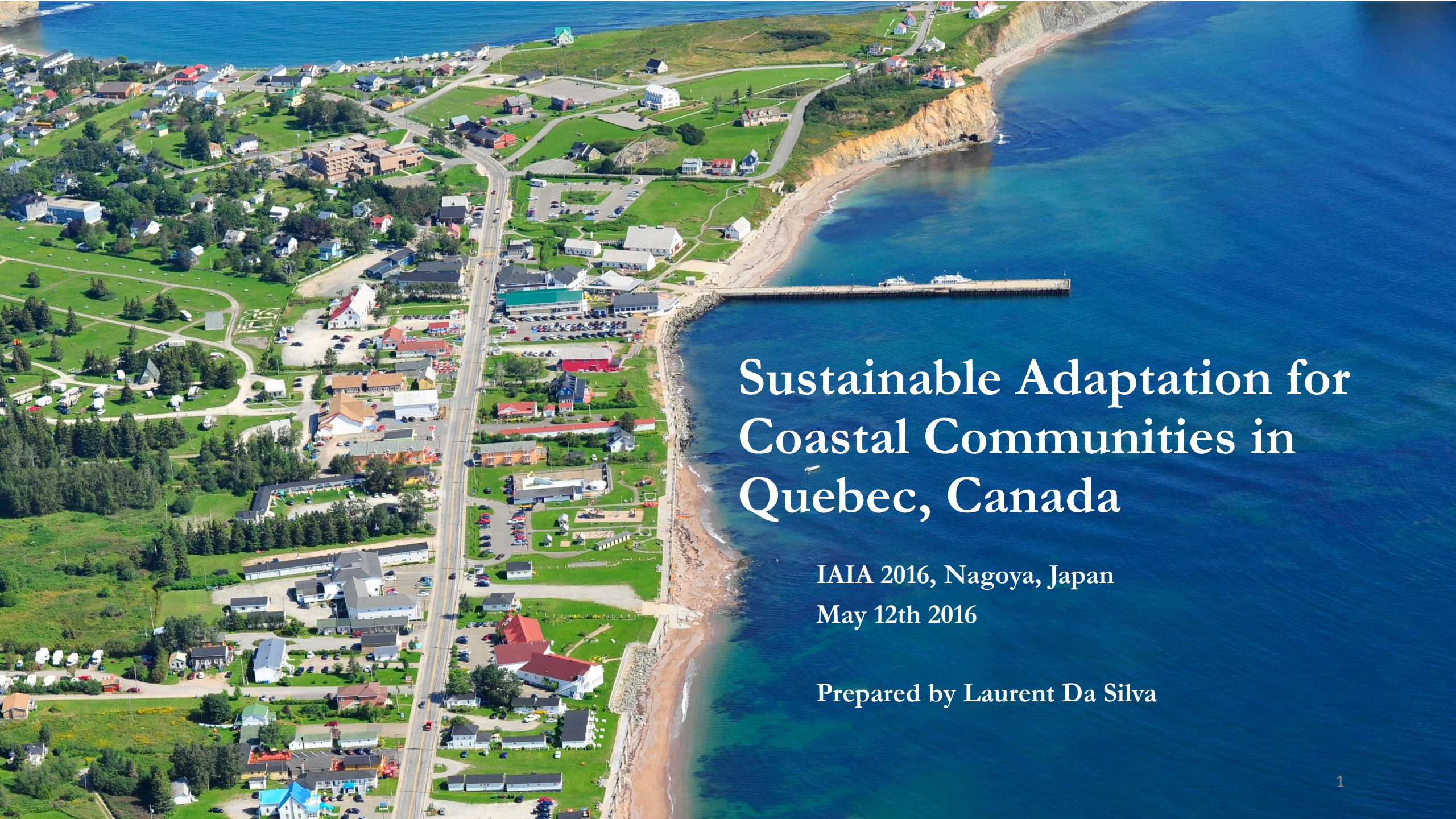

Sustainable Adaptation for Coastal Communities in Quebec, Canada

IAIA 2016, Nagoya, Japan

May 12th 2016

Prepared by Laurent Da Silva

Project context

- Co-funded by :
  - Natural Resources Canada
  - Environment Ministry of Quebec
  - Ouranos Inc. (Regional climatology and climate change adaptation)
  - Other partners (universities, municipalities, ministries)
- Research lead: Ouranos Inc. (www.ouranos.ca)
- Main research partner : *Chaire de recherche en Géoscience côtière de l'Université du Québec à Rimouski (UQAR)*

