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Small Island Innovations and New Technologies for Addressing Threats from Coastal Erosion and Sea Level Rise

Dr. Adam Fenech, University of Prince Edward Island
Building Small Island Resilience to Climate Change Symposium
22 September 2016

As Sea Level Rises, These People Show Us How to Cope

A tiny island off the Atlantic coast is shrinking as the climate warms and the seas rise. But its indigenous people aren't waiting for global help: They're taking action now.

By **Alanna Mitchell**, National Geographic

Small and Getting Smaller

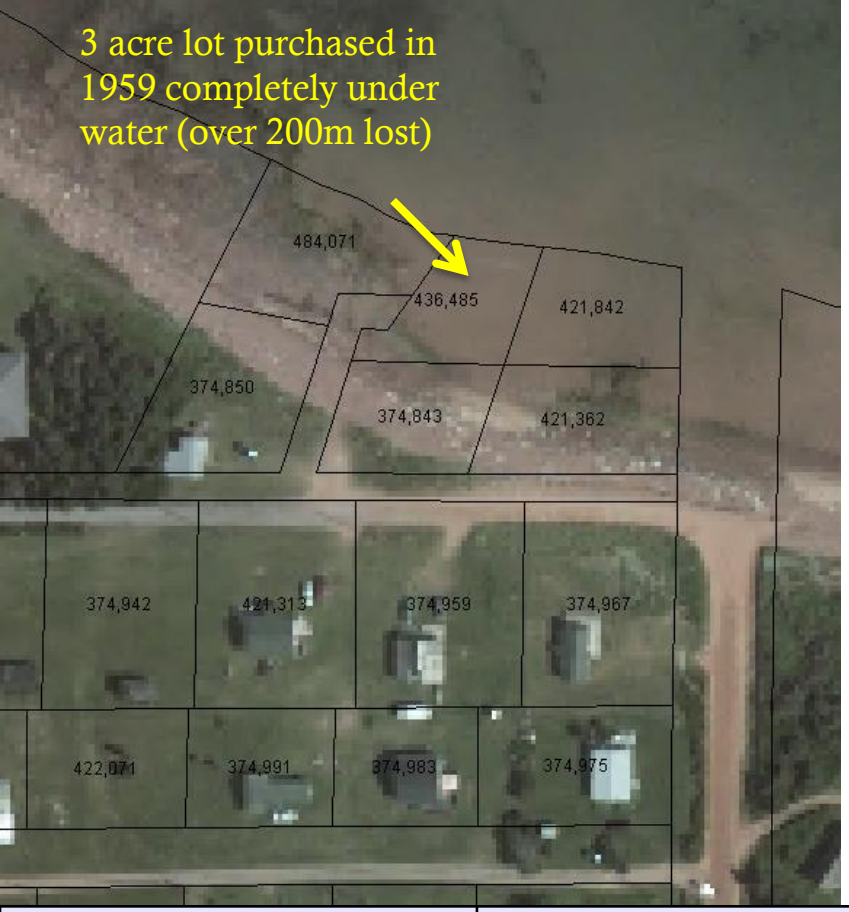
"We are an adaptable and resilient people and we will figure this out."

Matilda Ramjattan | Chief of Lennox Island First Nation

Information Is Power

"The sea wins, eventually."

