

# *Helping Coastal Communities Anticipate and Plan for Future Climates*

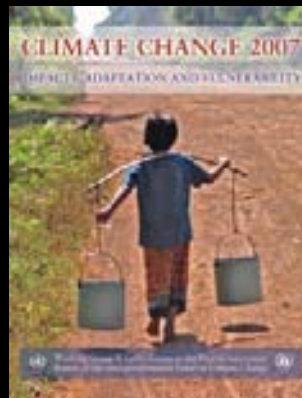


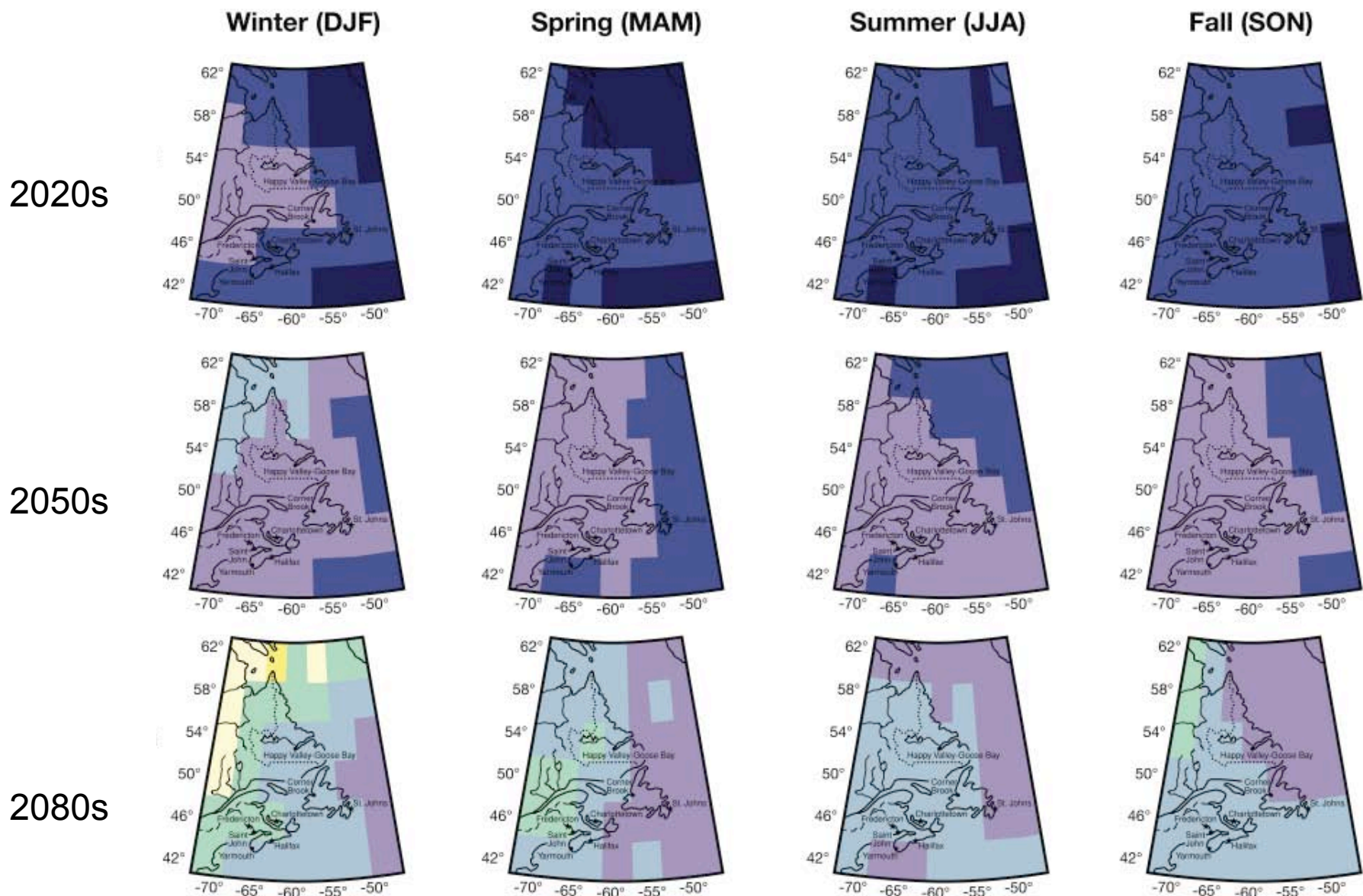
KYLE MCKENZIE, PLANADAPT  
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CURA  
JUNE, 2011

# *Climate change*

- Change in long term average weather
- Driven by both natural and man-made forces
- Heavily studied issue
  - IPCC's fourth assessment report (2007)
  - NRCan's National Adaptation Assessment (2008)



