



CANADIAN HIGH ARCTIC RESEARCH STATION

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Monitoring Coastal Ecosystems in Canada's Arctic

Opportunities and Challenges



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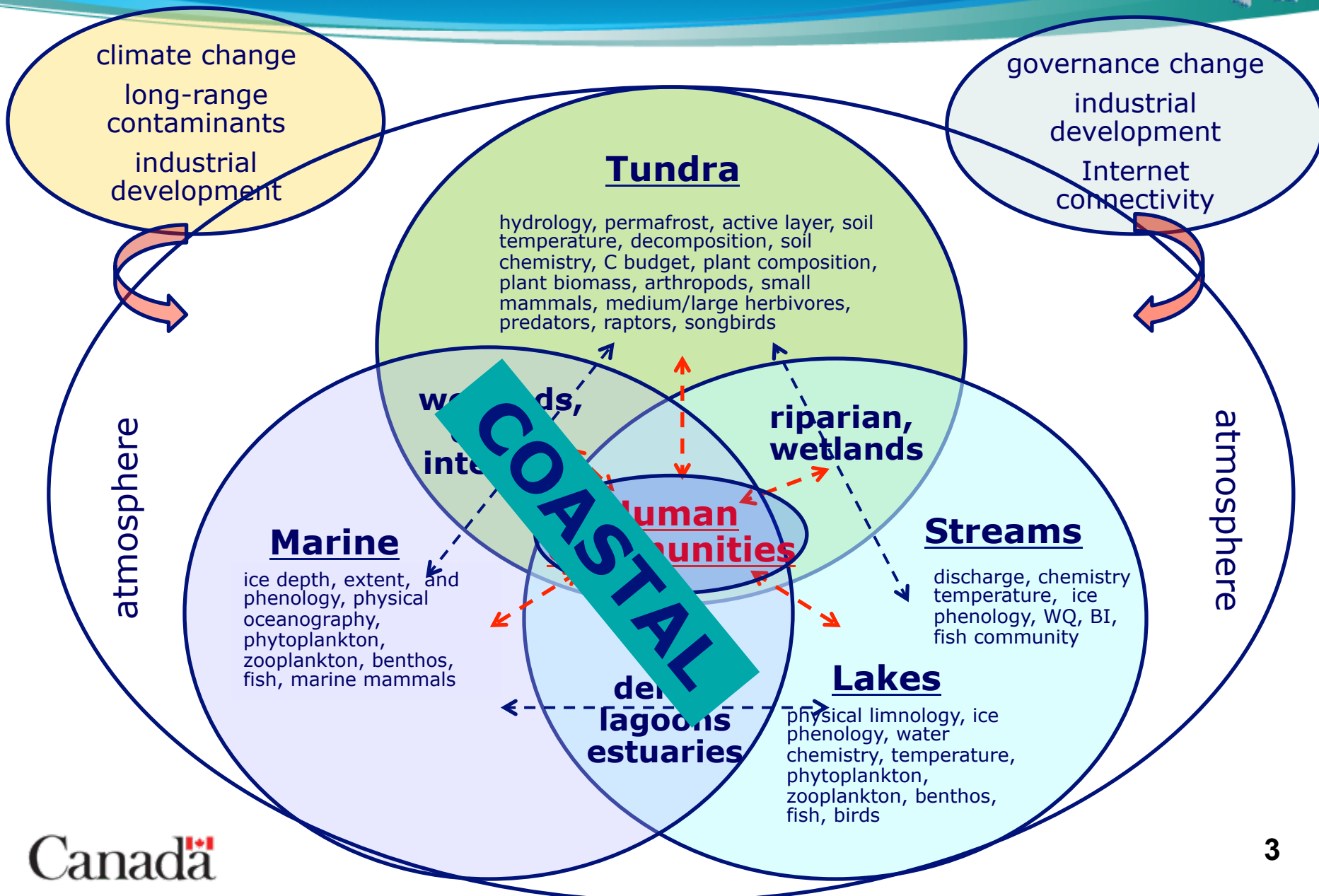
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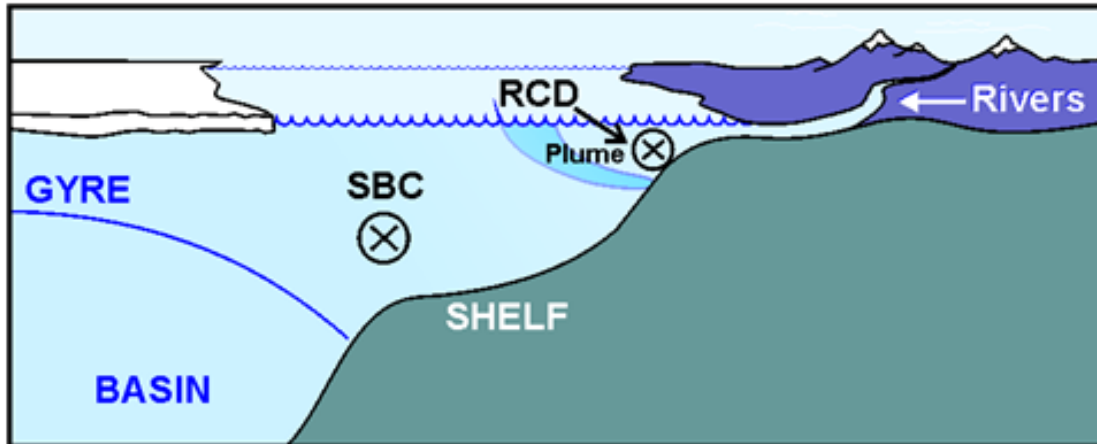
Presentation Overview