Adam Fenech | Climate scientist

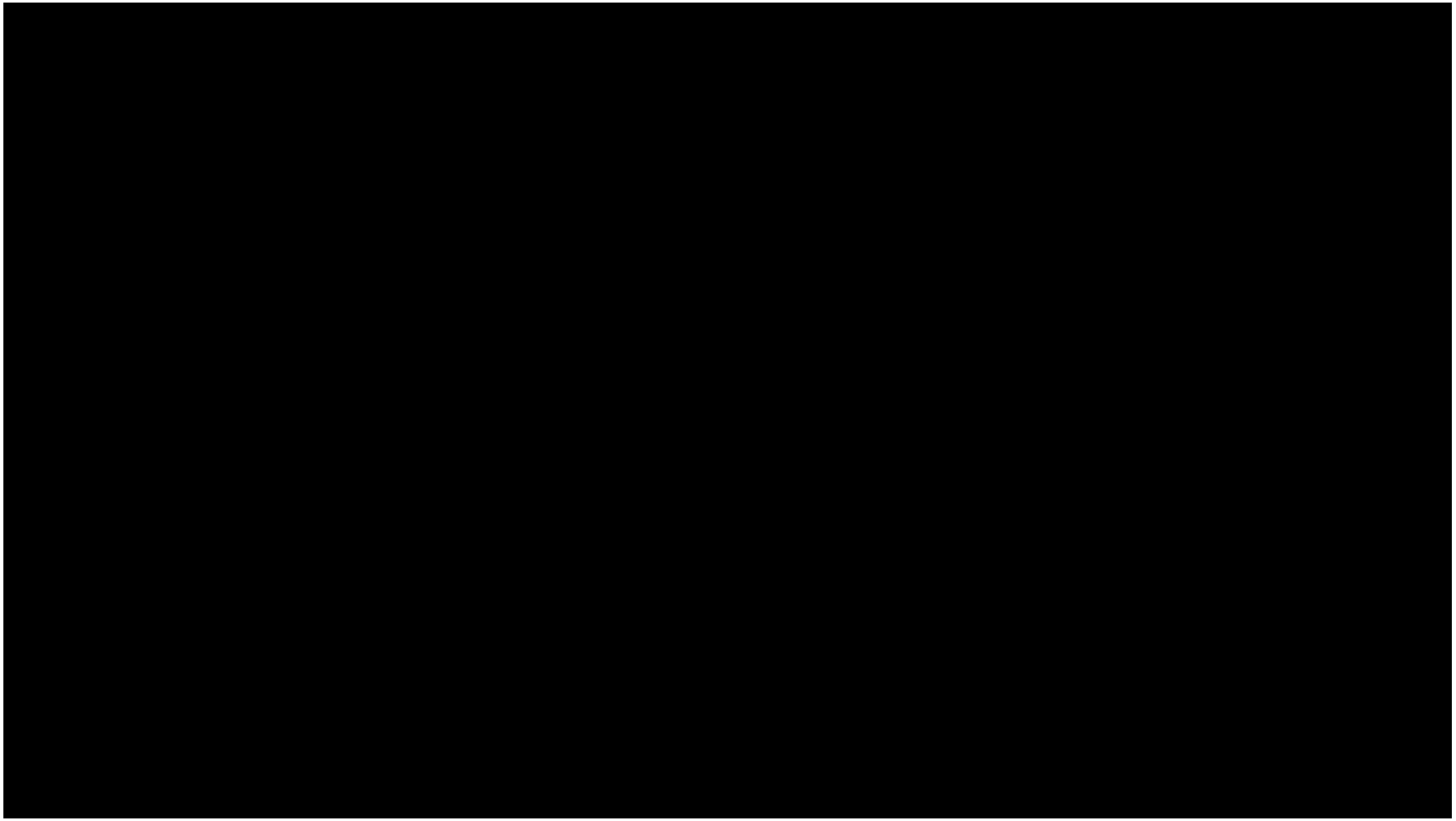


PEI Coastal Erosion

Vulnerable Infrastructure	
Type	**Total**
Bridges	126
Commercial	146
Garage	42
Lighthouse	17
Outbuildings	446
Residential	1004
Settling Pond	5
Wind turbine	1

Time Span	Land Area Lost	Land Area Gained	Net Loss/Gain
1968-2010	35.21 km^2	14.54 km^2	-20.67 km^2

Waste Water Treatment Settling Ponds Lennox Island, PEI



https://www.youtube.com/watch?v=Cg6dZHg76kA&feature=youtu.be

CoastaL Impacts Visualization Environment (CLIVE)

Public Consultations Summer 2014

- 8 communities across PEI
- concern went from “high” to “very high”
- “willingness to adapt” increased
- Sense of anxiety followed by urgency

Climate CoLab

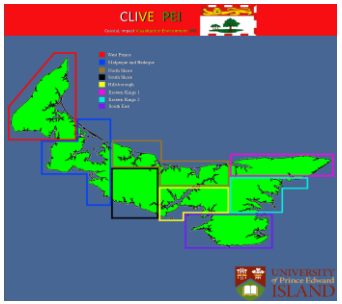
The Climate CoLab is a project of the MIT Center for Collective Intelligence in collaboration with many other organizations

