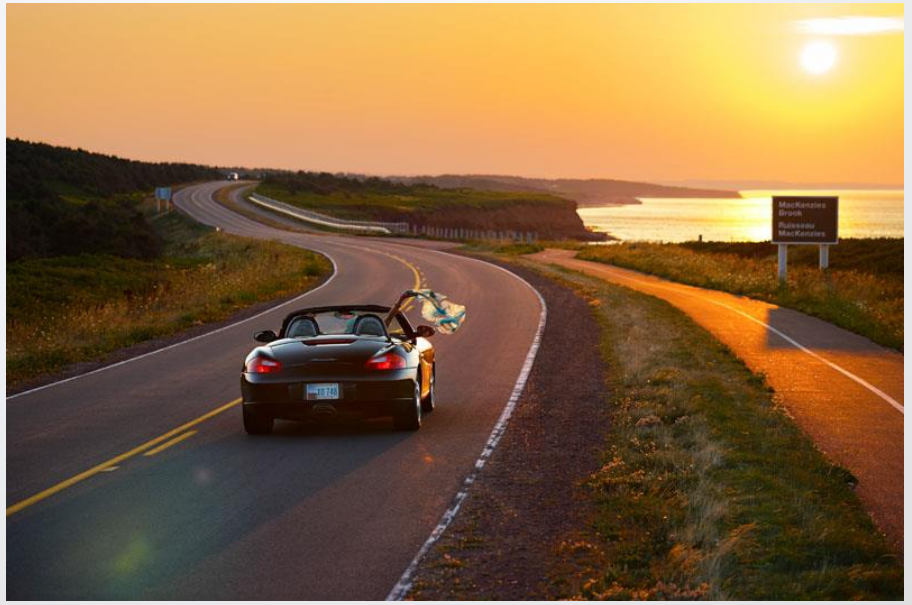
# Canadian Centre for Climate Change and Adaptation

