

# CanCoast: A National-scale Framework for Characterizing Canada's Marine Coasts

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Natural Resources  
Canada

Ressources naturelles  
Canada

# Impacts of Climate Change on Canada's Marine Coasts

- Accelerated sea-level rise
  - Reduced sea ice extent/thickness
  - Increased wave energy
  - Accelerated coastal erosion
  - Increased storm surge flooding hazard
- 
- Vulnerability is a function of exposure, sensitivity and adaptive capacity
  - Adaptation to climate change is important in reducing vulnerability
    - Strategies are dependant on local and regional physical and social variables
    - Differ based on contributions to vulnerability



# Adaptation strategies

- Local and regional physical and social variables
  - Mapped and analyzed
    - Inform policy decisions
    - Aid in adaptation planning
- A need for geospatial database to contain various National coastal features
  - Assist in adaptation planning in coastal zones
  - Contribute to national assessment of coastal vulnerability to climate change
  - CanCoast created for these purposes

Halifax, NS



# CanCoast

- National scale digital database
- 1:50,000 scale
- Multi-purpose
  - Assisting in climate change adaptation planning
  - Support coastal modeling research
  - Improve knowledge and understanding of shoreline variability and change
  - Identify coastal information and data gaps
  - Contribute to sustainable development of marine coasts
  - Potential for access to stakeholders
- Contains digital coastal data
  - Topographic relief
  - Bedrock geology
  - Surficial materials
  - Landforms
  - Sea level tendency
  - Tidal range
  - Wave height
  - Erosion