CANADIAN INSTITUTE OF PLANNERS / INSTITUT CANADIEN DES URBANISTES

Prince Edward Island Association of Planners
Murray Pinchuk Community Builder Award

ALJAZEERA

CLIVE Visualization
Data Compression



Original Data:
250 GB

CLIVE PEI:
6 GB

- GIS License
- Large memory required
- *Clunky* user interface
- Prone to crashing

- Clickable File on Desktop
  (no software required)
- Data compressed to **under 2.5%**

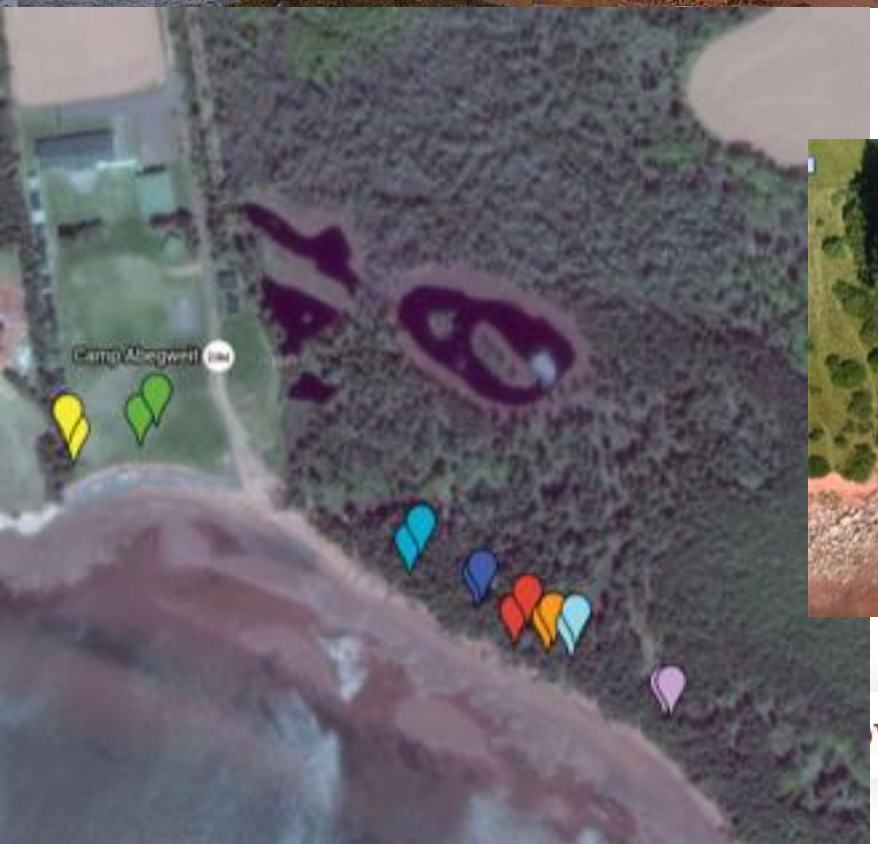
Weissman Score

- Keyboard, mouse, Xbox controller or LEAP (easy interface)
- Accessible by all

Building Virtual Realities


Sea Level Rise Slider
0 m
Sea Level Rise

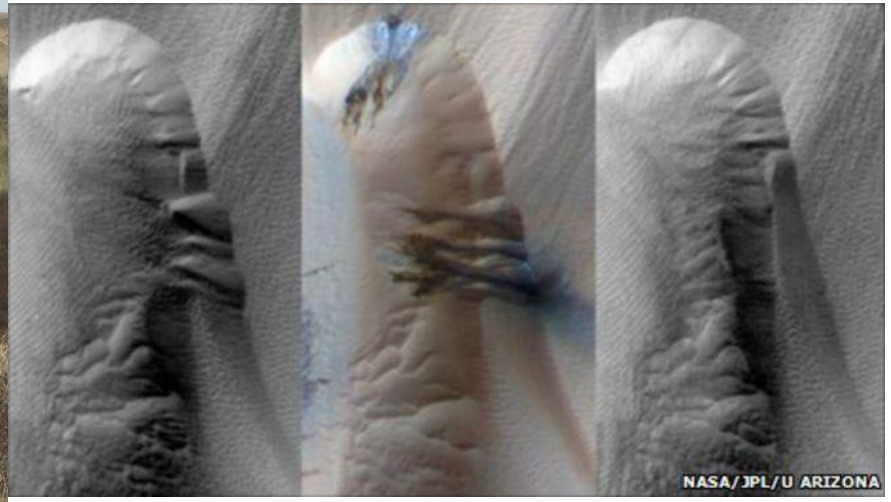
Graduate Student Research Armouring Techniques



Graduate Student Research LiDAR off of a Drone

	Specifications:
Sensor:	• Time of flight distance measurement with calibrated reflectivities • 16 channels • Measurement range up to 100 meters • Accuracy: +/- 3 cm (typical) • Dual returns • Field of view (vertical): 30° (+15° to -15°) • Angular resolution (vertical): 2° • Field of view (horizontal/azimuth): 360° • Angular resolution (horizontal/azimuth): 0.1° - 0.4° • Rotation rate: 5 - 20 Hz • Integrated web server for easy monitoring and configuration
Laser:	• Class 1 - eye safe • 905 nm wavelength
Mechanical/ Electrical/ Operational	• Power consumption: 8 W (typical) • Operating voltage: 9 - 32 VDC (with interface box and regulated power supply) • Weight: 830 grams (without cabling) • Dimensions: 103 mm diameter x 72 mm height • Shock: 500 m/sec² amplitude, 11 msec duration • Vibration: 5 Hz to 2000 Hz, 3G rms • Environmental Protection: IP67 • Operating temperature -10° to +60° C • Storage temperature - 40° to +105° C