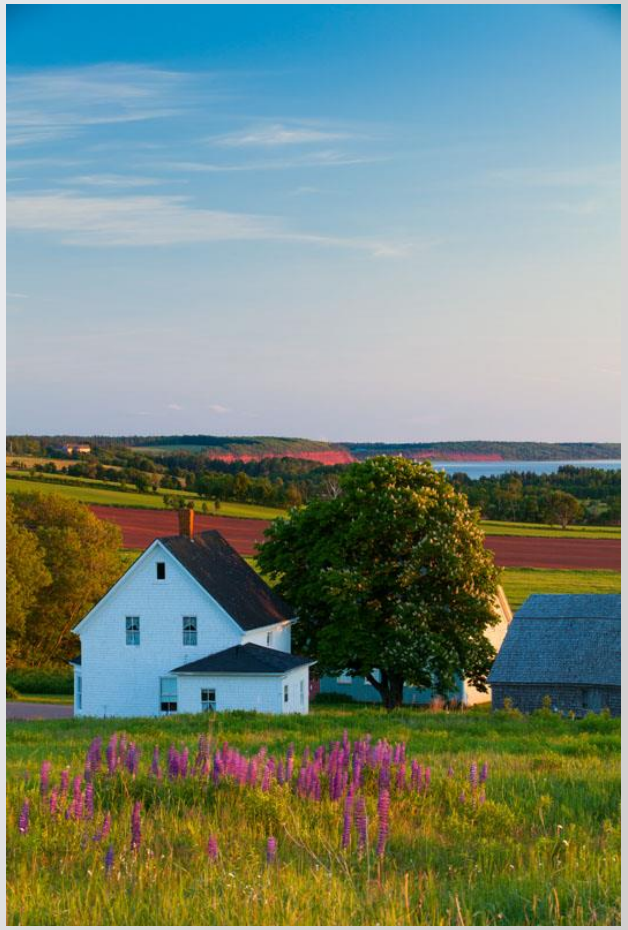
**Xander Wang, Ph.D., P.Eng.**

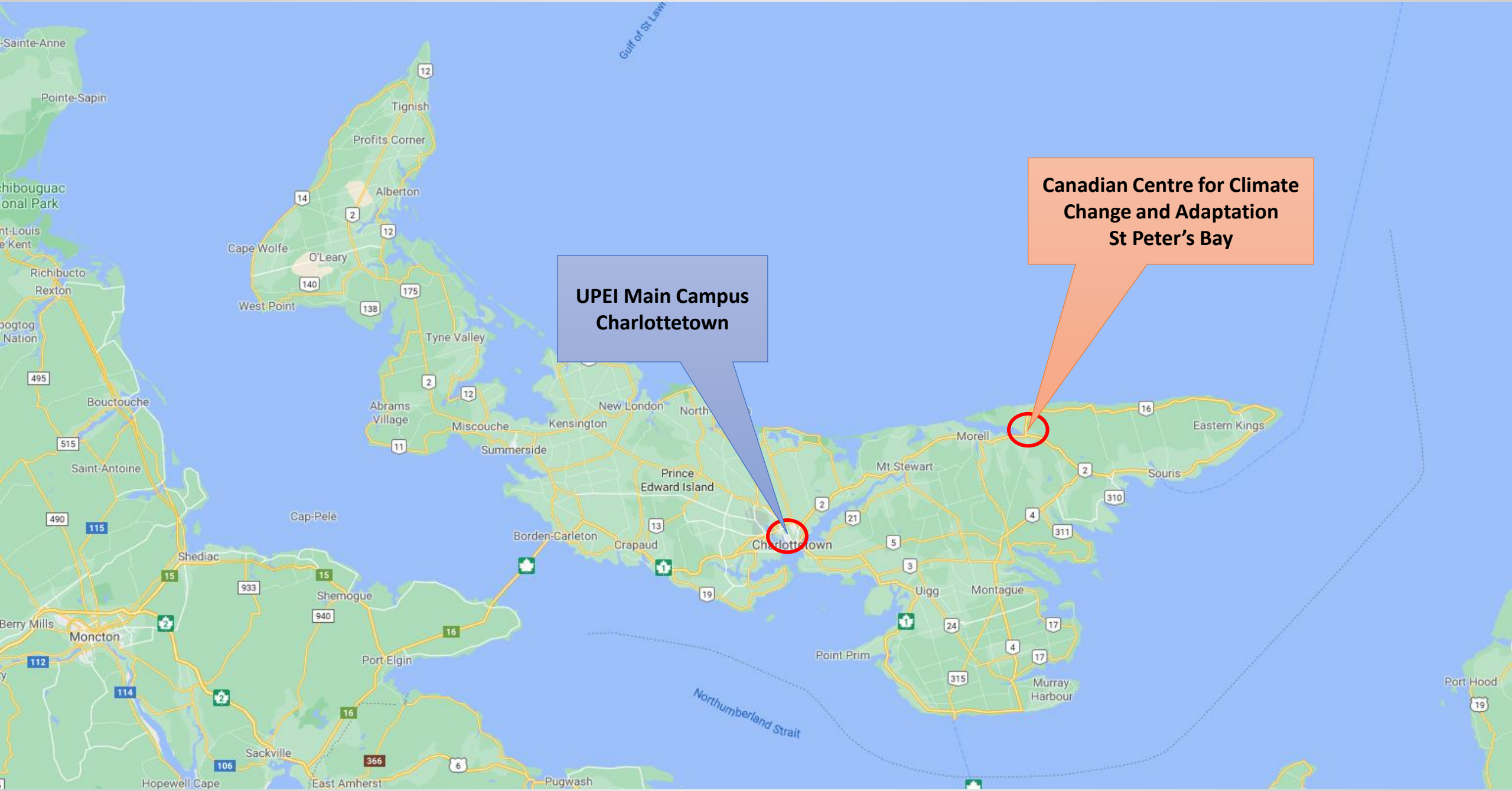
**School of Climate Change and Adaptation**