Brackley, PEI



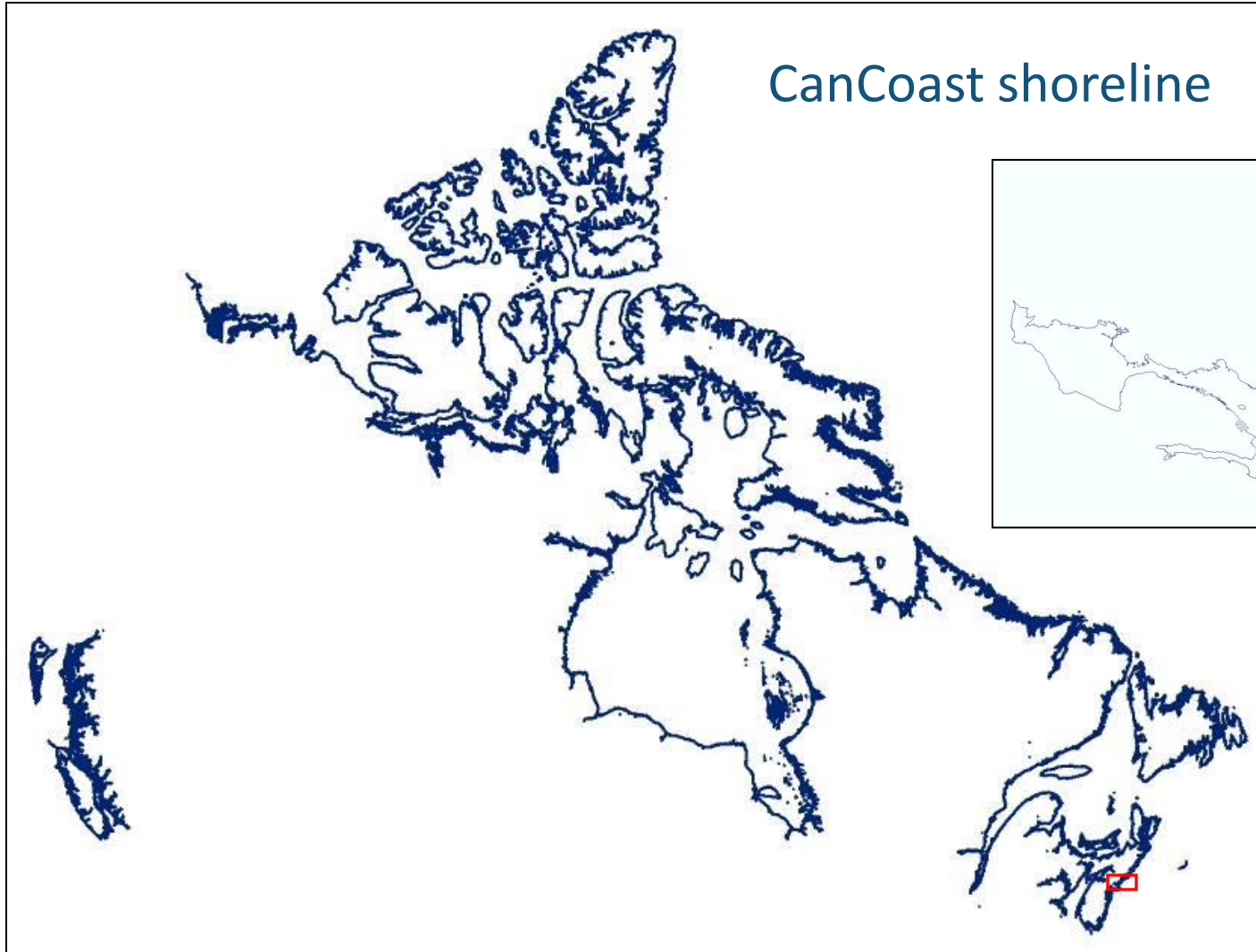
## CanCoast shoreline - Source

- Developed in ESRI ArcInfo 9.3
- Source: CanVec version 9.0
  - Natural Resources Canada product
    - Distributed through GeoGratis
  - Originates from multiple sources covering Canada
    - National Topographic Data Base (NTDB)
    - GeoBase
    - Landsat 7/Spot imagery
  - Contains topographical entities organized into distribution themes
    - Hydrography theme used
  - 1:50,000 scale product
  - Original CanVec product imported as polygon feature classes, by province
  - NAD83 CSRS geographic coordinate system





# CanCoast shoreline



## CanCoast shoreline - Methods

- Non-marine coastal features eliminated
  - Freshwater lakes, ponds, rivers, etc
  - Select by hydrography codes in attribute table corresponding to marine coastal features
- Necessary to eliminate additional non-tidal elements
  - CanVec hydrography codes not consistent
  - Erased using National Topographic System (NTS) 1:50,000 sheets
    - Sheets used in Shaw et al. (1998) sensitivity index analysis
- Some non-marine river features remain in database
  - Possible creation of a DEM to clip rivers consistently at a particular elevation

Hall Beach, NU



## CanCoast shoreline – Methods continued

- Polygons converted into polyline feature classes
  - Individual provinces
- Some gaps present in CanVec version 9.0
  - Baffin and Ellesmere Islands
  - Filled in using National Topographic Database (NTDB) 1:250,000 shoreline
- Provinces merged into one polyline, forming CanCoast shoreline
- CanCoast shoreline projected to North America Equidistant Conic (NAD83) projection
- CanCoast shoreline clipped by UTM (Universal Transverse Mercator) zones

