Cameron **Proctor**

Lecturer – Remote Sensing of Peatlands | Rhizosphere Processes

Contact

cameron.proctor@utoronto.ca

(647) 745-7498 (cell)

University of Toronto,
Mississauga Campus
Department of Geography
Room DV3274

Keywords

Hyperspectral
Radiative Transfer Modelling
Unmanned Aerial Vehicles
Peatlands
Rhizosphere
Spatially Explicit Models

Computational Skills

Programming: Python, C++, HTML, SQL
Software: eCognition, PCI Geomatica, ENVI, ERDAS, ArcGIS, Pix4D, GRASS, R, Matlab

Analytical Techniques

Capillary electrophoresis
Gas Chromatography
Lyophilization
UV-Spectroscopy
Fiber Analysis
Humic Acid Extraction

Equipment

Pushbroom hyperspectral
ASD Spectrophotometer
Motorized Linear Stage
Arduino and LIDAR
LICOR-6400
LAI Probe

Research statement

Plant roots mediate the cycling of carbon and nutrients. They form an interexchange network with soil microbes that is responsible for processing half of all photosynthetically captured carbon. Manipulating this environment risks shifting peatlands away from operating as an efficient carbon store. My primary research interests lie in understanding the mechanisms and implications of root-soil-microbial interactions and their role in the global carbon cycle.

Leaf and root growth are closely coordinated, with neither part outgrowing the other. Hence, I work from the plant overstory down to the root system, at both the root and landscape scale. Determining the coupling between the root-soil-microbial components and their dynamic interactions calls for integrative research strategies, such as **pairing remote sensing surveys of vegetation traits, with powerful numerical modelling tools that simulate root growth and function.** My belief is that belowground carbon deposition is inherently spatial, and requires meshing drivers and root biomass to determine process rates. Specifically, the role of plant roots in methanogenesis at the landscape scale relies upon the quality and complexity of the root upscaling parameters, which is why I spend my time developing novel techniques in the geospatial sciences, including Unmanned Aerial Vehicles, remote sensing, and GIS.

Current position

2017-Present **_Lecturer_**
Department of Geography and Programs in Environment
University of Toronto Mississauga, Ontario, Canada

Teaching 2nd and 3rd year courses in remote sensing, GIS, ecosystems, and environmental science.

Bibliometrics

First author publications: 5
Publications in the pipeline: 3
Citations: 20
H-index: 3
Reviews performed: 16
Conferences (oral presentation): 17
Publication Reads: 254
Top Article: Remote Sensing of Environment

Professional experiences

2017-Present	*Lecturer*	*University of Toronto Mississauga*
2011-2017	*PhD*	*University of Toronto*
2009-2011	*MSc*	*University of Toronto*
2008-2010	*Spatial Data Analyst*	*Waste Diversion Ontario*
2007-2008	*Information Officer*	*Ministry of Natural Resources*
2006-2007	*GIS Specialist*	*OFAH*
2005-2006	*Policy Analyst*	*Ontario Waterpower Association*
2004-2005	*Wildlife Data Analyst*	*Ministry of Natural Resources*
2000-2004	*BSc*	*Trent University*

Education

2011-2017 *PhD (Spatial Information Systems), University of Toronto, Department of Geography and Planning. Advisors: Dr. Yuhong He (Associate Professor, Department Chair) and Vincent Robinson (Retired Professor)*

The overall research quantified the carbon deposited by a peatland sedge and shrub via the root exudation pathway. The objective of this thesis was to; (**1**) assess the magnitude of composition of root exudates; (**2**) determine the fine root interface with the anoxic zone; (**3**) develop remote sensing tools to distinguish *Eriophorum vaginatum* tussocks from the surrounding vegetation utilizing radiative transfer modelling and phenological timing; (**4**) assess whether vertical heterogeneities in soil properties influence exudation rates.

2009-2011 *MSc (Spatial Information Systems), University of Toronto, Department of Geography and Planning. Advisors: Dr. Yuhong He (Associate Professor, Department Chair) and Vincent Robinson (Retired Professor)*

The overall research objective was to determine whether high resolution multispectral remote sensing could distinguish the invasive aquatic macrophyte *Hydrocharis morsus-ranae* from native vegetation. Research expanded to explore whether imager texture aided the discrimination between macrophyte species.