**University of Prince Edward Island**

UNIVERSITY of Prince Edward ISLAND



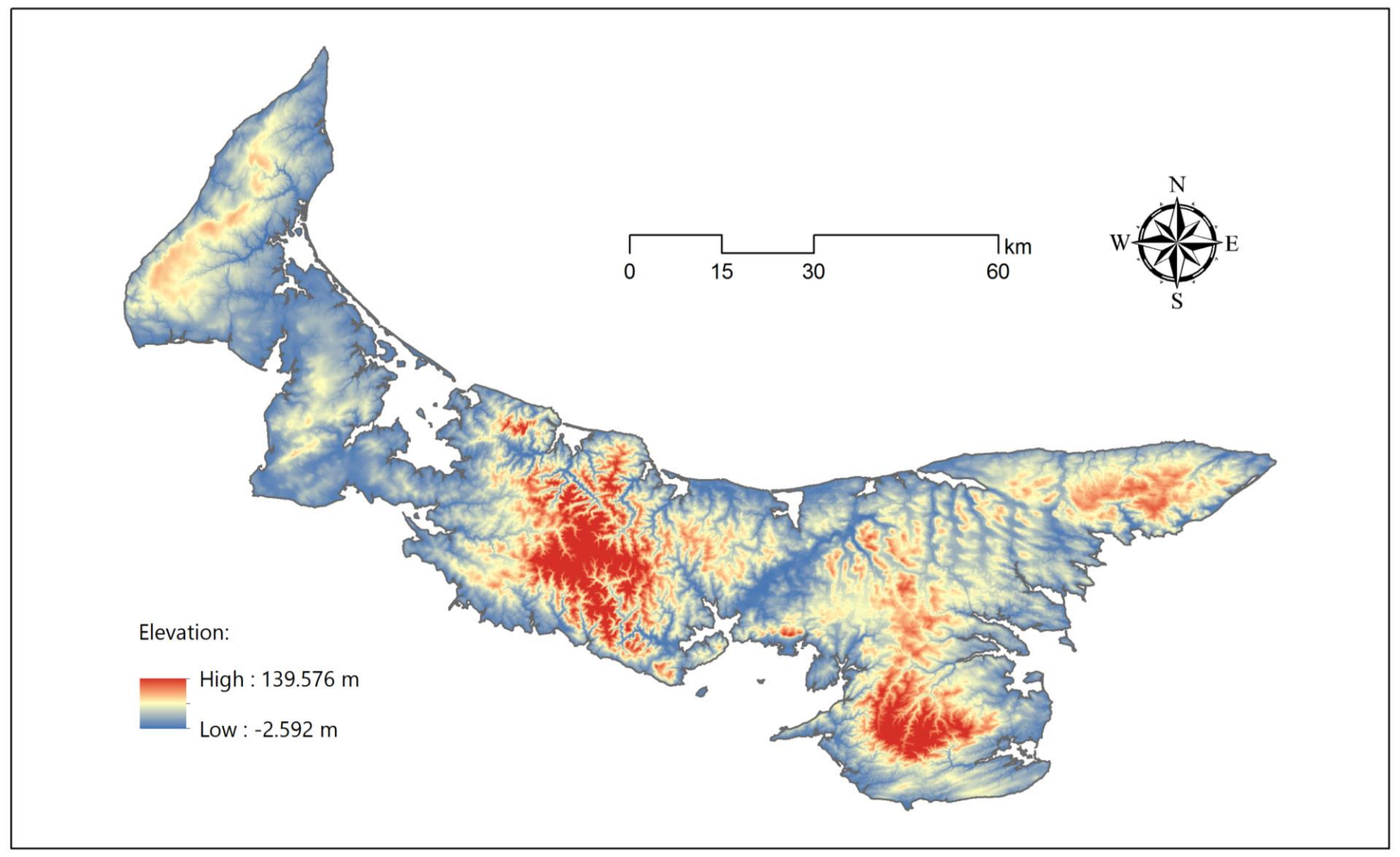



UPEI Main Campus
Charlottetown
Canadian Centre for Climate
Change and Adaptation
St Peter's Bay
Gulf of St Lawr
Tignish
Profits Corner
Alberton
Cape Wolfe
O'Leary
West Point
Tyne Valley
Abrams
Village
Miscouche
Summerside
Kensington
New London
Prince
Edward Island
Borden-Carleton
Crapaud
Charlottetown
Morell
Mt Stewart
Eastern Kings
Souris
Uigg
Montague
Point Prim
Murray
Harbour
Port Hood
Northumberland Strait
Pointe-Sapin
Richibucto
Rexton
Bouctouche
Saint-Antoine
Cap-Pelé
Shediac
Shemogue
Berry Mills
Moncton
Port Elgin
Sackville
Hopewell Cape
East Amherst
Pugwash

# UPEI's
# Canadian Centre for Climate Change & Adaptation

A leading research and teaching cluster in climate change monitoring, modeling, impact assessment, and adaptation.

# DEM for Prince Edward Island



# Climate Change in Coastal Regions

PEI is extremely vulnerable to climate change!

Sea Level Rise

Source: http://www.gov.pe.ca

Coastal Flooding

Source: USA Today

Erosion

Source: Don Jardine

Storm Surge

Source: Don Jardine

...

# Bachelor of Science in Applied Climate Change and Adaptation

COURSES AND EMPLOYABLE SKILLS

## YEAR 1

### PROGRAM-SPECIFIC COURSES

ACC 1010 Introduction to PEI's Living Climate Lab
ACC 2030 Indigenous Knowledge in Climate Change and Adaptation

### GENERAL COURSES

CHEM 2020 Environmental Chemistry
CS 1510 Introduction to Computer Science
ENV 1010 Introduction to Environmental Studies
MATH 1910 Introduction to Variable Calculus I
PHIL 2030 Environmental Philosophy

*One of the following electives:*
BIO 1010 Current Issues in Environmental Biology
CHEM 1110 General Chemistry I
PHYS 1210 Physics for Life Sciences I

*One of the following electives:*
UPEI 1010 Writing Studies
UPEI 1020 Engaging Ideas and Cultural Context
UPEI 1030 Engaging University Contexts and Experiences

*One of the following electives:*
ECON1010 Introductory Economics
ENG 2060 Critical Approaches to Texts I
HIST 1010 Canadian History-Pre-Confederation

## YEAR 2

### PROGRAM-SPECIFIC COURSES

ACC 1020 Introduction to Community Climate Program Technologies
ACC 1030 Surveying Cultural Landscapes in the Environmental Humanities

### GENERAL COURSES

BIO 3270 Field Coastal Ecology
ENV 3210 Natural Hazards
ENV 3110 Understanding Climate Change
PHYS 2510 Energy, Environment and the Economy
POLS 2020 The Politics of Climate Change and Adaptation
STAT 2210 Introductory Statistics I

*One of the following electives:*
PHIL 1050 Technology, Values and Society
PSYC 1010 Introduction to Psychology I
SOC 2550 Science, Culture and Society

*One of the following electives:*
BIO 2050 Microbiology
ENV 2120 Earth Physical Science
STAT 2220 Introduction to Statistics II

