capture and consolidate soil, soil management and yield data from individual farmers and land users.
- Develop an easy-to-use web server called the Digital Integrated Resource Technology for Soil (DIRTS) to be used by farmers, producers or other land users to accurately and quantitatively assess their soils and guide their soil management or land use decisions.

## BENEFITS TO ALBERTA

- Enhanced soil quality and sustainability, reduced costs, and increased productivity and crop yields.
- Better use of soil science, Alberta-specific data and machine learning to make land use decisions and to respond to different environmental, crop or climate challenges.
- Potential transfer of the methods and tools to other land uses in Alberta, other provinces and other jurisdictions outside Canada, creating a viable soil science software enterprise that could result in world-wide sales and exports.
- Reduced crop insurance premiums with lower risk of poor crop yields or failed crops.
- Reduced greenhouse gas emissions with increased soil carbon sequestration rates which would then allow farmers to apply for carbon credits.
- Potential savings of hundreds of millions of dollars with even a modest 1-2% improvement in yields.

**4 Publications**

**1 Student Trained**

**4 Project Jobs**

**3 New Products/Services**

**10 Future Jobs**

## CURRENT STATUS

### MAY 2022
Work has begun on database development and data processing, including data acquisition for the DASH, quality assurance/quality control on data for the database, and building of the DASH database.