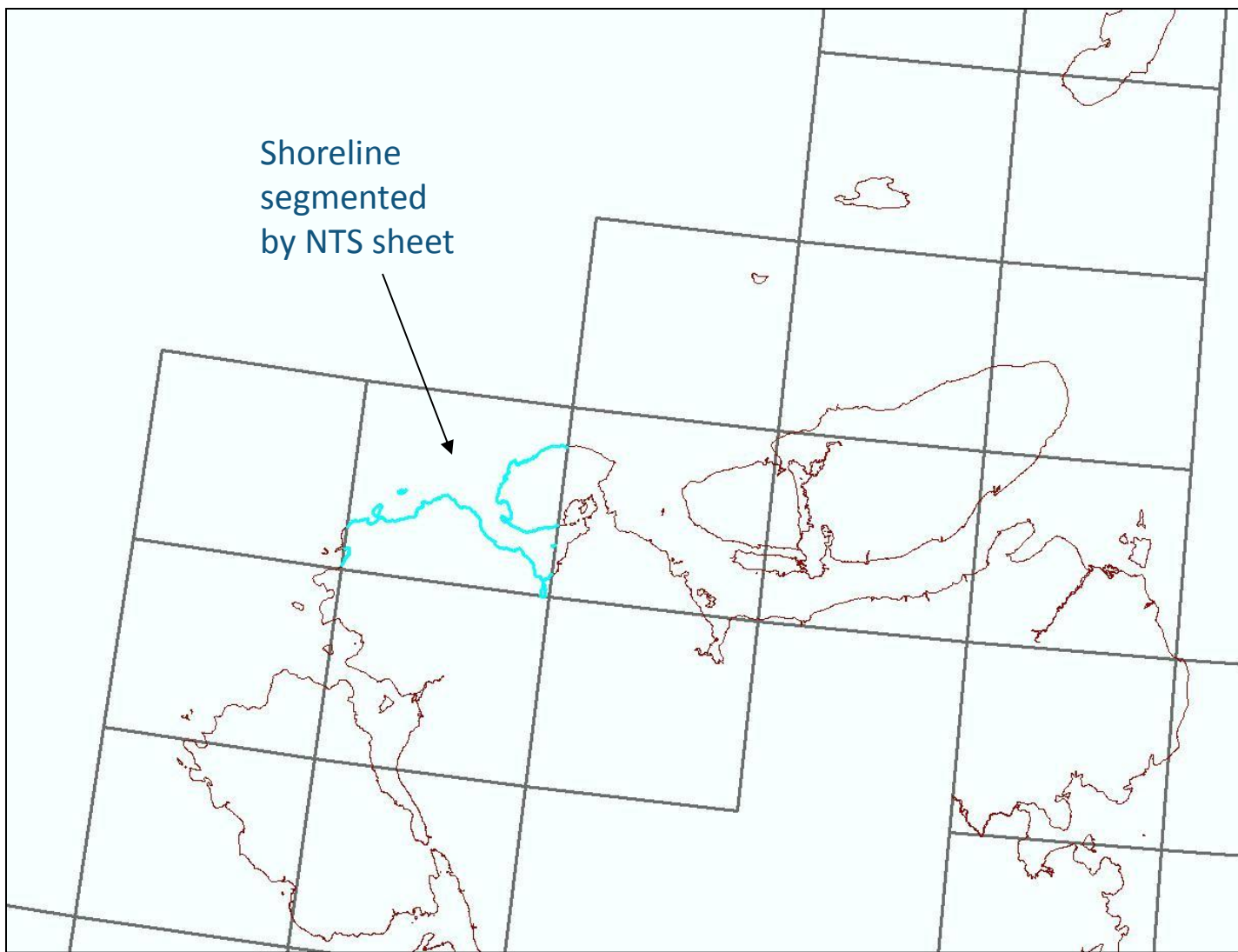




## CanCoast - Geodatabase

- Several coastal variables added to CanCoast
  - Appropriate for adaptation planning
  - Nationally consistent
  - Shaw et al. analysis variables were used
  - (sensitivity to sea-level rise):
    - Relief
    - Rock type
    - Surficial material
    - Landform
    - Sea level tendency
    - Tide range
    - Wave height
- NTS 1:50,000 sheet polygon intersecting the shoreline were selected
  - Shaw et al. variables contain a NTS sheet attribute, sheet numbers matched
  - Variables joined to copies of CanCoast shoreline using identity tool
  - Each NTS 1:50,000 sheet contains one attribute per variable
    - Polylines segmented by NTS sheet boundaries





Shoreline  
segmented  
by NTS sheet



# CanCoast - Geodatabase

- Shaw et al. variables each contain a score attribute
  - Based on various classifications
  - 1 = Very low, 5= Very high

VARIABLE	Ranking of Sensitivity Index				
	Very Low 1	Low 2	Moderate 3	High 4	Very High 5
<b>1 Relief (m)</b>	>30	21-30	11-20	6-10	0-5
<b>2 Rock type</b>	Plutonic rocks, high-grade metamorphic & volcanic rocks	Metamorphic rocks	Most sedimentary rocks	Poorly consolidated sediments	Unconsolidated sediments, ice
<b>3 Landform</b>	Fiord, high rock, cliffs, fiord	Moderate and low rock cliffs	Beach, unconsolidated sediment over bedrock	Barrier, bluffs, salt marsh, peat, mud, flat, delta, spit, tombolo	Ice-bonded sediment, ice-rich sediment, ice shelf, tidewater glacier
<b>4 Sea-level change (cm/100a)</b>	>-50	-50 to -20	-19 to +20	21 to 40	>40
<b>5 Shoreline displacement (m/a)</b>	>+0.1 accreting	0 stable	-0.1 to -0.5 eroding	-0.6 to -1.0 eroding	>-1.0 eroding
<b>6 Tidal range (m)</b>	<0.50	0.5-1.9	2.0-4.0	4.1-6.0	>6.0
<b>7 One year maximum wave height(m)</b>	0-2.9	3.0-4.9	5.0-5.9	6.0-6.9	>6.9