2000-2004 *BSc (GIS Specialization), Trent University, Department of Environment and Resource Science. Advisors: Dr. Raul Ponce-Hernandez and Dr. Wayne Evans*

Utilized GIS to estimate which renewable energy technology (wind, solar, hydropower, geothermal) that best suited a geospatial location based upon general environmental characteristics.

Awards (Scholarship Total $230,690)

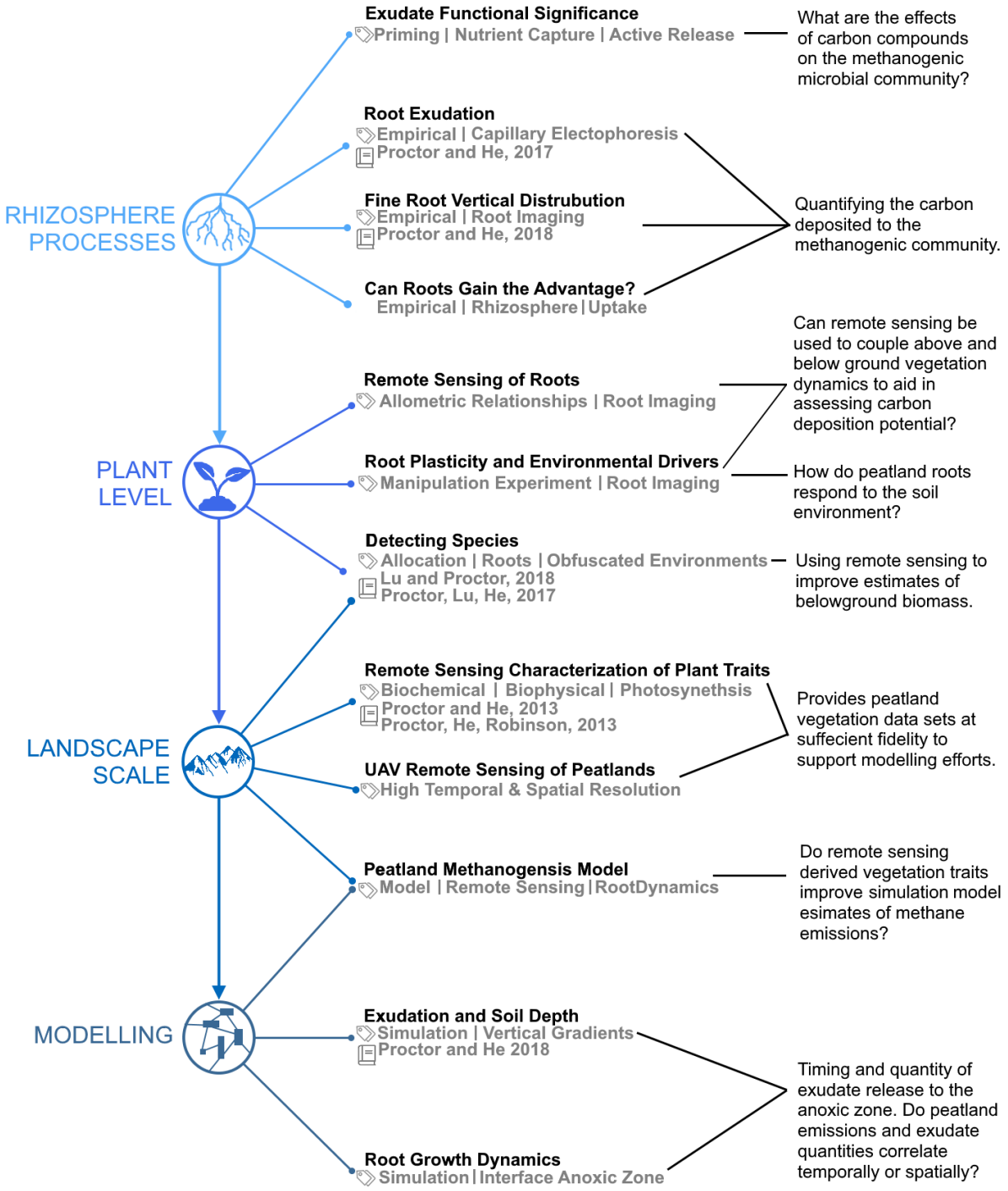
Extramural (Total $100,500)

2019	NSERC Postdoctoral Fellowship (3rd ranked out of 30 in Earth Science)	$90,000
2017	Nominated by Department for the Schmidt Science Fellows	non-$
2015	Ontario Graduate Scholarship	$15,000
2013-2014	NSERC Alexander Graham Bell Canada Scholarship Doctoral (CSG D) - 2 Year	$70,000
2013	VisiSens Competition 2013	non-$
2011	ESRI Canada Scholarship (QEII-GSST)	$15,000
2011	Best student presentation awards, CAG 2011, GIS-SIG Study group	$500