Laboratoire de dynamique et de gestion intégrée des zones côtières | UQAR

Project context

Project
CC coastal areas
CBA and IA
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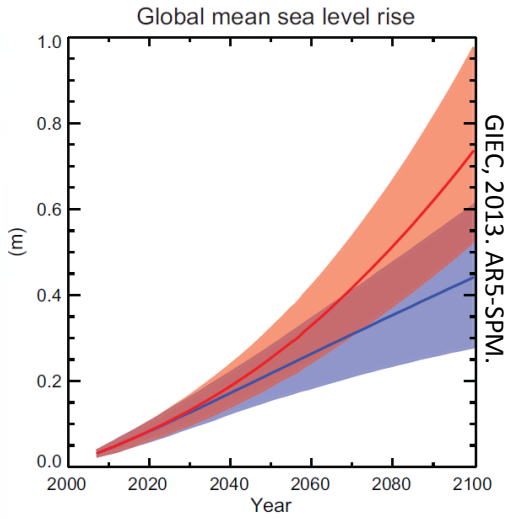
Three main tasks

1. Assessing the economic impacts of coastal erosion in Quebec in a climate change context
2. Analyzing the costs and benefits of various adaptation options to erosion and flooding hazards in coastal areas
3. Sharing lessons learned from the economic analyses completed in Quebec and the Atlantic provinces

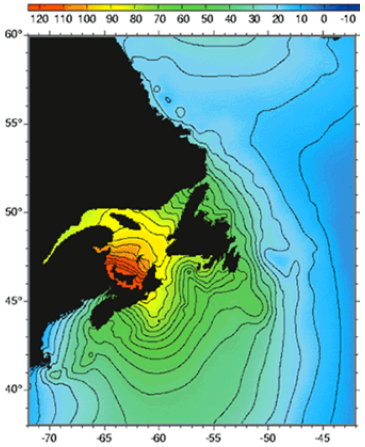
Project context

Climate change in coastal areas

1. Sea level rise	2. Reduced ice-cover	3. Increased freeze-thaw cycle	4. Changing extreme events patterns



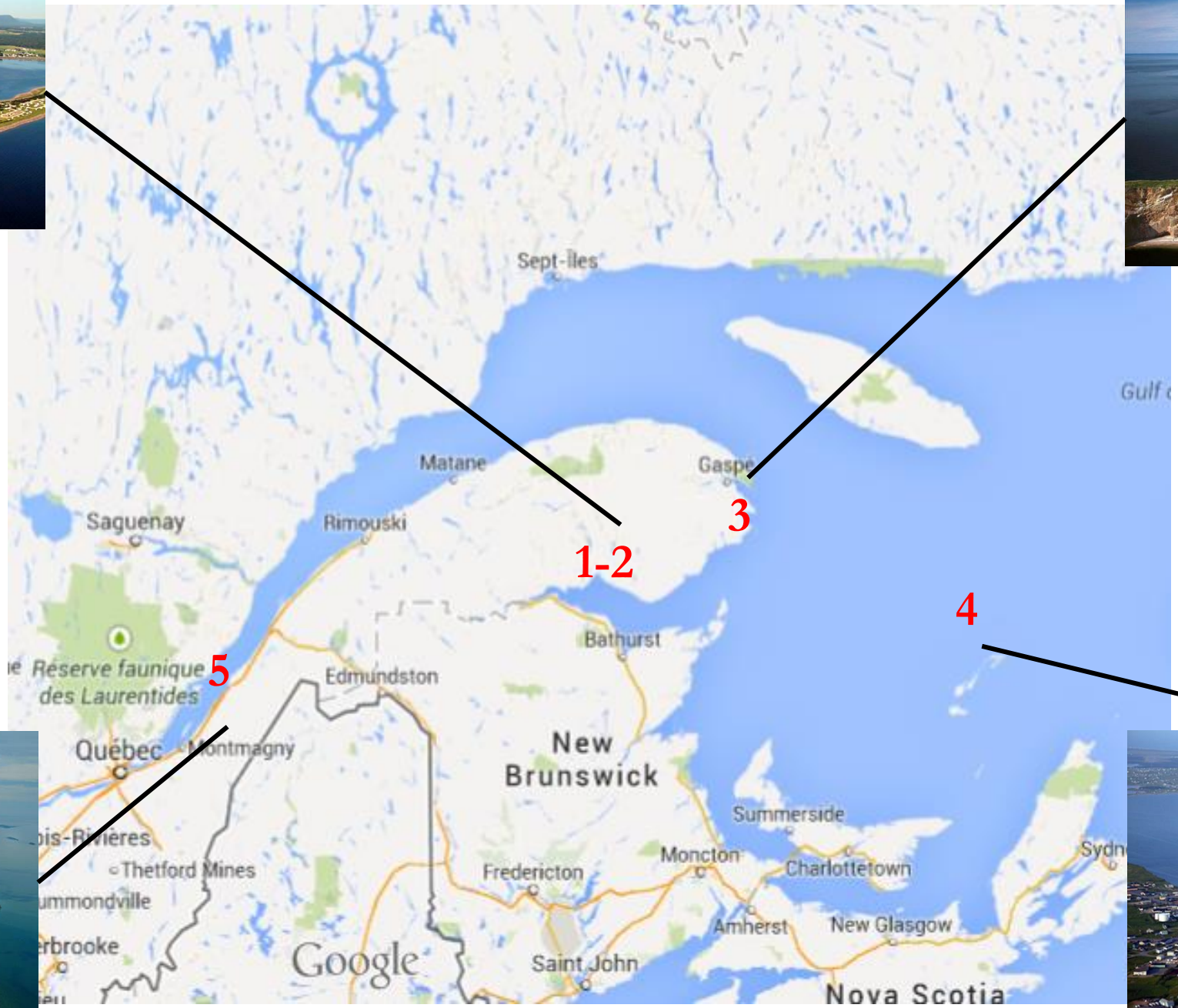
Pied de glace (Percé, Gaspésie). Photo :