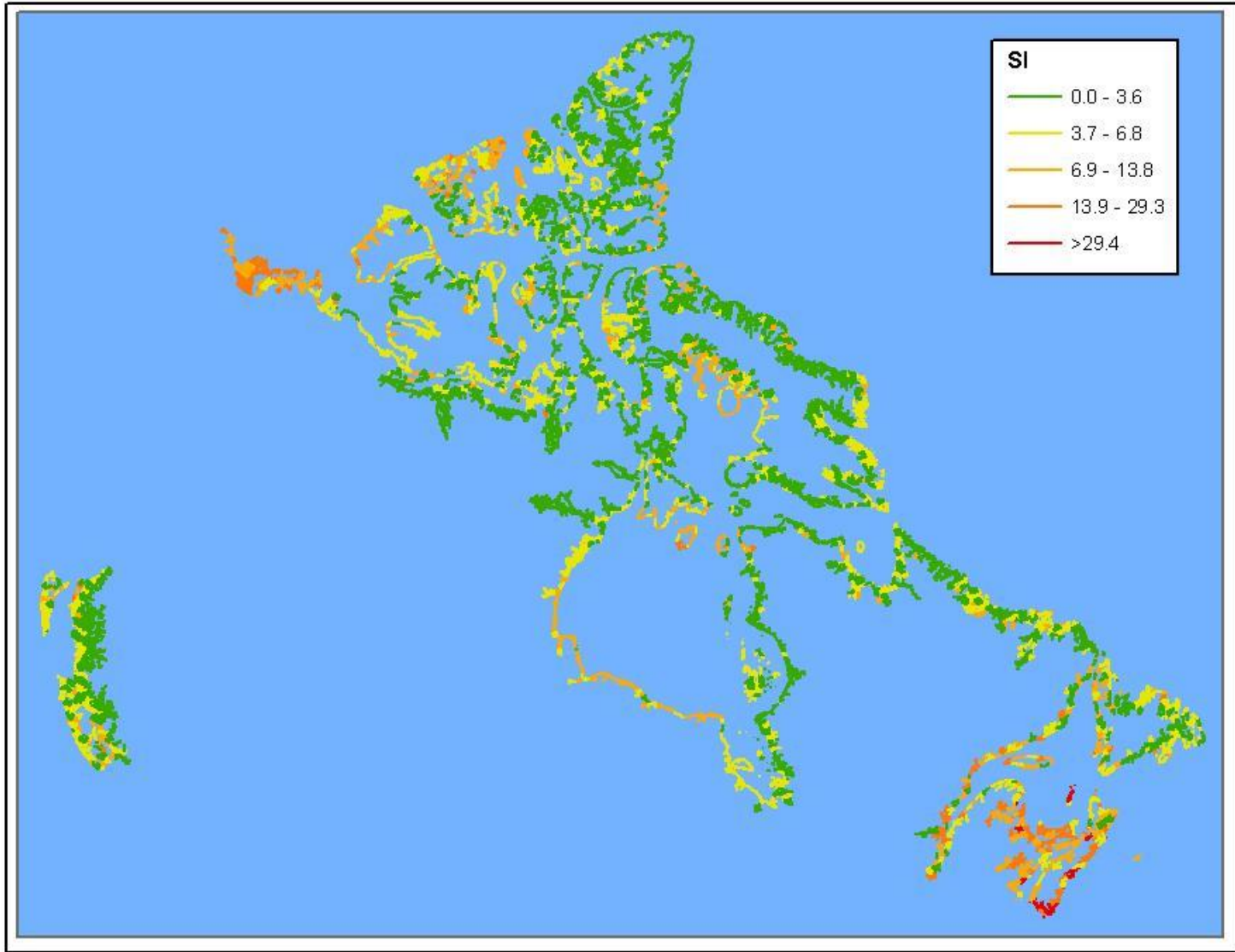
# CanCoast - Geodatabase



- Scores used to calculate a Sensitivity Index (SI)
  - Originally done in Shaw et al. analysis
  - Replication of methods to include newly added segments
    - Detail of CanCoast shoreline greater than original analysis
    - Variables and scores interpolated using neighboring values
- $SI = \sqrt{((v1*v2*v3*v4*v5*v6*v7)/7)}$
- Results of the newly calculated SI attached to CanCoast shoreline
  - Using the identity tool