Intramural (Total $40,190)

2016	Doctoral Completion Award	$6,000
2013	Nominated for the TATP Teaching Assistant Excellence Award	non-$
2013	School of Graduate Studies Conference Grant	$440
2012	McCualg -Throop Bursary	$3,000
2012	Oscar Marshall Graduate Fellowship	$3,000
2011-2016	Graduate Department Research and Travel Funds	$5,750
2011	J.E.R. Ross Scholarship	$1,000
2009-2011	Graduate Department Research and Travel Funds Fund	$2,000
2009-2011	Department Graduate Scholarship, Masters	$15,000
2004	Dean's Honours List	non-$
2000	Undergraduate Entrance Scholarship	$4,000

Research Overview



Publications

Proctor C, Phuong Dao, He Y. 2019. Development and testing of a high-performance close-range heavy-duty hyperspectral imaging system. (Submitted to IEEE Geoscience and Remote Sensing Letters, GRSL-00245-2019: February 28, 2019, 5-year impact factor **2.866**).

Proctor C, He Y. 2018. Modelling Root Exudate Accumulation Gradients to Estimate Net Exudation Rates by Peatland Soil Depth. (Submitted to New Phytologist, NPH-MS-2019-29394: February 24th, 2019, 5-year Impact Factor **7.00**)

***Proctor C**, He Y. 2018.* Quantifying Peatland Plant Vertical Root Distribution for Estimating the Interface with the Anoxic Zone. (Major Revision Plant and Soil, PLSO-D-18-01751: Jan 11th, 2018, 5-year Impact Factor **3.770**)

Lu Bing, ***Proctor C***, He Y. 2018. Estimating Vegetation Properties using Radiation Transfer Modelling and High-Spatial Resolution Hyperspectral Imagery. Remote Sensing of Environment. (Submitted Remote Sensing of Environment, RSE-D-18-01408: September 13, 2018, 5-year Impact Factor **7.737**)

Proctor C, He Y. 2017. Quantifying Root Extracts and Exudates of Sedge and Shrub in Relation to Root Morphology. Soil Biology and Biochemistry. 114: 168-180 (5-year Impact Factor **5.419**)

Proctor C, Lu B, He Y. 2017. Determining the Absorption Coefficients of Decay Pigments in Decomposing Monocots. Remote Sensing of Environment. 199: 137-153 (5-year Impact Factor **7.737**)

Proctor C, He Y. 2013. Estimation of Foliar Pigment Concentration in Floating Macrophytes using Hyperspectral Vegetation Indices. International Journal of Remote Sensing. 34(22): 8011-8027. *(*5-year Impact Factor **2.003***)*

Proctor C, He Y, Robinson V. 2013. Texture Augmented Detection of Macrophyte Species using Decision Trees. ISPRS Journal of Photogrammetry and Remote Sensing. 80. 10-20. *(*5-year *Impact Factor **6.592**)*

Proctor C, Robinson V, He Y. 2012. Multispectral Detection of European Frog-bit using Quickbird Imagery and Fuzzy Image Classification. Canadian Journal of Remote Sensing. 38(4): 476-486. *(*5-year Impact Factor **2.393***)*

Refereed Book Chapters

Proctor C. 2018. Chapter 3: Building a UAV-Hyperspectral System I: UAV Considerations. Book: High Spatial Resolution Remote Sensing: Data, Analysis, and Applications. Editors: He Y, Weng Q. Taylor & Francis Series in Imaging Science.

Proctor C. 2018. Chapter 4: Building a UAV-Hyperspectral System I: Hyperspectral Sensor Considerations and Data Preprocessing. Book: High Spatial Resolution Remote Sensing: Data, Analysis, and Applications. Editors: He Y, Weng Q. Taylor & Francis Series in Imaging Science.