## YEAR 3

### PROGRAM-SPECIFIC COURSES

ACC 3010 Global Climate Change Vulnerability and Adaptation
ACC 3020 Climate Future and Modelling
ACC 3030 Climate Change Surveillance
ACC 3040 Climate Change Statistics in R
ACC 3050 Renewable Energy and Clean Technologies
ACC 3060 Visualization of Climate Change
ACC 3090 Geographic Information Systems for Climate Change
ACC 3100 Climate Change Impacts on Biodiversity
ACC 3120 Climate Change Management and Adaptation in Canada
ACC 3140 Business Risk Assessment Under Climate Change

## YEAR 4

### PROGRAM-SPECIFIC COURSES

ACC 3080 Reducing Greenhouse Gas Emissions
ACC 4010 Oceans, Coastal Systems and Climate Change
ACC 4020 Uncertainty and Probability in Climate Change
ACC 4040 Computer Programming to Visualize Climate Change
ACC 4060 Measuring Your Carbon Footprint through Carbon Accounting and Carbon Trading
ACC 4070 Climate Extremes
ACC 4080 Climate Change Impact and Adaptation
ACC 4090 Climate Change and Sustainable Tourism
ACC 4110 Climate Change and Human Health
ACC 4120 International Climate Diplomacy

### YEARS 2 – 4

Two **Work Integrated Learning** experiences for students will take place over eight-week periods during the summers between years 2 and 3 (ACC2150), and years 3 and 4 (ACC350). These experiences are paid and for credit within the 127-credit Applied degree. They may take place locally, regionally, nationally and, potentially, internationally through a flagship partnership being developed with Parks Canada.

### YEARS 1 – 2

Years 1 and 2 will be delivered through lectures, coursework, and labs at the UPEI campus in Charlottetown, PEI.

### YEARS 3 – 4

Years 3 and 4 will be delivered through small group projects, labs, community learning, and field courses—the latter of which will be delivered in partnership with The Smithsonian Institute, a UPEI learning and research partner—at UPEI's satellite campus, the UPEI Greenwich School of Climate Change and Adaptation, being established at the Prince Edward Island National Park—Greenwich site in the St. Peters area of PEI.

## EMPLOYABILITY SKILLS gained include:

- Piloting **drones** safely in gathering data for application in environmental science;
- Programming **virtual reality** environments using UNITY software;
- Using a **geographic information system** (GIS) to answer questions spatially
- Statistically analyzing data using **R software**
- Installing a **climate station** and other instrumentation
- Operating a **Real Time Kinematic (RTK) global positioning system** for precision locating
- Using output from global climate change models for **predicting future climate**
- Examining **climate observations** to understand past climate change trends
- **Negotiating** an international environmental agreement
- Measuring your **carbon footprint** using Canadian Standards Association (CSA) and International Standard Organization (ISO) protocols
- Establishing biodiversity monitoring plots using standards developed by the Smithsonian Institution
- **Working with businesses, industries and governments** in addressing environmental issues
- Preparing applications under **Environmental Assessment** legislation
- Conducting **climate change impact assessments** using methods recommended by the Intergovernmental Panel on Climate Change
- Directing **business risk analyses** in an era of climate change
- Conducting **environmental audits** in keeping with industry standards

# Learning with Innovative Technologies

- Small Unmanned Aerial Vehicles or Remotely Piloted Aircraft Systems
- Real Time Kinematic (RTK) Global Positioning Systems (GPS)
- Living Shoreline Coastal Armoring
- High-Performance Computing for Climate Modeling
- Big Data Analytics and Machine Learning
- …

# Research Expertise

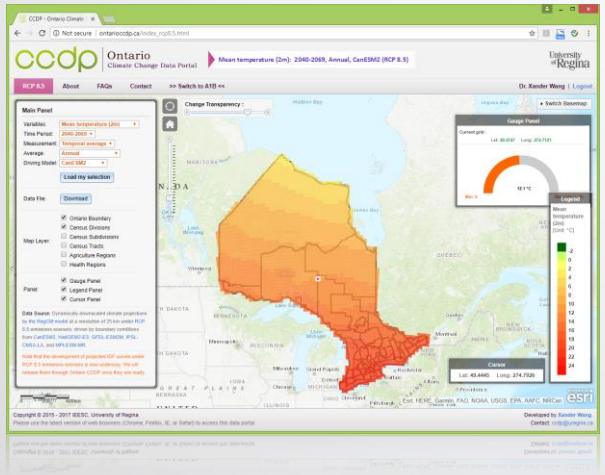
- High-resolution climate modeling
- Hydrological and flood modeling
- Energy systems modeling under climate change
- GIS, remote sensing, and drone technologies
- Precision agriculture and food security
- Big data analytics and machine learning
- Nature-based climate adaptation solutions
- Climate policy and economic modeling
- …