- what are 'coastal ecosystems'?
- Challenges and Opportunities for sustainable monitoring of coastal ecosystems
- going forward together

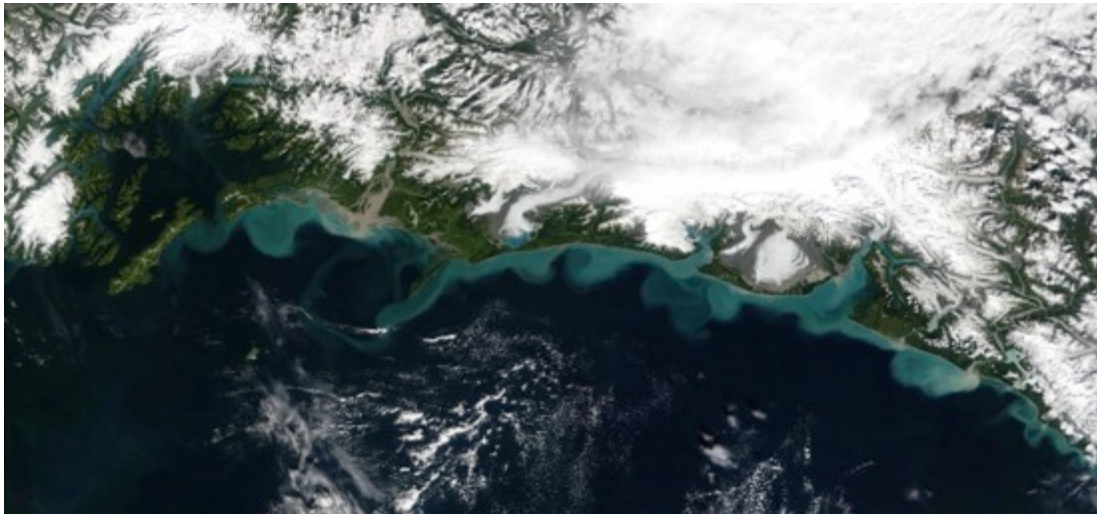
CBMP – Monitoring Domains