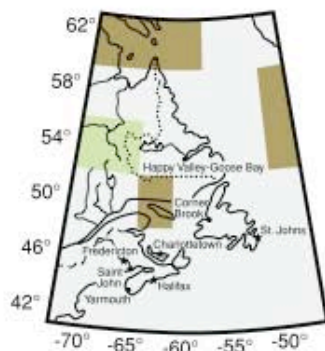


NRCan, 2008

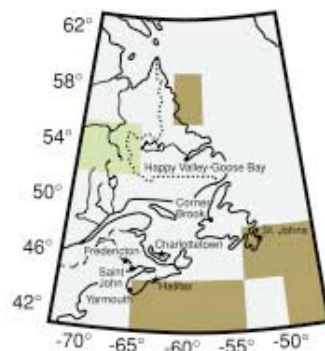


2020s

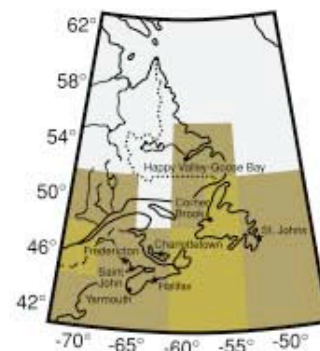
Winter (DJF)



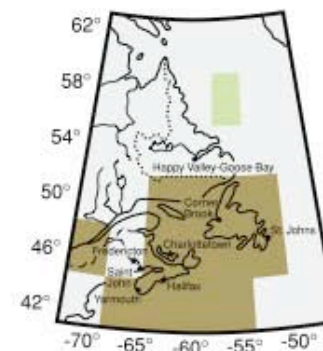
Spring (MAM)



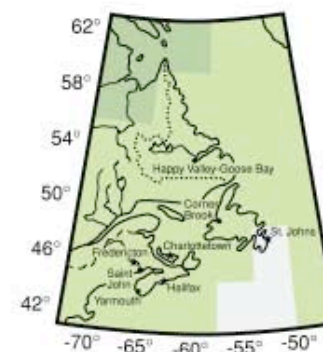
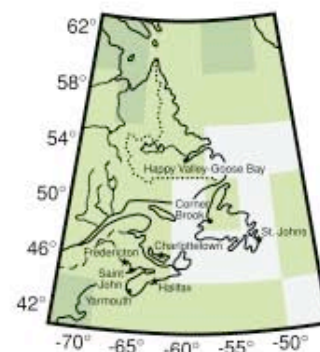
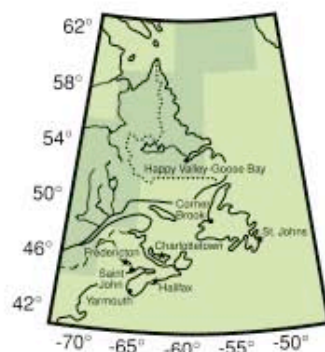
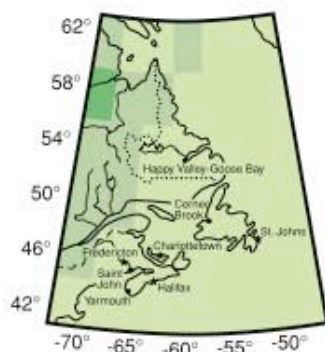
Summer (JJA)



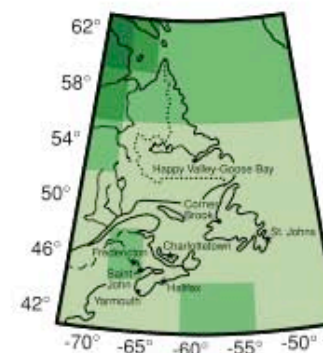
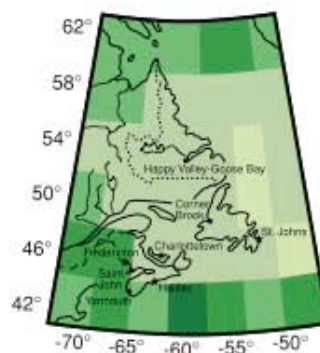
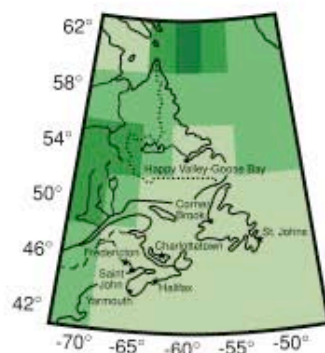
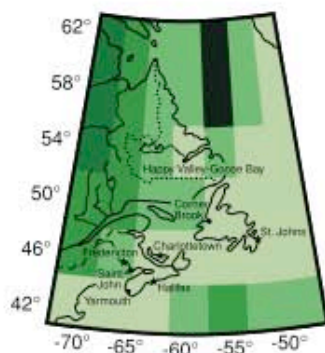
Fall (SON)