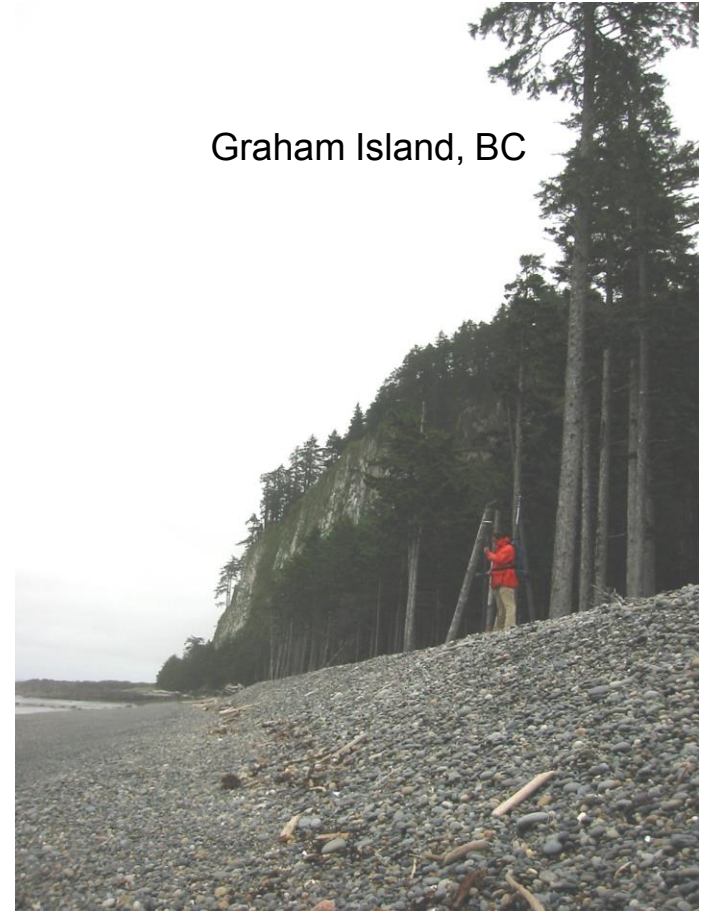




# CanCoast - Geodatabase

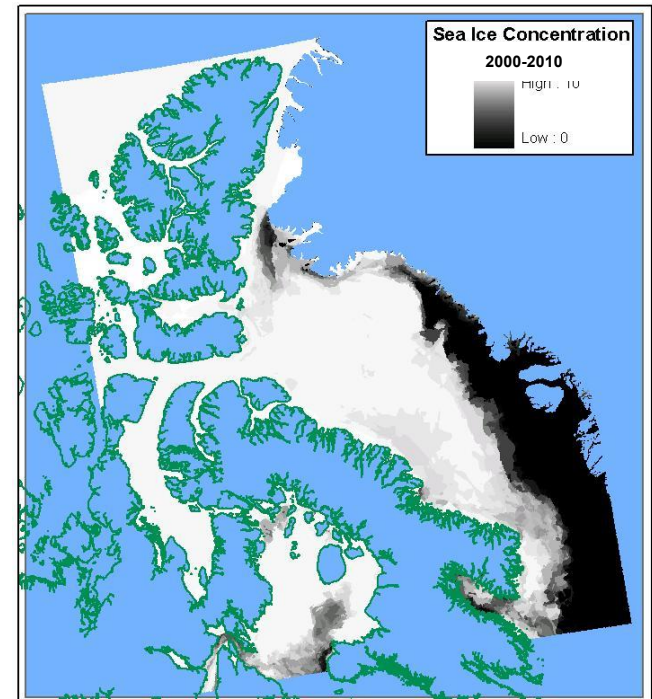
- Bedrock geology, Surficial materials added to CanCoast geodatabase
  - 1:5,000,000 scale
  - Wheeler et al. (1996) and Fulton (1995)
  - Natural Resources Canada products
- Imported as polygons
- Manually stretched to ensure full coverage on CanCoast shoreline
- Attributes attached to copies of CanCoast shoreline to create two new polyline feature classes