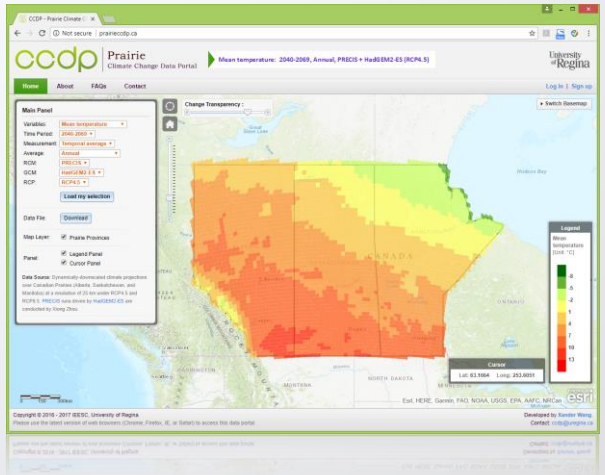
# GIS- and Web-Based Climate Change Data Portal

## Canada CCDP
http://canadaccdp.ca

## China CCDP
http://chinaccdp.org

## Ontario CCDP
http://ontarioccdp.ca



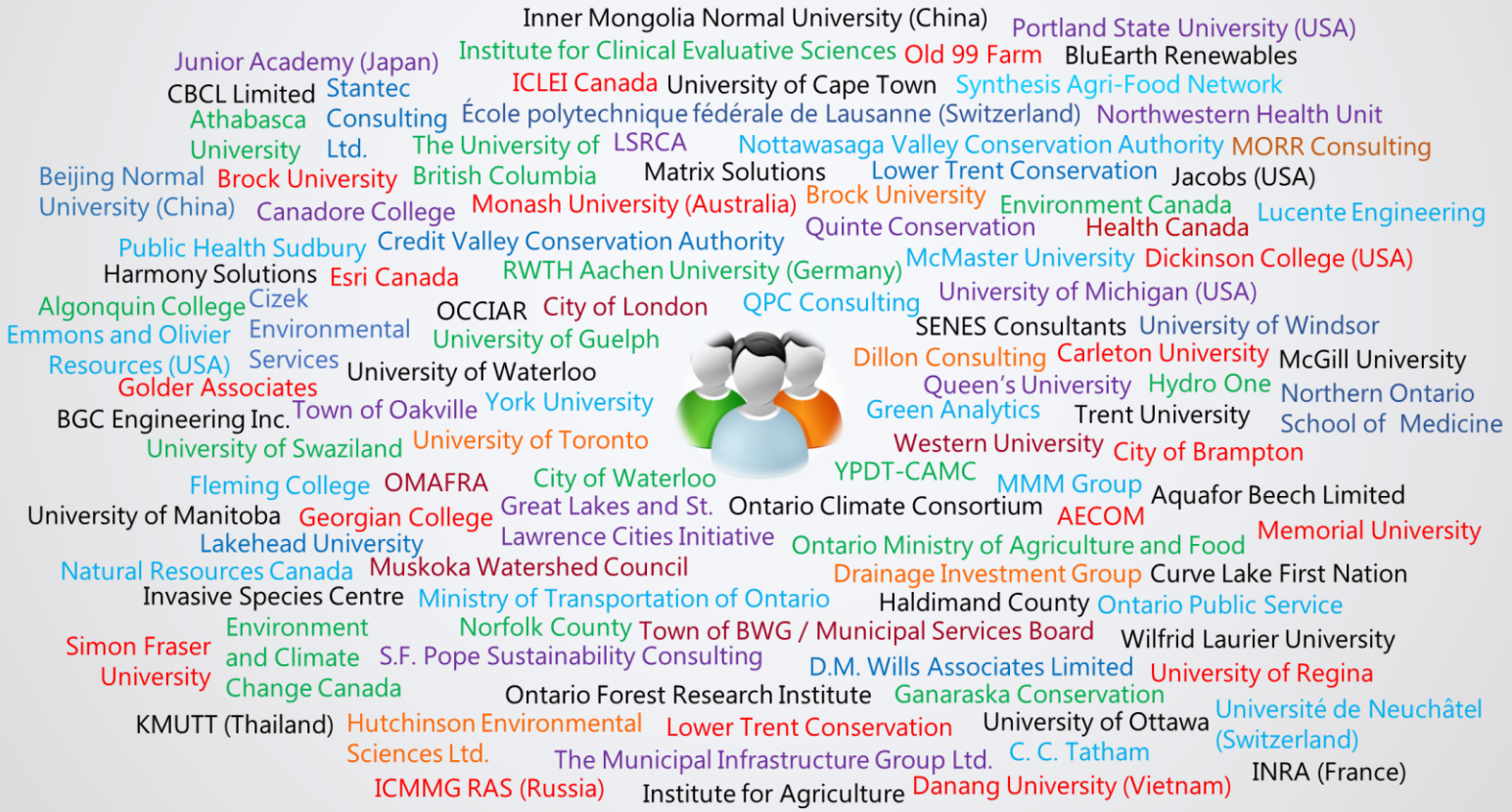

## Prairie CCDP
http://prairieccdp.ca

# GIS- and Web-Based Climate Change Data Portal

**Our goal is to cover all nations around the world.**

# GIS- and Web-Based Climate Change Data Portal

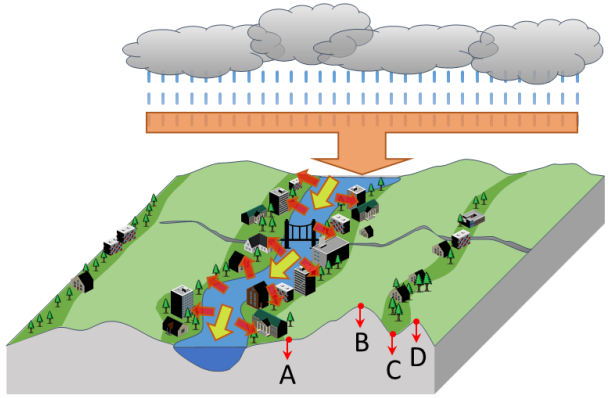
**> 800**
Registered Users



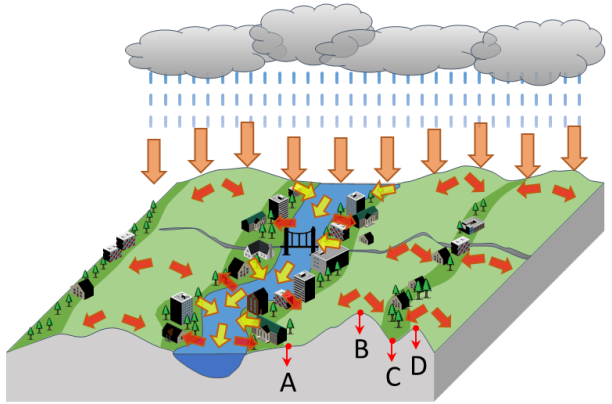

**> 70,000**
Downloads

# Urban Flood Prediction Under Heavy Rainfall

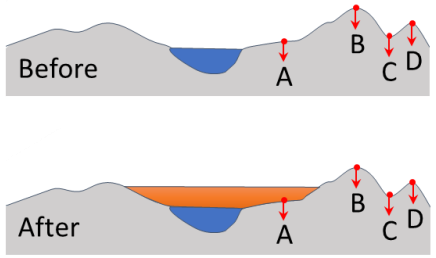
**Flood Inundation Model**
(urban floods under heavy precipitation)



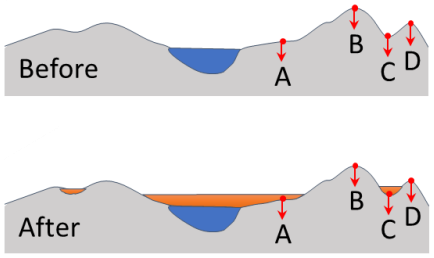

**Real Dynamical Process**
(urban floods under heavy precipitation)




Precipitation
Flow in river channel
Flow over land




A will be flooded after a heavy rainfall event, but C will be safe as it is blocked by B.




A will be flooded after a heavy rainfall event, meanwhile C will be flooded because of the accumulation of surface runoffs from B and D.