2050s



2080s



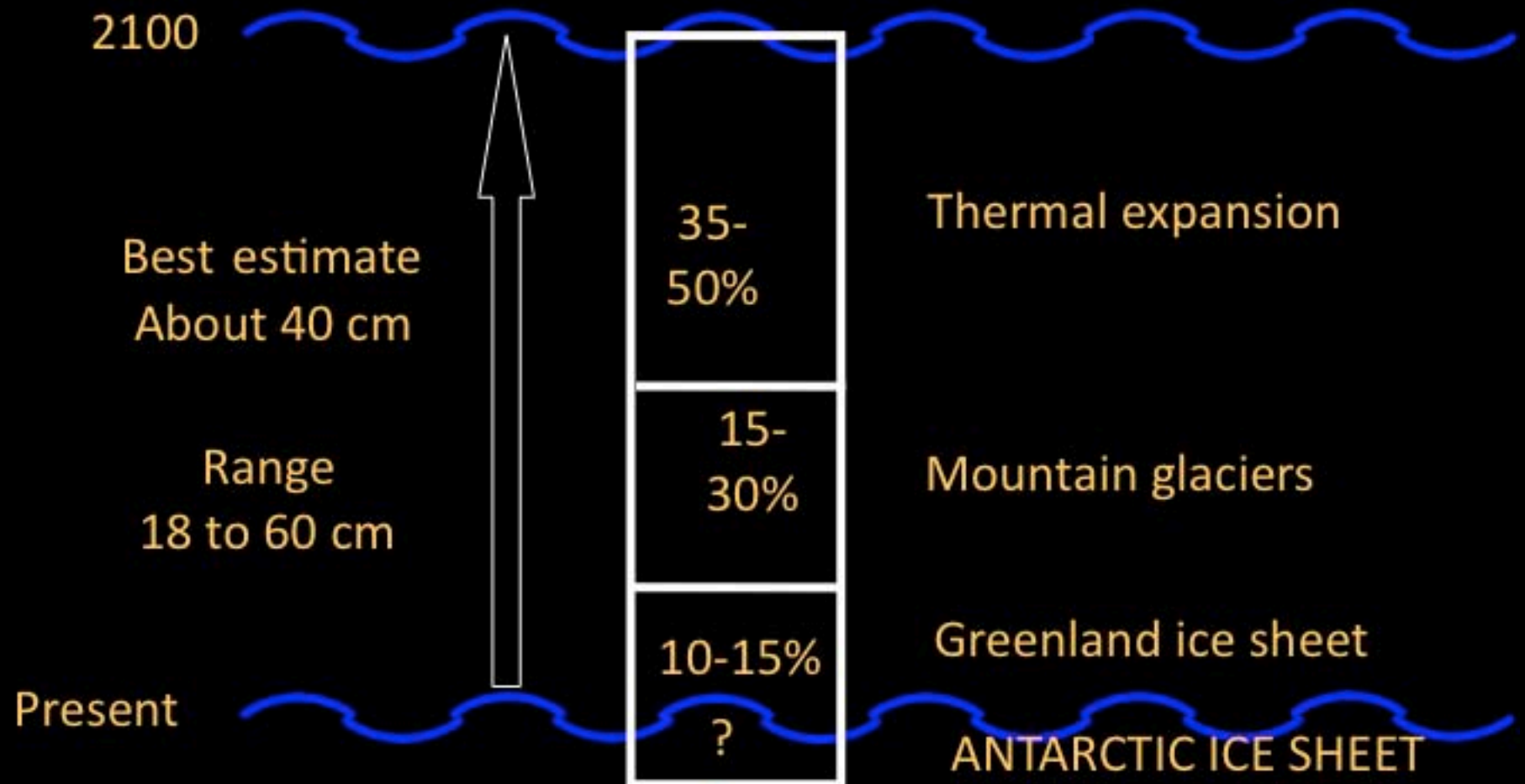
-50 -40 -30 -20 -10 0 10 20 30 40 50

Precipitation Change (%)