Conference Papers

Proctor C, He Y. 2015. Workflow for Building a Hyperspectral UAV: Challenges and Opportunities. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives 40(1W4): 415-419. *(37 Reads on ResearchGate)*

Technical Reports

He Y, ***Proctor C***, Tong A, Meier RJ. 2016. Technical Report: Biogenic Gas Bubbles Produced within Soil Macropores Simultaneous measurement of gas bubble size and CO2 concentration with VisiSens A3. DOI: 10.13140/RG.2.1.3620.1366 *(67 Reads on ResearchGate)*

Presentations and Posters

Proctor C, He Y. 2018. *Close Range Hyperspectral Imaging of Vegetation Decomposition*. CAGONT 2018. October 19-20, Toronto, CAN. Provincial. (*Oral Presentation*)

Proctor C. 2017. *Do Vertical Gradients in Soil Environmental Conditions Regulate Exudation Rates from Peatland Vegetation?* AGU Fall Meeting. December 11-15, New Orleans, USA. International. (*Oral Presentation*)

Proctor C. 2017. *Using ArcGIS to Define the Ground Area Samples by a UAV flown Pushbroom Sensor.* GIS in Education and Research. October 11, Toronto, CAN. Provincial. (*Oral Presentation*)

Proctor C. 2017. *Root Exudates: Does Soil Depth Affect Carbon Deposition Quantity?* Mer Bleue Workshop. June 12-14, Montreal, CAN. International. (*Oral Presentation*)

Lu B, **Proctor C**, He Y. 2017*. A Hyperspectral Imaging System for Vegetation studies*. Annual Meetings of the Canadian Association of Geographers. May 29-June 2, Toronto, CAN. National *(Oral presentation)*

Lu B, **Proctor C**, He Y. 2017. *Retrieval of Grassland Biophysical and Biochemical Properties using Helicopter-Acquired High Spatial Resolution Hyperspectral Imagery and Radiation Transfer Modeling*. Association of American Geographers. April 5-9, Boston, USA. International *(Oral presentation)*

Lu B, **Proctor C**, He Y. 2016. *Investigating Grassland Properties using Helicopter-Acquired High-Spatial Resolution Hyperspectral Imagery*. Canadian Association of Geographers. October 28-29, Waterloo, CAN. National *(Oral presentation)*

Proctor C. 2016. *Utilization of UAV's for Eriophorum Detection*. Mer Bleue Workshop. Feb 29-March 1, Montreal, CAN. International (*Poster*):

Proctor C, He Y. 2015. *Workflow for Building a Hyperspectral UAV: Challenges and Opportunities*. UAV-g: International Conference on Unmanned Aerial Vehicles in Geomatics. August 30-September 2, Toronto, CAN. International (*Oral presentation*)

Lu B, **Proctor C**, He Y. 2015. *Evaluating PROSPECT and Soil-Leaf-Canopy model for Estimating Chlorophyll Content in a Heterogeneous Grassland*. Association of American Geographers Annual Meeting. April 21-25, Chicago, USA. International (*Oral presentation*)

Proctor C, Lu B, He Y. 2014. *Calibration of PROSPECT for Monocot Litter*. IEEE International Geoscience and Remote Sensing Symposium. July 13-18, Quebec City, CAN. International (*Oral presentation*)

Proctor C, Lu B, He Y. 2014. *SLC Radiative Transfer Model for Estimating LAI in Wetland Ecosystems*. American Society for Photogrammetry & Remote Sensing. March 23-28, Louisville, USA. International (*Oral presentation*)

Proctor C. 2014. *Quantification of Exudates from Eriophorum and Ledum Roots*. Mer Bleue Workshop. March 2-3, Montreal, CAN. International (*Oral presentation*)

Proctor C*. 2013. Modifying the Boreal Ecosystem Productivity Simulator and TerrainLabV2.0 hydrological models to simulate CH4 fluxes from Mer Bleue Bog.* Mer Bleue Workshop. March 3-4, Montreal, CAN. International (*Oral presentation*)

Proctor C, Robinson V, He Y. 2012*. Floating Macrophyte Foliar Pigments.* Canadian Association of Geographers Ontario Division. October 12-13, Toronto, CAN. Provincial (*Oral presentation*)

Proctor C, Robinson V, He Y. 2011. *Mapping of European frog-bit using multispectral Imagery.* Canadian Association of Geographers. December 6-8, Calgary, CAN. National (*Oral presentation*)

Proctor C, Robinson V, He Y. 2011. *Mapping of European frog-bit (Hydrocharis morsus-ranae) using Quickbird Imagery*. 32nd Canadian Symposium on Remote Sensing. June 12-13, Sherbroke, CAN. National (*Oral presentation*)

Proctor C, Robinson V, He Y. 2011. *Potential Challenges of Early Detection of European frog-bit for conservation purposes*. Canadian Aquatic Species Network. April 12-14, Toronto, CAN. National Network (*Oral presentation*)

