

**Project Title:** Remote sensing and GIS-based research in Canadian grasslands

**Number of students:** 1 student

**Academic Background:** Biological Sciences, Biology, Computer Science, Earth Science, Ecology, Environmental Studies, Geography, Geomatics, Science and Technology, Surveying

**Start date:** 2 June 2025

**Date flexible:** Yes. The latest acceptable start date is the last week of June to ensure participation in fieldwork training and the fieldwork component.

**Brief description of specialized research area:**

The research area focuses on the intersection of remote sensing and Earth observation for environmental management and grassland ecology, incorporating basic Geographic Information System (GIS) analysis. Fieldwork is essential for training and validation, and geospatial technology and workflows such as image processing, programming, and machine learning are used.

**Research project description:**

Our project aims to: 1) develop methods to accurately estimate woody plant cover in grasslands using satellite images, 2) enhance methods to detect woody plant expansion (WPE) at an early stage, 3) understand the causes of WPE for better land management, 4) identify vulnerable areas in western Canada, and 5) assess the economic and environmental benefits of WPE detection for Canadian ranchers and society.

Grasslands provide numerous ecosystem services but are rapidly disappearing. WPE, a major and often unnoticed issue, is difficult to reverse. Despite the risks to ranchers, there is no clear understanding of the extent of grassland affected by WPE or its economic impact in Canada.

Our project leverages machine learning and cloud computing with optical and passive satellite images (e.g., Landsat, Sentinel 1 & 2, Radarsat) to systematically address this issue. Field sites for training and validation are provided by our numerous collaborators, including the Nature

Conservancy of Canada, the Italian National Research Council, Agriculture and Agri-Food Canada, Environment and Climate Change Canada, the Canadian Wildlife Federation, the Ministry of Parks, Culture and Sport - Government of Saskatchewan, the Saskatchewan Bison Association, the First Nations Land Management Resource Centre, and the University of Saskatchewan Knowledge Centre.



*Field work in Foam Lake, Saskatchewan, CA (July 2024)*

This 3-year project, funded by the Canadian Space Agency under the ROSEO program (Research Opportunities in Satellite EO: <https://www.asc-csa.gc.ca/eng/funding-programs/programs/smartearth/contributions-grants-contracts-awarded.asp>), is titled: “Enhancing Woody Plant Encroachment (WPE) Detection in Grasslands Using Multi-Source EO Data and Modern Data Processing Technologies Benefiting Canadian Environment and Economy”. It explores the complexities of WPE and its impact on sustainable grassland management.

Our interdisciplinary and multicultural project team includes members with backgrounds in geomatics, ecology, and agricultural economics. We offer hands-on research opportunities for undergraduates, supervised by experienced and early-career researchers. Join us to help preserve our natural resources and explore Canada’s beautiful grasslands!

**Required skills/background of the student (100 words):**

- Background in environmental science, geography, or a related field.
- Strong communication and teamwork skills, with intermediate to excellent English language proficiency.
- Experience in data collection and analysis, with the ability to learn and adapt to new methodologies. Prior fieldwork experience is advantageous.
- Basic knowledge of GIS software (ArcGIS, QGIS) and/or familiarity with Google Earth Engine. Programming skills in R are an asset.
- Organizational skills and attention to detail, particularly in managing fieldwork data.

A proactive and enthusiastic attitude towards learning and problem-solving is essential for skill development and the success of the project.

**Required role of the student:**

As a senior undergraduate student, you will be part of a dynamic interdisciplinary team, participating in weekly project meetings to collaborate and network with fellow researchers. Under the guidance of an early-career researcher, you will assist in various research tasks to support the project's objectives.

Your responsibilities will include both fieldwork and data analysis. You will participate in comprehensive fieldwork training and conduct surveys in native grassland areas in one of the Prairie provinces of Canada (Alberta, Saskatchewan, Manitoba). The training typically lasts one week, with up to two additional weeks for fieldwork. You will experience the beautiful Prairie landscapes and gain valuable fieldwork experience.



*Snapshot of research crew during fieldwork (Foam Lake, Saskatchewan, CA)*

During fieldwork, you may need to:

- Walk long distances
- Carry equipment
- Estimate vegetation percent cover and clip biomass
- Use measurement tools (e.g., measurement tape, LAI instrument, spectroradiometer, GPS, camera, UAV-drone)
- Collaborate with team members
- Back up and transcribe data
- Weigh, sort, and dry biomass samples

Other tasks outside of fieldwork may include:

- Drafting weekly presentations and presenting progress to the research team
- Pre-processing and analyzing fieldwork data
- Downloading satellite data
- Assisting in image pre-processing and processing using ArcGIS Pro, R, or Google Earth Engine
- Conducting GIS analysis using ArcGIS or QGIS, and creating maps and visualizations

This role offers a unique opportunity to immerse yourself in both the field and analytical aspects of environmental research, preparing you for a rewarding career at the intersection of remote sensing, GIS, and ecology. Additionally, you will have the chance to discover Saskatoon, known as the land of living skies, situated on Treaty 6 Territory of the First Nations and the Homeland of the Métis.

## **INTERESTED?**

**APPLY HERE:** <https://globalink.mitacs.ca/#/student/application/projects>

(Look for the last name "Guo" in the field of "Faculty last name" and put "Saskatchewan" as the "Faculty Province" to find the project: **Project ID 46266-Remote sensing and GIS-based research in Canadian grasslands**)