NRCan, 2008

# *Projected global sea level rise to 2100*

IPCC, 2007



# Coastal sensitivity to sea level rise

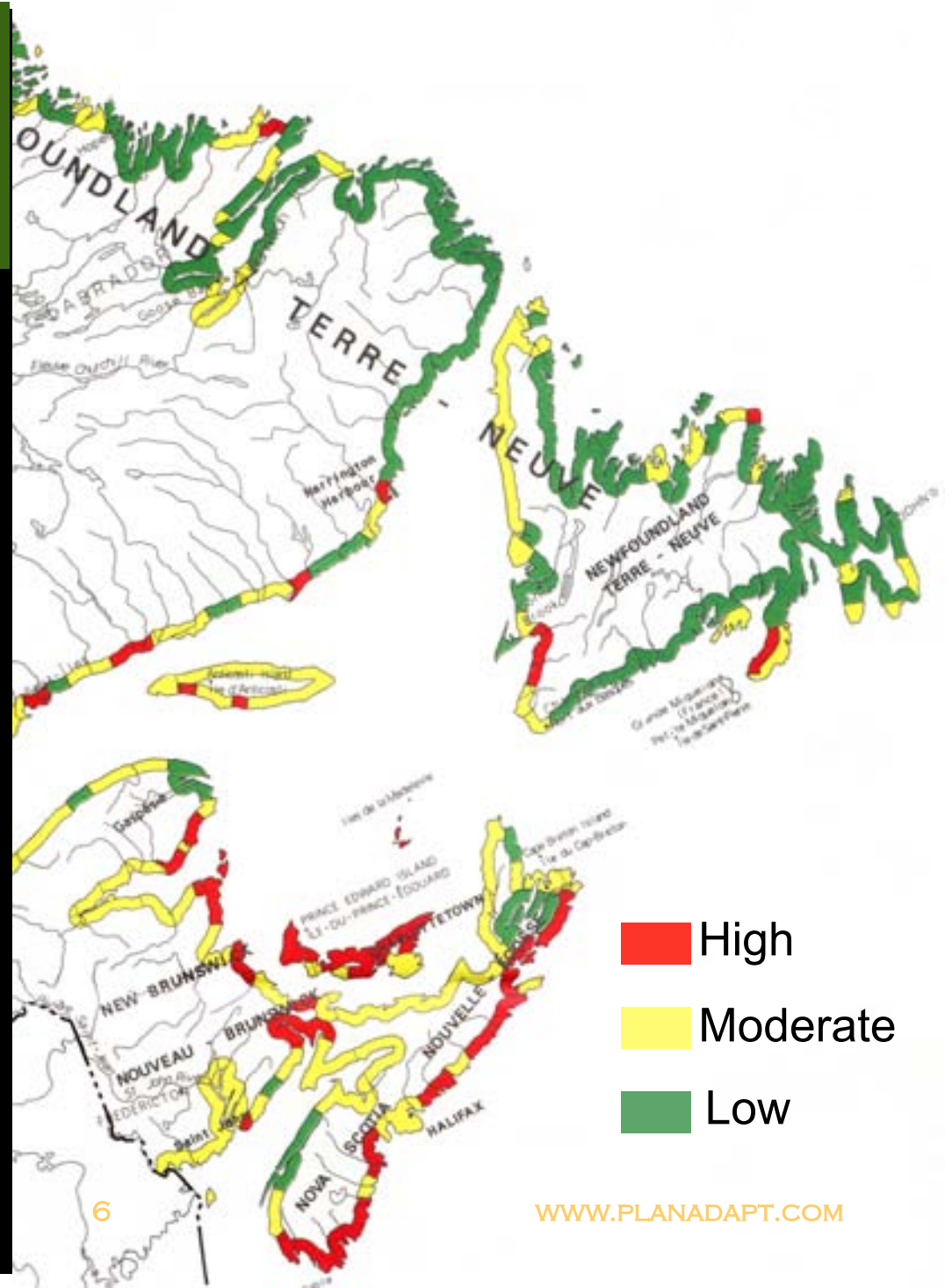
Risk from sea level rise influenced by:

- coastal elevation
- rock type
- wave heights
- land rising / falling

Land is subsiding in Maritimes and southern Newfoundland by about 30 cm per century.

Atlantic Region has the greatest length of sensitive coast in Canada.

Source: Geological Survey of Canada Bulletin 505,  
*Sensitivity of the Coasts of Canada To Sea Level Rise*, 1998.





# *Natural resources*

- Forests
  - Can't move fast enough to keep up with changing climate
  - Stressed forests will be more vulnerable to pests and extreme events
- Agriculture
  - Potentially most susceptible, yet also most adaptable sector
  - Water management may be biggest challenge
- Fisheries
  - Changes in species distribution and timing
  - More dynamic marine environment



# *Generalizing the Future*

- Warmer, wetter winters
- Warmer, drier summers
- Higher mean sea-level
- More storms
- More flooding
- More coastal erosion and deposition
- Disruption of social and economic systems





# *Climate Change Adaptation*

- modifications to natural and/or human systems in response to changes in the environment or climate (IPCC 2001)
  - biological, physical, technical, institutional, economic, behavioural
- reasons
  - some climate change will happen
  - being prepared
  - resilience to current climate variability
- we can reduce some impacts of climate change; for other impacts, adaptation is not possible or practical



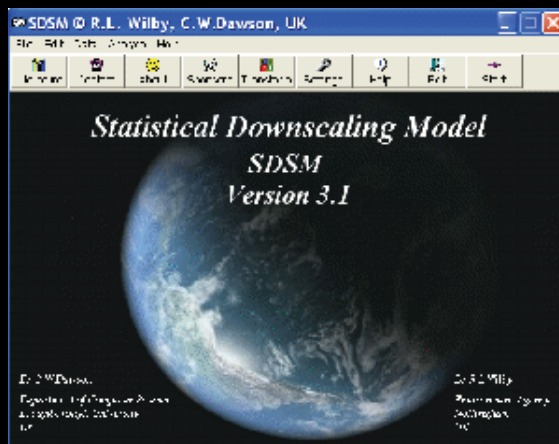
# Examples

- Annapolis Royal, N.S.
- Le Goulet, N.B.
- Halifax, N.S.