## A New Model

**can be applied to any urban settings.**

# Energy Systems Modeling Under Climate Change

Input-Output Tables

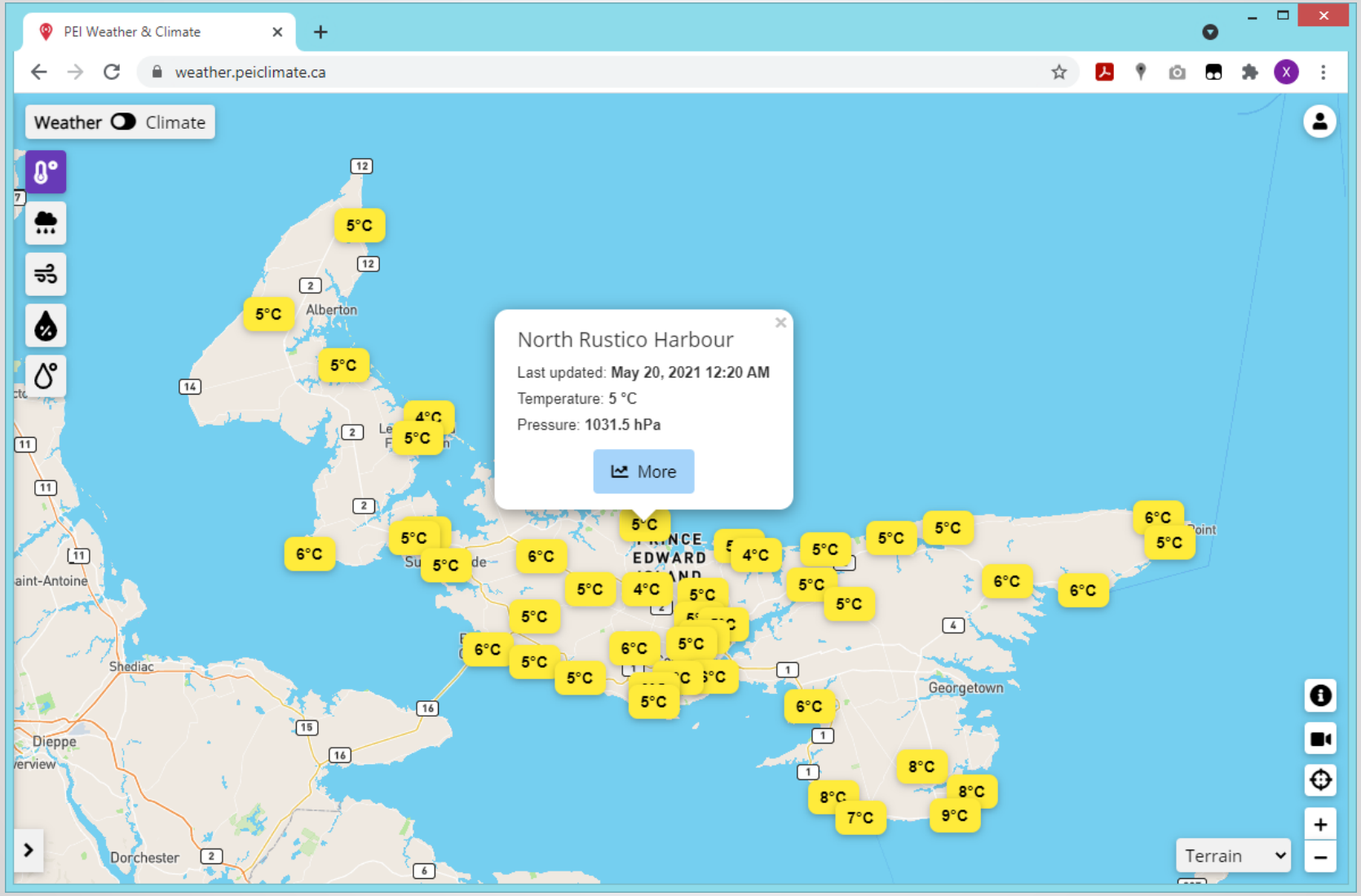
Climate Change Scenarios

Optimization Models

To help find effective carbon reduction policies: carbon cap and trade, carbon tax, or others.

