

Project Profile

Project Name:	Soil Productivity and Soil Health Status Following Restoration of Pipeline Corridors on Agricultural Land Reserve (ALR) Cropland in Northeast BC
Project Number:	ES-Pipe-2019-02
Proponent:	University of Manitoba—Dr. Francis Zvomuya
Funding Partner:	Mitacs
Funding Envelope:	Engineering and Safety Research—Pipelines
Timeframe:	July 1, 2019, to April 30, 2021

Project objectives

The objective of this project is to assess and quantify impacts related to oil and gas development, specifically on cultivated lands within the Agricultural Land Reserve (ALR):

1. Determine the effects of recovery period on soil productivity (crop yields), other soil functions, and soil health in the pipeline corridor (right of way, RoW);
2. Identify fertilizer forms and rates that optimize crop yields and quality at varying pipeline ages; and
3. Determine the roles of baseline soil properties and environmental factors on soil productivity recovery following pipeline installation.

Project description

Plots will be established in the Fort St. John-Dawson Creek area in northeastern British Columbia. At least 12 ALR land properties with pipeline footprints varying widely in recovery periods (time since reclamation) will be identified and permission will be sought from the landowners for use of their crop fields. The target is to have 3 fields per recovery period to allow for statistical comparison of recovery period effects.

Soil samples will be obtained from the plots and analyzed for:

- total and available (ammonium and nitrate) nitrogen;
- total and available phosphorus;
- extractable potassium, calcium, magnesium and sodium;
- sulphur;
- micronutrients (boron, copper, zinc, manganese, iron, molybdenum, chlorine);
- organic matter content (light and heavy fractions); and
- electrical conductivity (salinity).

Soil bulk density will also be measured.

At each site, 4 replicate plots will be established per treatment and seeded with canola, wheat, or barley.

The treatments to be tested will be fertilizer rate (0, standard agronomic rate, and 1.5 times the standard agronomic rate).

Replicate plots (4 for each of the 3 rates) will also be established on undisturbed sites adjacent to the pipeline corridor (right of way, RoW), giving a total of 24 plots per field site and 288 plots for the 12 sites each year.

Across all sites, the study setup will allow for testing of the effects of fertilizer treatment and site recovery period, while allowing evaluation of crop differences. For better control of experimental conditions, the plots will be seeded and fertilized manually whenever feasible. Seeding rates and all other field operations will follow local standard agronomic practice.

Data will be analyzed to determine treatment effects and the effects of recovery period and crop type. Soil property data, historical field management data, and available microclimate data will be used to develop multivariate models for modeling reclamation success.

Project approach

Field studies will be conducted during two growing seasons starting in spring 2019.

- **Year 1 (2019)**—In spring 2019, composite soil samples will be taken from the 0-15 and 0-60 cm layers in all plots for baseline characterization. Plots will be harvested at the end of the season for determination of grain and straw yields. Grain and straw samples will be analyzed for nitrogen and phosphorus concentration, from which uptake of these nutrients will be calculated. Soil samples will be taken after harvest for determination of the more dynamic soil properties: available nitrogen, available phosphorus, electrical conductivity, and light fraction organic matter.
- **Year 2 (2020)**—repeat experiments at different locations within the 12 sites from Year 1 or at different sites if available.

Project deliverables

The deliverables from this project include the following:

1. Final report describing the research approach, findings and implications.