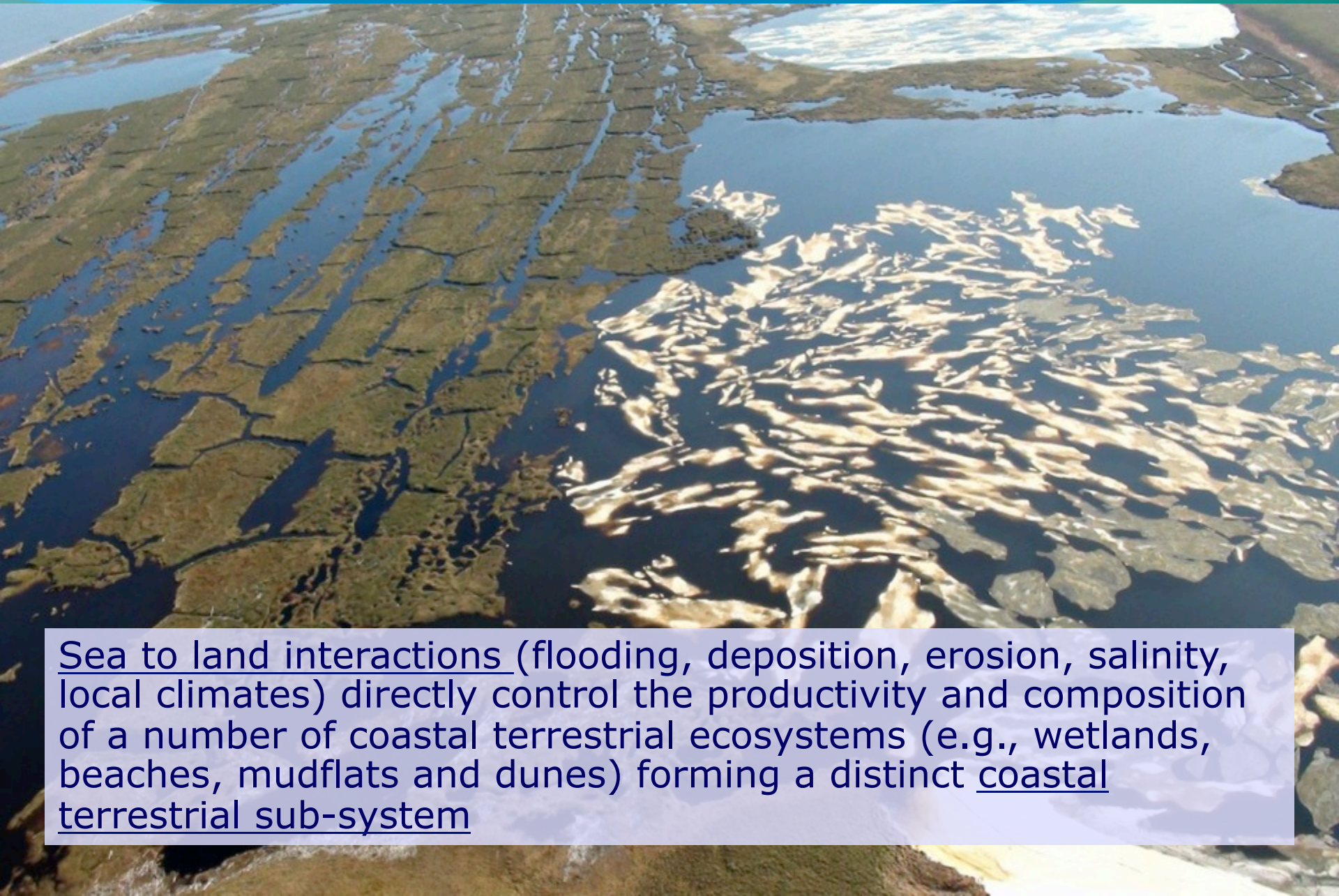
Coastal Marine Ecosystems



Land to sea interactions
(riverine inputs, biota,
coastal erosion)
significantly impact
arctic marine
ecosystems forming a
distinct coastal marine
sub-system