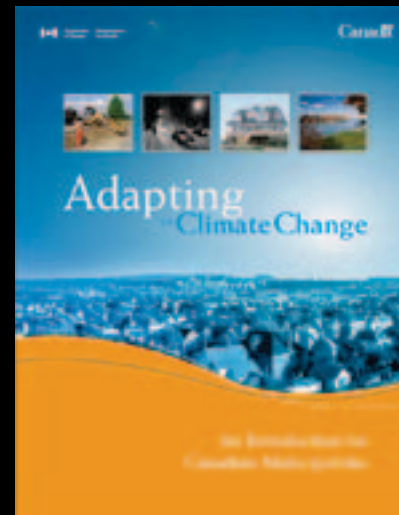


# Adaptation Resources

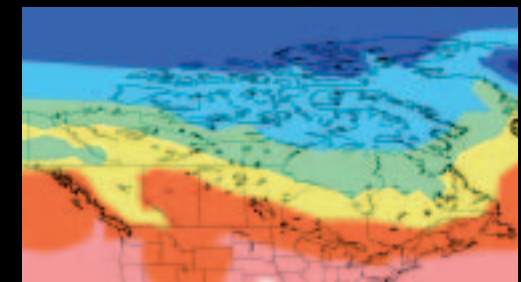
- Background, research, tools, guides ([www.adaptation.nrcan.gc.ca](http://www.adaptation.nrcan.gc.ca))
- Canadian Climate Change Scenarios Network ([www.cccsn.ca](http://www.cccsn.ca))
- C-CIARN Atlantic ([www.c-ciarn.com](http://www.c-ciarn.com))
- Climate Change Adaptation Community of Practice ([www.ccadaptation.ca](http://www.ccadaptation.ca))
- Provincial governments



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# Driving the CC adaptation process



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# Driving the CC adaptation process

		Anticipatory	Reactive
Natural			<ul style="list-style-type: none"> <li>•Change in length of growing season</li> <li>•Change in ecosystem composition</li> <li>•Wetland migration</li> </ul>
Human	private	<ul style="list-style-type: none"> <li>•Purchase of insurance</li> <li>•Preapproved siting for house construction</li> <li>•Redesign of equipment</li> </ul>	<ul style="list-style-type: none"> <li>•Changes in farm practices</li> <li>•Changes in insurance premiums</li> <li>•Purchase air conditioning</li> </ul>
	•public	<ul style="list-style-type: none"> <li>•Early warning systems</li> <li>•New building codes</li> <li>•Incentive for relocation</li> </ul>	<ul style="list-style-type: none"> <li>•Compensatory payments, subsidies</li> <li>•Enforcement of building codes</li> <li>•Beach nourishment</li> </ul>

## *Driving the CC adaptation process*





# *Municipal Climate Change Action Plans in Nova Scotia*

“How will climate change affect places, property, public facilities, infrastructure, people, regional and local economies, and environment.

Will largely focus on identifying impacts based on historical experiences, identifying where those impacts occur, and then focusing geographically on those spots and identifying what infrastructure is there and is vulnerable / at risk.

Will consider social and economic ramifications of identified impacts, as well as impacts to natural areas.



Clean Nova Scotia,  
2008



# *The traditional approach*

## *Some Traditional Pitfalls . . .*

- Based on probabilities; uncertainty ignored
- Often decides more data is needed
- Bigger-hammer-thinking
- The most persuasive person rules
- Vulnerable to vested interests
- Inadequate time given to process
- Single-point forecasting









What strategies should be in the ICSP to address  
Climate Change impacts and bolster Mayberry's  
resiliency?



Think . . . What's your one question?





How often will we experience severe storms?

Will the federal government fund municipalities? How much?

What will insurance be like?

Will we have affordable energy?

Will we engineer our infrastructure differently?

What will the economy be like?

What will our local population be in 20 years?

Will we still depend on property taxes?

Will food be plentiful and accessible?

What will the climate do? emissions?

Will the province support emergency measures?

To what extent have climatic feedback loops been triggered?

What will people do for work?

Will adaptation be regulated? If so how?

What will infrastructure requirements be?

What will be our flood level in 25 years?