Graham Island, BC



# CanCoast - Future Development, 2013

- Scores added to bedrock geology and surficial material feature classes
  - Replace existing Rock type and Landform
  - Recalculation of SI using new scores
  - Moving towards CanCoast variables that do not use NTS sheet segmentation
- Addition of socio-economic variables to database
  - Relevant census data from Statistics Canada
- Coastal Digital Elevation Model (DEM) created
  - Replace existing Relief layer
  - Use in excluding non-tidal rivers
- Sea Ice concentrations
  - Thirty-year median calculations
  - Climate change sensitivity variable



## CanCoast - Future Development

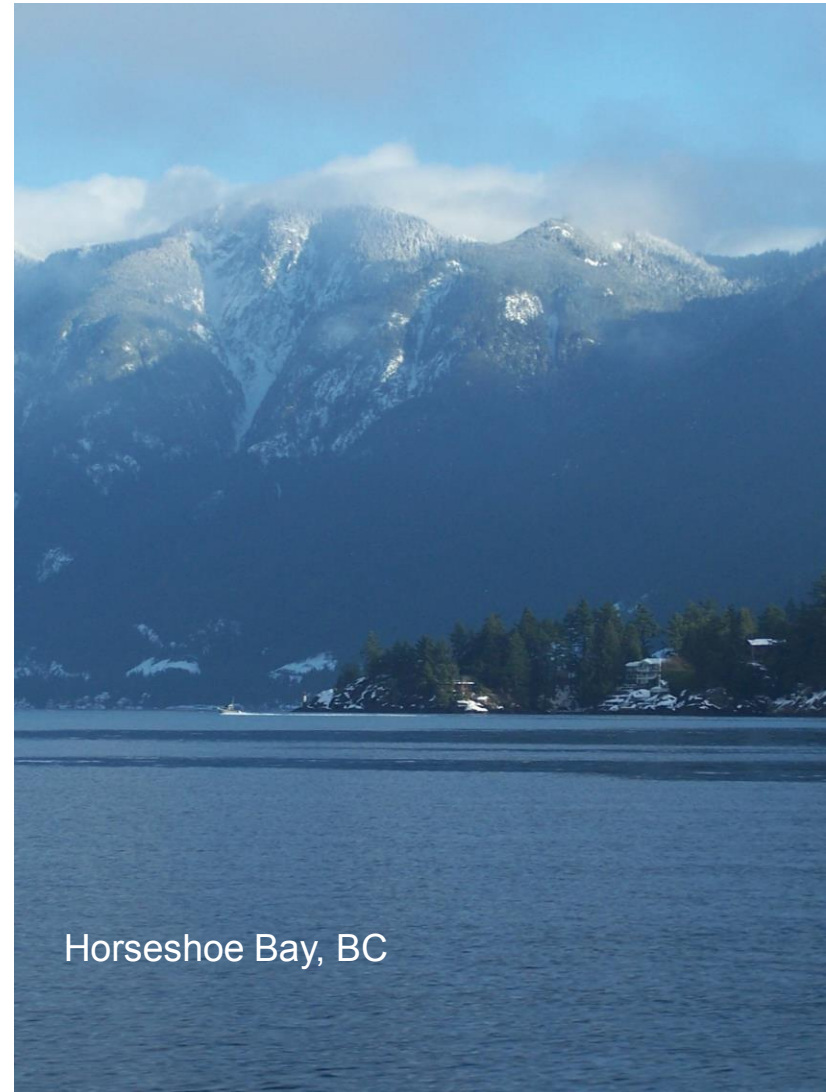
- Ongoing partnership with Climate Change Impacts and Adaptations Division (CCIAD)
  - National assessment of coastal vulnerability
  - Development of adaptation strategies
- Addition of physical and socio-economic variables to contribute towards assessing vulnerability to climate change
  - Moving from a sensitivity index to sea-level rise to a vulnerability index to climate change





## CanCoast - Distribution

- Currently distributed to interested groups
  - Coastal and Ocean Information Network (COIN) Atlantic
  - Emergency Pre-SCAT Assessment for Arctic Coastal Environments (eSPACE), Environment Canada
  - Oceans and Ecosystems Division, Fisheries and Oceans Canada
- Currently unpublished
  - Available upon request from GSC-A
  - Future publication to web-based interface through Natural Resources Canada





Thank you!

Questions?