Coastal Terrestrial Ecosystems



Sea to land interactions (flooding, deposition, erosion, salinity, local climates) directly control the productivity and composition of a number of coastal terrestrial ecosystems (e.g., wetlands, beaches, mudflats and dunes) forming a distinct coastal terrestrial sub-system

Coastal Freshwater Ecosystems

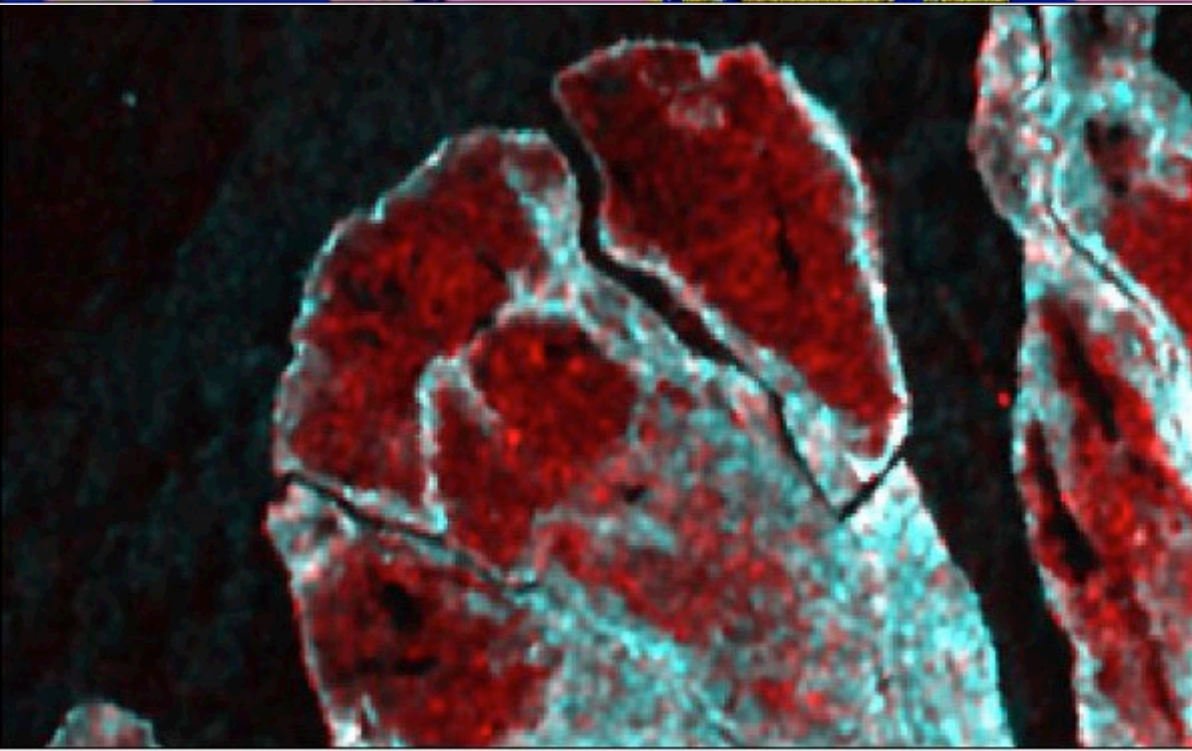
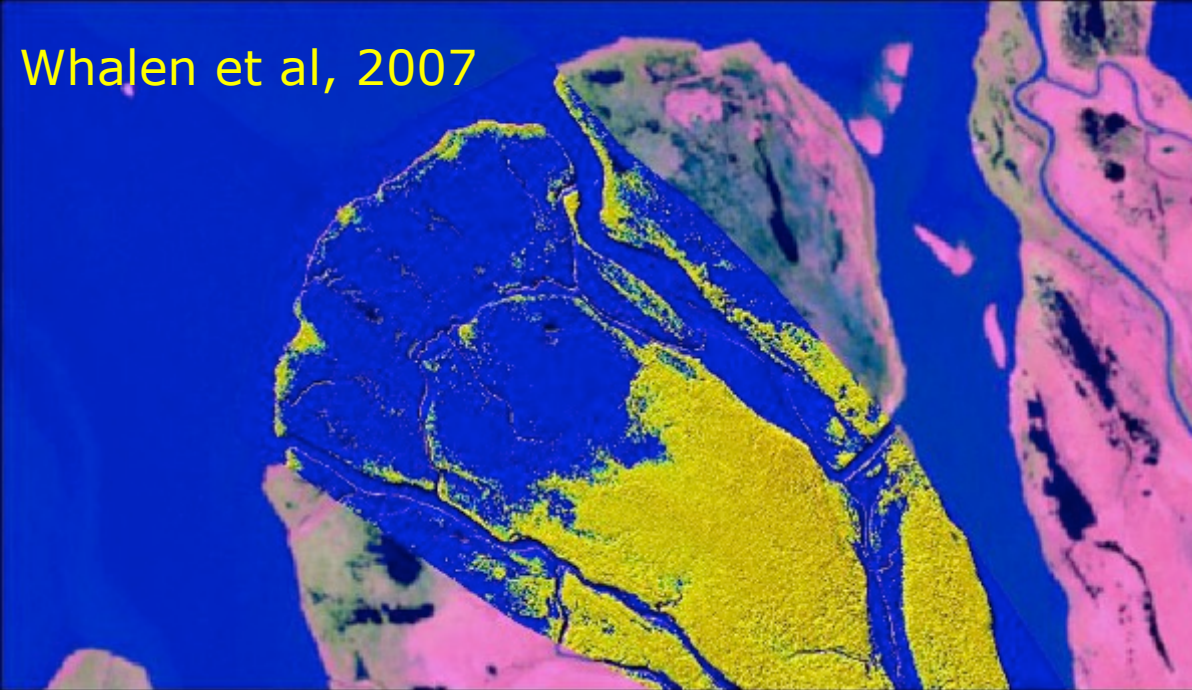