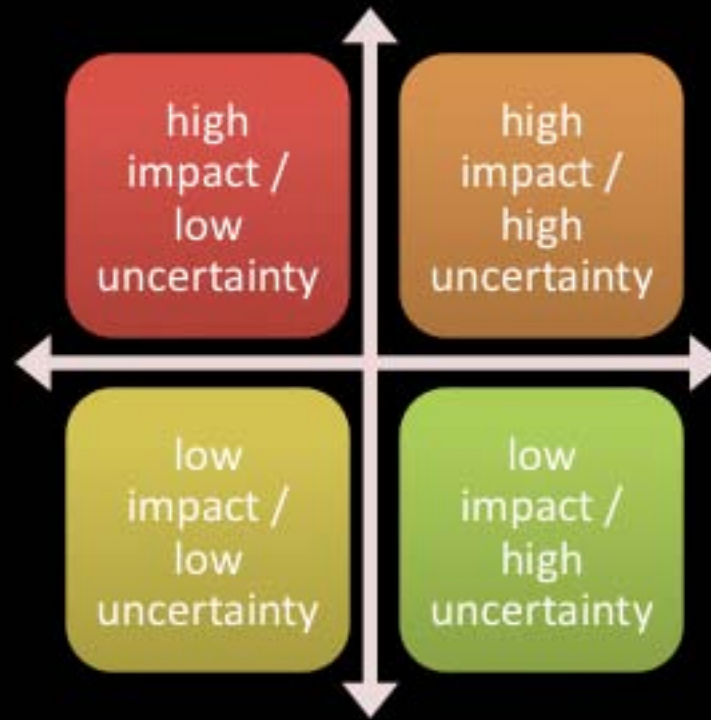


Governance Capacity	New Solutions & Services	Financial Systems	Climate System	Nature of Citizens
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Amalgamation	Gas tax transfer	Fresh water availability	Demographics	Election cycles	Citizen engagement
Youth education	Property taxation	Pressure for citizen safety & protection		Regional services	
Council employment	Debt load	Insurable property	Transportation infrastructure & Service	Policing services	
Health care	Property rights	Citizen safety & protection	Volunteerism	Planning requirements	Foreign land ownership
	Training	Planning at Prov level		Prov. Land mgt strategies	
Improvements in building sciences		Development trends	Migration shifts	UN conventions	Education
Electricity deregulation	Land protection	Pressure for citizen safety & protection		Regional services	
Transportation fuel costs	Debt load	Voter / citizen preferences	EMO resources and preparedness	Infrastructure replacement needs	
Job types	CDN conversion	Prediction technologies	Coastal erosion rates	Wastewater regulations	
	Mapping resources		Coastal land mgt strategies		
Political will					



Now . . . What forces are  
High Impact / High Uncertainty?

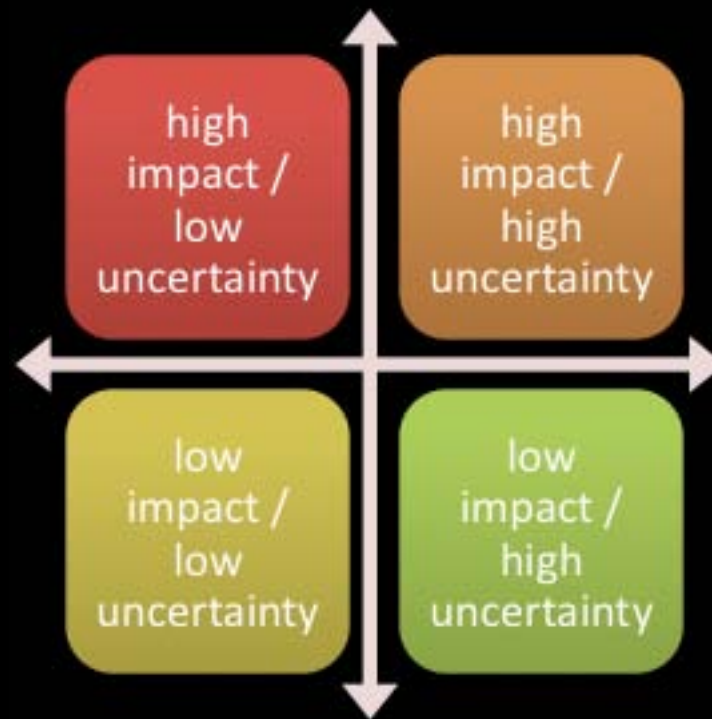






Common  
elements in all  
scenarios

Used to fill in  
scenario details



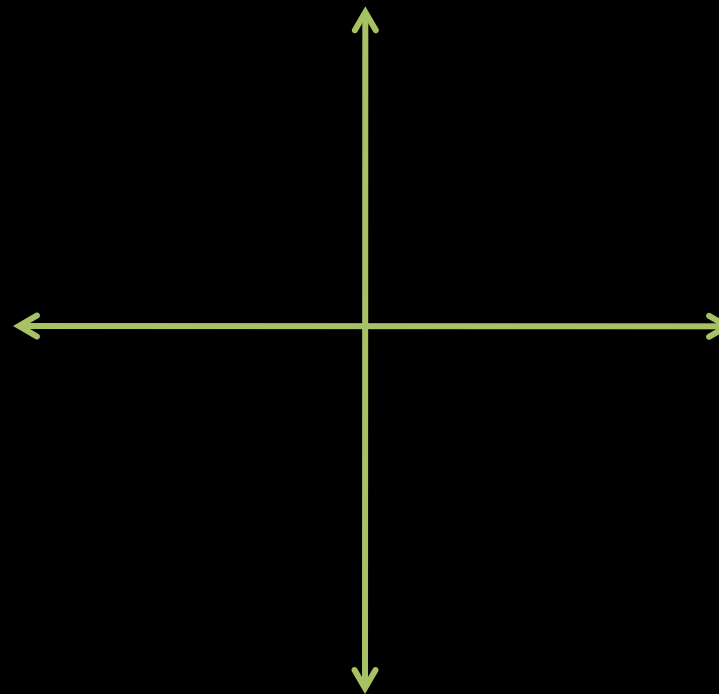
Story lines for  
how future could  
work