Output:	• Up to 0.3 million points/second • 100 Mbps Ethernet connection • UDP packets containing - Distances - Calibrated reflectivities - Rotation angles - Synchronized time stamps (µs resolution) • $GPRMC NMEA sentence from GPS receiver (GPS not included)

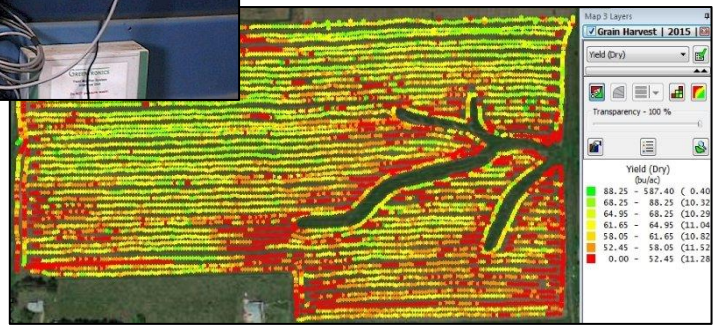
Graduate Student Research
Parabolic Sand Dunes



Graduate Student Research
Wind Turbine Leading Edge Blade Erosion

- Coastal Salt spray and winds
- Energy performance reduced by 20%
- Wind Energy Institute of Canada (WEICAN)

Graduate Student Research
Precision Agriculture



- Linking spectral signature of potato plants (greenness) to yield
- Helping farmers reduce fertilizer and water inputs

Graduate Student Research
"Threatened" Wildlife Species

- Gulf of St. Lawrence Aster is labeled as "threatened" by the Committee on the Status of Endangered Wildlife in Canada
- recently reintroduced at Blooming Point in PEI National Park
- over 100 plants and seed heads grown by UPEI biologists and transplanted to relatively sheltered sandy areas that experience periodic flooding

Graduate Student Research
Climate Change and Chocolate

- Climate change allowing for successful cacao harvest at Big Pine Key of Florida Keys
- Only continental USA cacao harvest

Conclusion

- New innovative, relatively-affordable technologies now available to small islands for addressing risks of coastal erosion and sea level rise

- Video gaming software motivates communities to adapt to a changing climate

- Drone technology allows for multiple applications when dealing with opportunities and challenges from climate change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