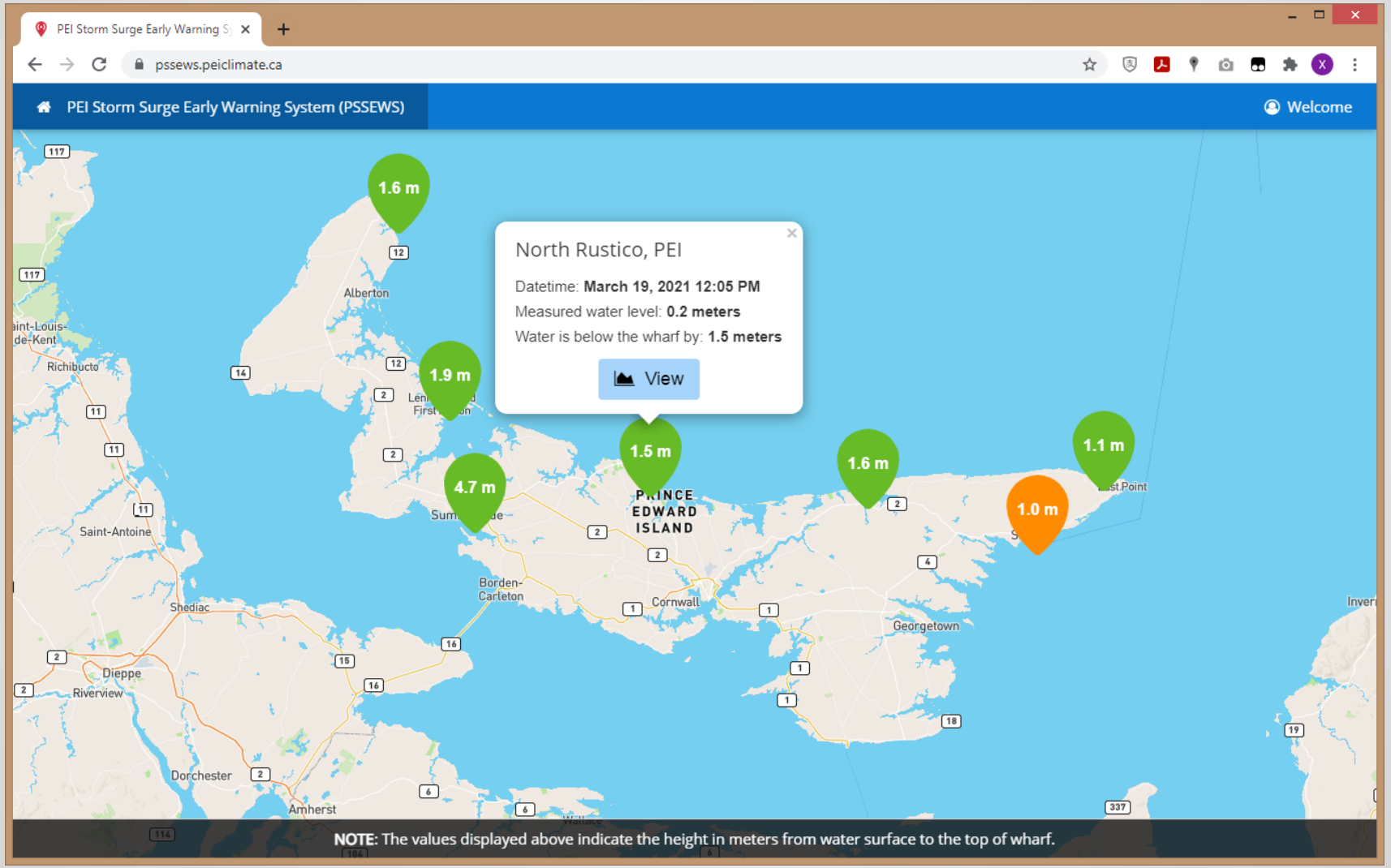
# PEI Weather & Climate App

## Website: https://pssews.peiclimate.ca



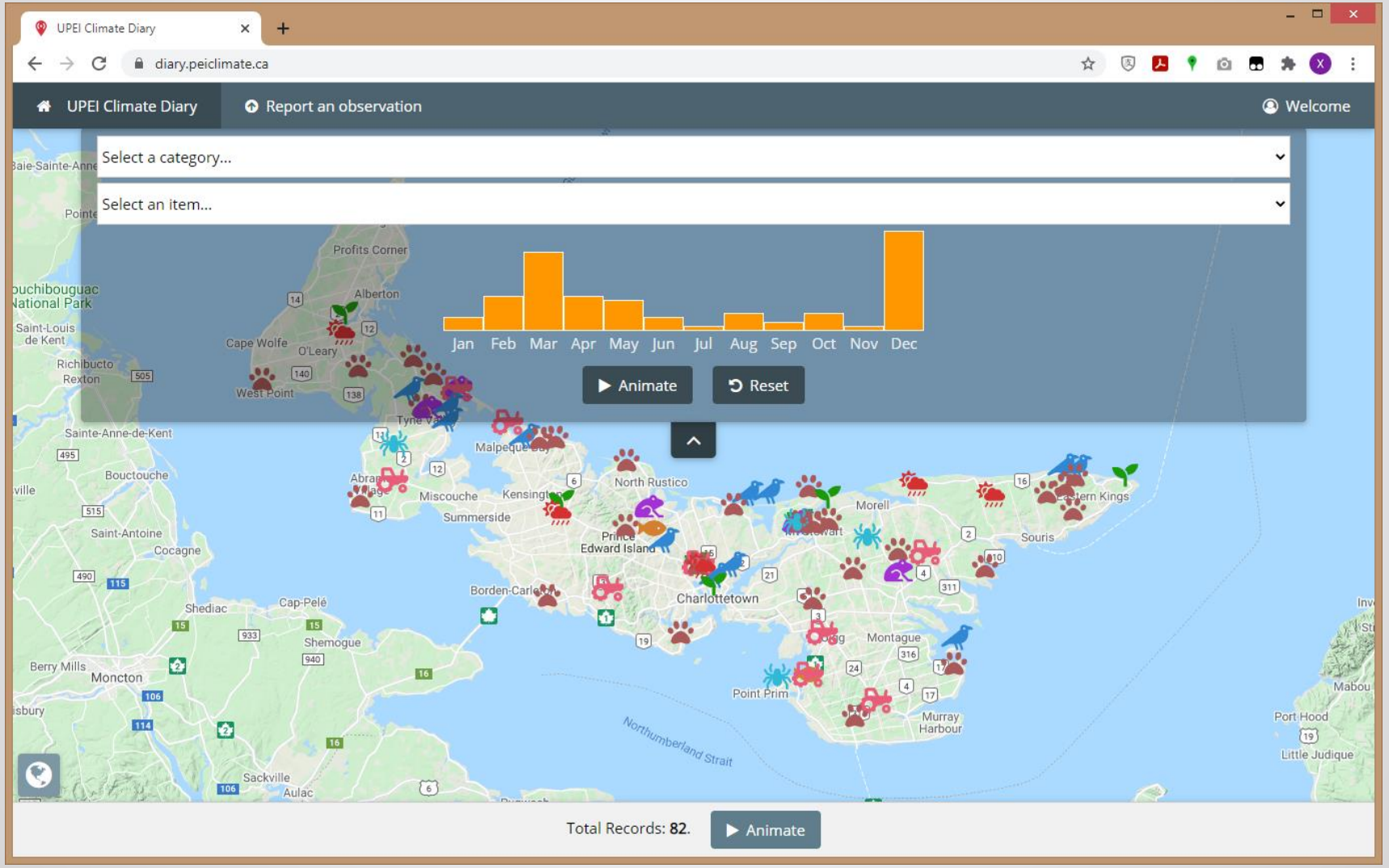
# PEI Storm Surge Early Warning System

## Website: https://pssews.peiclimate.ca



# PEI Climate Diary App

## Website: https://diary.peiclimate.ca



# Thank you very much.

Email: xxwang@upei.ca