Used to fill in  
scenario details



Environmental Stress

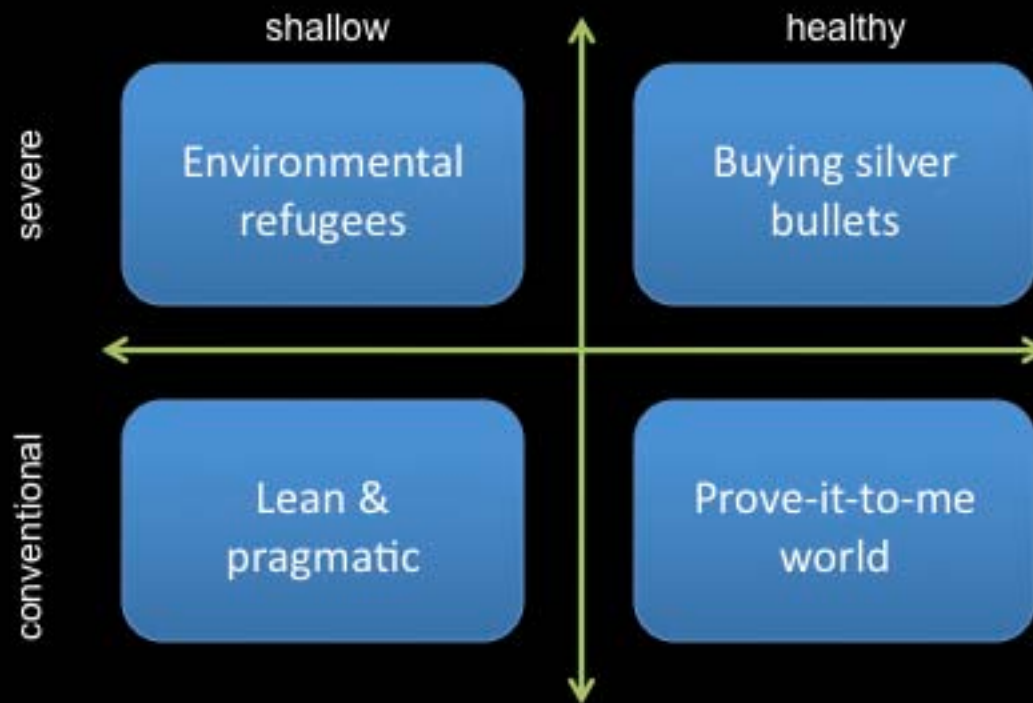
Financial Capacity





## Financial Capacity

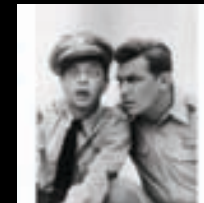
### Environmental Stress







- Brief Description
  - highlight major forces at work
- Narrative
  - beginning, middle and end
  - has conflict
  - present tense
  - uniqueness
  - 2-3 pages
- Comparison Table
  - shows how key elements play out





	Environmental refugees	Buying silver bullets	Lean & pragmatic	Prove-it-to-me world
Laws & regulations	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Technology	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Economics	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Catastrophes	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Social trends	<p>Many coastal communities and select riverside properties abandoned. Fisheries industry decimated and agricultural sector subsistence only, resulting in highest unemployment rate in region in over 200 years. Multi-generations living together. Buyer's housing market. . . .</p>	<p>People willing to invest in alternative energy, but development patterns don't change. Food and energy prices increase, as does disparity between rich and poor. Migration out of major cities, slight population increase in east . . .</p>	<p>Regional population fairly stable. Do-it-Yourself trends very popular. Employment in natural resource sectors declining slightly, and training in skilled trades increasing. Enrollment in Universities decreases. Region still tops the nation in charitable giving. Government jobs in cities still number one regional employer . . .</p>	<p>People's level of consumption &amp; preferences haven't changed relative to the start of the millennium. Most people live and work from home in cities, with technical and white collar jobs increasing in the region. Birth rate is down slightly. Coastal property still sought after-people just building sea walls . . .</p>



## Moving from Scenarios to Decisions . . .



1. ID opportunities and threats
2. Assess effectiveness of ICSP in each scenario
3. How does the ICSP need to change? – strategies
4. Evaluate Strategy ideas using criteria





## Rehearsal Time!

- ID opportunities and threats
- Assess effectiveness of ICSP in each scenario
- How does the ICSP need to change? - strategies
- Evaluate Strategies ideas using provided criteria
- Present your favorite

# *Scenario 1: Environmental refugees*

(shallow financial capacity, severe environmental stress)

- Population is stagnant
- fishery is still the main economic activity, but is struggling to adapt
- boats have to go further offshore in more dangerous conditions
- federal fishing regulations aren't changing fast enough to accommodate changes to fish patterns
- effort to become a tourism destination failed when newly restored heritage buildings and waterfront boardwalk were destroyed in a hurricane
- 'boat people' keep coming ashore from Caribbean countries and stretch the town's resources to provide for them (U.S. coastline is too well guarded)

## *Scenario 2: Buying silver bullets*

(healthy financial capacity, severe environmental stress)

- Economy has shifted from resource-based to tourism and knowledge-based
- tourists, seasonal residents, and retirees from central Canada
- cruise ship passengers from New York and Boston
- fresh water shortages in the summer because reservoir is too small
- More young people are staying because it's now a hip place to live
- Fishery is down but recreational activities on the water are way up (boating, surfing, etc.), but too many people are now out on the water in dangerous conditions
- Boat building is way up because luxury sail boats are the new motor homes (it's post peak oil)
- Difficult to procure wood for boats because the Maritime forest industry planted the wrong trees way back in the 2000s
- Tax base is way up because of luxury seasonal homes
- Seasonal residents build homes too close to the water because they're not here to witness winter storms
- Too many old people are overwhelming the health care and social services
- New tropical diseases are showing up