Sea to freshwater interactions (seawater inundation, deposition, erosion, salinity, local climates) directly control the productivity and composition of a number of coastal freshwater ecosystems (e.g., lagoons, estuarine ponds) forming a distinct coastal freshwater sub-system

Additional Coastal Ecosystems (1)



- many coastal areas experiencing very high rates of coastal erosion
- direct effects on terrestrial and freshwater coastal ecosystems and important indirect effects on coastal marine ecosystems
- propose including 'zones of rapid coastal erosion' in the CEMG Domain



Additional Coastal Ecosystems (2)

- some low-lying coastal ecosystems previously unaffected by marine water are being inundated due to rising sea level, stronger storms, etc
- direct effects on terrestrial and freshwater coastal ecosystems
- propose including 'zones of recent or historic marine inundation' in the CEMG Domain

Proposal for CBMP Coastal Domain

- Coastal Domain dynamic and overlapping with Marine, Freshwater and Terrestrial Domains
- CAFF CBMP Coastal EMG have proposed a definition for consideration by other EMGs - key features:
 - to depth of 30m into marine system (links to Marine EMG)
 - to 'high water mark' into terrestrial system (link to Terrestrial and Freshwater EMGs)
 - including areas of active erosion and areas of marine inundation
- further discussion required with other CBMP EMGs on monitored attributes that use more than 1 Domain, e.g., marine mammals, migratory fish and birds, benthos
- cooperation required with existing networks, e.g., C-Bird Group, Polar Bear Group

Challenges

- scale and inaccessibility of the area to be monitored
- complexity of processes driving change
- relative lack of research compared to offshore marine and terrestrial ecosystems
- importance of coastal biodiversity globally and locally and difficulty in predicting impacts
- high vulnerability and increasing risk to climate change and anthropogenic impacts
- engaging communities and building local capacity to deliver the monitoring