Teaching Activities

2017-Present Lecturer, UTM Geography
- GGR227: Ecosystems and Environmental Change
- GGR276: Quantitative Methods I in Geography
- GGR278: Geographical Information Systems
- GGR311: Landscape Biogeography
- GGR337: Environmental Remote Sensing
- GGR372: Geographic Analysis of Land Resources
- ENV330: Experimental Design in Environmental Science

2015-2016 Sessional, UTM Geography: GGR321 Geographic Information Processing (Fall/Summer)
Sessional, UofT Forestry (Graduate): FOR1412 Natural Resource Management
Teaching Assistant
- GGR372 Geographic Analysis of Land Resources
- GGR373 Advanced Geographic Information Systems
- JPG1906 Geographic Information Systems

2013-2014 Teaching Assistant
-GGR337 Environmental Remote Sensing
-GGR413 Watershed Hyrdoecology

2012-2013 Teaching Assistant
- GGR272 Geographic Information and Mapping I
-GGR278 Geographical Information Systems
-GGR337 Environmental Remote Sensing
-GGR413 Watershed Hyrdoecology

2011-2012 Invited guest lecturer, (Undergraduate): Remote Sensing GGR337
Teaching Assistant
- GGR373 Advanced Geographic Information Systems
-GGR413 Watershed Hyrdoecology

2010-2011 Invited guest lecturer, (Undergraduate): Remote Sensing GGR337
Teaching Assistant
- GGR100 Introduction to Physical Geography
- GGR227 Ecosystems and Environmental Change
- GGR337 Remote Sensing
- GGR373 Advanced Geographic Information Systems

2009-2010 Teaching Assistant
- GGR100 Introduction to Physical Geography
- GGR227 Ecosystems and Environmental Change
- GGR273 Geographic Information and Mapping
- GGR373 Advanced GIS

2006 Invited guest lecturer, Sir Sandford Fleming College (Undergraduate): GIS and Ecology

Teaching and Professional Development

Robert Gillespie Academic Skills Center Active learning orientation day
University of Toronto - Active learning community of practice participant

Teaching Assistants Training Program Teaching Skill Development Workshops
University of Toronto
- First Time TA: Engineering & Physical Sciences
- First Time TA: Sciences
- Grammar workshop
- Blackboard workshop
- Syllabus Design workshop
- Preparing your teaching dossier workshop
- Small groups to engage and enthuse students' workshop
- Developing study skills in undergraduate learners' workshop
- Students in crisis: helping students workshop
- Conflict management workshop
- Microteaching I & II: Presentation skills workshop

Graduate Professional Skills Program
University of Toronto

Communication and Interpersonal Skills Workshops
- Let's Talk Science: Classroom Visit: McMurrich PS
- How to Effectively Communicate and Resolve Conflict
- Group Works: learn how to facilitate and coordinate a group
- Connecting Leadership Theory to Practice

Teaching Competence Workshops
- Let's Talk Science: Science Fair Judging
- Presenting Your Case Effectively

Research-Related Skills Workshops
- Writing a Thesis or Grant Proposal
- Writing NSERC Proposals

Service

Active Roles

2018-	Editor of Remote Sensing special issue
2018-	GIS Program Advisor (curriculum review)
2017-	Outreach committee (attending department events and school presentations)
2017-	GIS outreach promoter (webpage design)
2016-	Advocate and in-class trainer for the Geospatial Web Based Learning Platform

Past Roles

2013	Student representation on the UTM Geography Department Search Committee
2012-2016	Vice-president of the University of Toronto Science Alliance

Peer Review

Air Quality, Atmosphere and Health	2014
European Journal of Remote Sensing	2017
Journal of Applied Remote Sensing	2017
ISPRS Journal of Photogrammetry and Remote Sensing	2013, 2014 (3)
International Journal of Remote Sensing	2017 (2)
ISPRS International Journal of Geo-Information	2018 (2)
Remote Sensing	2018 (3)
Remote Sensing Letters	2016
Remote Sensing of Environment	2015

Professional and Academic Affiliations

2017 -	Canadian Remote Sensing Society
2016 -	American Geophysical Union
2014-2015	Institute of Electrical and Electronics Engineers
2013 -	American Society for Photogrammetry and Remote Sensing
2013 -	URISA Ontario
2012 -	Association of American Geographers
2011 -	Canadian Association of Geographers
2007-2010	Union of Concerned Scientists