# Monitoring Program

## Governance Capacity

## New Solutions & Services


## Financial Systems

## Climate System

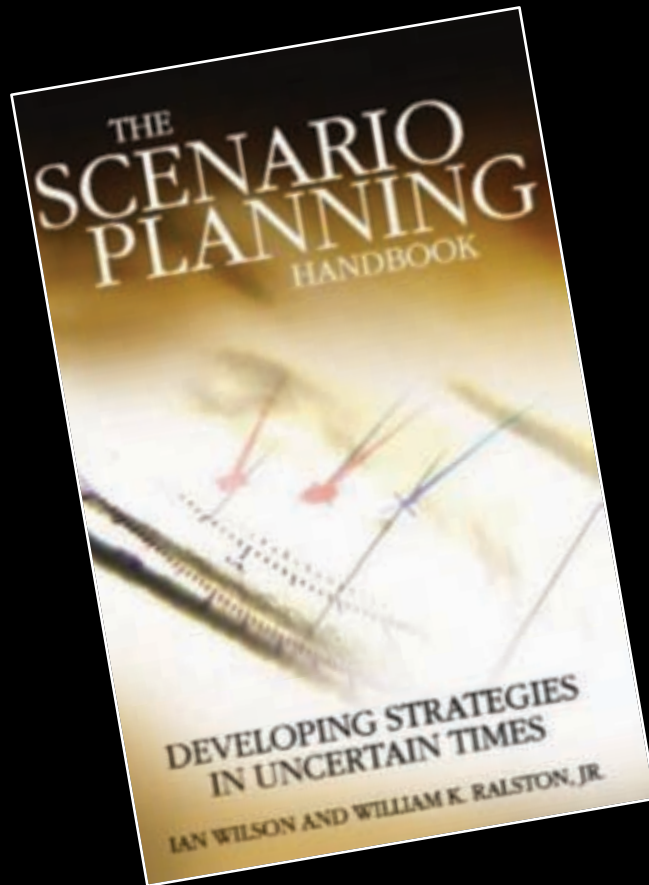
## Nature of Citizens

Amalgamation	Gas tax transfer	Fresh water availability	Demographics	Election cycles	Citizen engagement
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Political will					

# Monitoring Program

Forces	Indicators	Measures	Signposts
Regulatory/eco-factors	Increasingly harmonized & stricter env. regulations	Global treaties implemented	Global CO <sub>2</sub> reduction treaty implemented
		Directives on fuel quality are improved and spread	EU fuel quality directives adopted by other regions
		Increasing use of lists of 'bad' products	# of chemical products on toxic lists increases by ____ %
		Government support for environment	

# *Change-oriented culture*

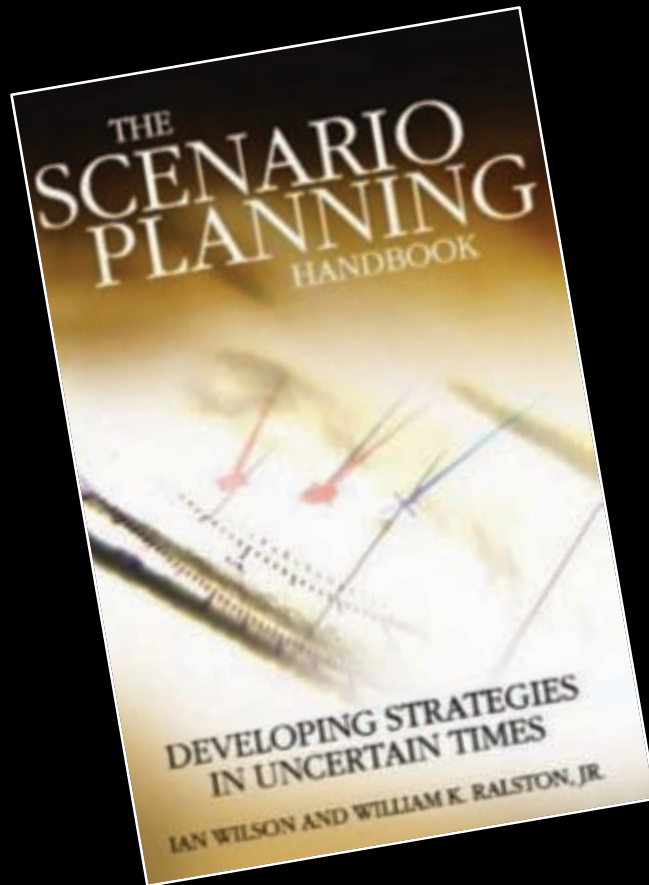


*The old order “will always seek to reassert itself and relegate scenarios to, at best, a position of merely interesting studies of the future.”*

vs.

**Adaptive Organizations**

# *Change-oriented culture*



## *Adaptive Organizations:*

- Constantly consider & prepare for the future
- Decision making amidst uncertainty is a competence
- Are monitoring forces & responding



# *Thank You!*

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