NRCan - CanCoast

CanCoast Coastline



http://dusk.geo.orst.edu/ICAN_EEA/ICAN6/13-CanCoast.pdf

- 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
- Contains digital coastal data
 - Topographic relief
 - Bedrock geology
 - surficial materials/landforms
 - Sea level tendency
 - Tidal range
 - Wave height
 - Erosion



stable coastline



eroding coastline



eroded organics



vulnerable infrastructure

Sensitivity to Erosion

VARIABLE	Ranking of Sensitivity Index				
	Very Low 1	Low 2	Moderate 3	High 4	Very High 5
1 Relief (m)	>30	21-30	11-20	6-10	0-5
2 Rock type	Plutonic rocks, high-grade metamorphic & volcanic rocks	Metamorphic rocks	Most sedimentary rocks	Poorly consolidated sediments	Unconsolidated sediments, ice
3 Landform	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
4 Sea-level change (cm/100a)	>-50	-50 to -20	-19 to +20	21 to 40	>40
5 Shoreline displacement (m/a)	>+0.1 accreting	0 stable	-0.1 to -0.5 eroding	-0.6 to -1.0 eroding	>-1.0 eroding
6 Tidal range (m)	<0.50	0.5-1.9	2.0-4.0	4.1-6.0	>6.0
7 One year maximum wave height(m)	0-2.9	3.0-4.9	5.0-5.9	6.0-6.9	>6.9



A Frame for Designing National Coastal Monitoring

Criteria - Monitoring Sites

- ✓ sensitivity to erosion
- ✓ biodiversity hotspots
- ✓ access to communities
- ✓ threats/risk/vulnerability



Conservation of Coastal Biodiversity

- coastal ecosystems support critical stages (nesting, staging, rearing, summer feeding) in the life cycles of important populations of arctic species (waterfowl, shorebirds, fish, marine mammals)
- climate-driven changes in coastal processes will have complex and largely unpredictable impacts on the habitats of coastal-dependent species
- coastal ecosystems are also the most vulnerable to increasing shipping and other industrial activities
- most coastal communities rely very heavily on coastal species for subsistence and cultural sustenance
- for all of these reasons strategic monitoring of coastal ecosystems is critical for understanding how systems are changing and what the implications are for coastal biodiversity

Opportunities

- engaging communities – benefit from traditional and local knowledge of coastal ecosystems and country food species
- increasing awareness of the importance of coastal ecosystems and their vulnerability
- previous work to build on and increasing amounts of research on coastal ecosystems
- national and international focus on arctic research and monitoring – CBMP, territorial programs, academic programs
- commitments by industry and governments to development that does not threaten the environment

Arctic Communities in Canada are Coastal Communities



GRAMINOID DOMINATED	SHRUB DOMINATED	SPARSE VEGETATION	WETLANDS	NON-VEGETATED
 Tundra: graminoid tundra	 Low shrub	 Sparsely vegetated bedrock	 Wetlands	 Barren
 Wet edge	 Tall shrub	 Sparsely vegetated till-colluvium		 Ice / snow
 Non-tundra: graminoid / dwarf shrub tundra	 Prostrate dwarf shrub	 Bare soil with cryptogam crust - frost heils		 Shadow
 Dry graminoid: prostrate dwarf shrub tundra				 Water

Threatened Communities

CHALLENGES

- direct climate change effects on infrastructure
- indirect climate change effects on country food
- pending oil and gas developments


OPPORTUNITIES

- community based monitoring established
- important TK is being catalogued
- recent science activity (BREA, IPY, ArcticNet)
- ISR communities have strong relationship with science community
- ISR communities politically empowered and have key input into oil and gas developments

Tuktoyuktuk, NT
Photo: Don Forbes

Going Forward Together

- given scale and complexity of the issues need to engage a wide number of partners to tackle the issues (governments, industry, communities, academia)
- importance of engaging and including knowledge and experience of coastal communities as part of the solution
- importance of linking monitoring to ongoing research to ensure we are monitoring the right things in the right ways



Thank You
...any Questions?

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