Vita

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Universities Attended: University of New Brunswick (2018)
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Masters of Science
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<u>Presentations/Conference Papers:</u>

Dobson T.J.A., Butler K.E., Danielescu S., and Li S., 2020 Time-lapse Electrical Resistivity Imaging (ERI) reveals how rainfall, evapotranspiration, percolation and tile drainage affect soil moisture below a field of oats. Conference Paper. Geoconvention 2020. Calgary, AB, Canada. pp.5.

Dobson T.J.A., Butler K.E., Danielescu S., and Li S., 2021 Time-Lapse Electrical Resistivity Imaging resolves and quantifies subsurface drainage processes in agricultural plots following a spring thaw. EEGS WG-PSS SEG virtual Symposium, Aug 16-19, 2021.

Dobson T.J.A., Butler K.E., Danielescu S., and Li S., 2020 Investigating the variability and dynamics of soil moisture beneath a tile-drained field using time-lapse electrical resistivity imaging (ERI). Atlantic Geoscience 46th Colloquium. Truro, NS, Canada. Feb 7, 2020.

Understanding Spatiotemporal Variations in Soil Moisture Associated with Tile Drains Using Electrical Resistivity Imaging

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Troy J. A. Dobson

in the Department of Earth Science

U.N.B., Fredericton, N.B.

Friday, April 22nd, 2022
9:00 a.m.

Via MS TEAMS

Examining Committee

Dr. Karl Butler	Co-Supervisor
Dr. Serban Danielescu	Co-Supervisor
Dr. Bruce Broster	Internal Examiner
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Dr. Chris McFarlane	Chair of Oral Examination

Abstract

Agriculture in the Canadian Atlantic provinces is influenced by a humid continental climate, hilly landscape, and soil derived from glacial till. As a result, many regions suffer from poorly draining soil. Tile drains have gained popularity since the 1970s for removing excess moisture and increasing field productivity.

The goal of this study was to use time-lapse electrical resistivity imaging (ERI) to resolve, in space and time, how well tile drains help to remove excess water from sandy loam agricultural soils underlain by low permeability glacial till in the Saint John River valley at Fredericton, New Brunswick. One of the plots was equipped with tile drains at approximately 90 cm depth, while the other was not. Time-lapse ERI successfully inferred temporal changes in saturation in both fields. ERI-derived estimates of changes in water storage were in good agreement with those made using capacitive moisture sensors except immediately following intense rainfalls at the shallowest sensor locations (15 cm depth) where installation artifacts may have affected both methods. Results indicated that the tile-drained field (TDF) showed significantly faster drying immediately following rainfall, and that drying extended to greater depth after prolonged periods compared to the non-tile-drained field (NTDF). Up to 20% desaturation was observed after a week of drying in the TDF during the late summer period.

Three different methods - soil water balance, moisture sensors, and time-lapse ERI - were used to estimate changes in water storage in the two fields during spring 2020. ERI-derived estimates of water gain during an intense rain event indicated that the TDF gained an amount nearly equal to the 25 mm rainfall, while the NTDF gained very little water, consistent with its higher antecedent water content and measurements of surface runoff. Following the rainfall event, with both fields near full-saturation, ERI indicated that the tile drains improved the field-scale drying by a factor of 3 after 48 hours. Beyond 48 hours, the effect of the tile drains was less noticeable as the two fields lost water at similar rates.