In Quebec in the next 50 years:

- More than 5 000 buildings at risk
- More than 300 km of roads and railways at risk
- This translate into more than 1.5 billion $ of potential damages


PERCÉ


Sept-Îles
Matane
Gaspé
Saguenay
Rimouski
Bathurst
Réserve faunique des Laurentides
Edmundston
Québec
Montmagny
New Brunswick
Summerside
Thetford Mines
Moncton
Charlottetown
Fredericton
Amherst
New Glasgow
Saint John
Google
Nova Scotia
Gulf

1-2

3

4

5

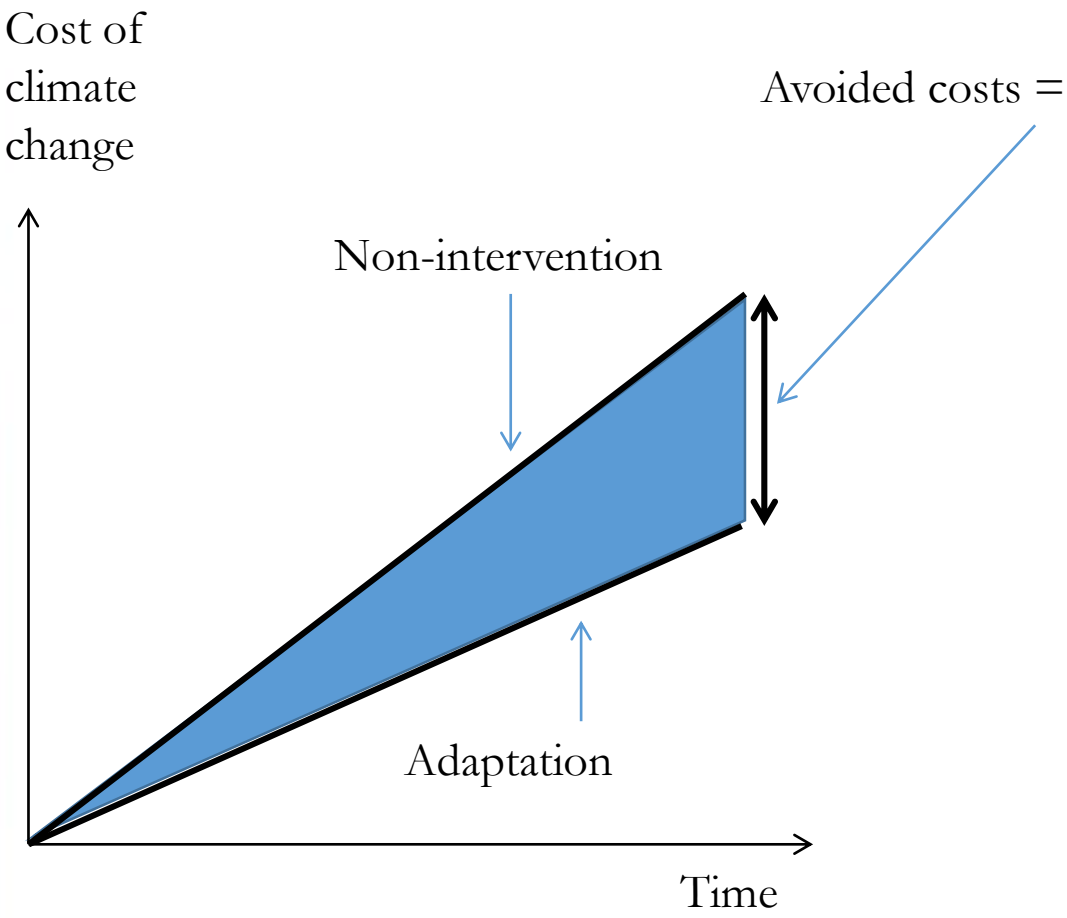

SAINT-ANDRÉ

CBA basics

Why using Cost-Benefit Analysis (CBA) for climate change adaptation?

- Bridge the gap between research and policy making
- Provide a decision-making tool (NPV, CBR, IRR) by allowing to compare the costs and benefits of various adaptation options (measures, strategies)
- Identify the most efficient adaptation measure (or option) from a society's point of view
  - Including environmental, social and economic impact: lost of seaview, destruction of natural habitats, diminution of insecurity, etc.

CBA basics



Estimate the cost of non-intervention

↓

Identify adaptation measures

↓

Identify, quantify and monetize the impacts of non-intervention and adaptation measures

↓

Compare costs and benefits of adaptation measures and non-intervention

CBA basics

Basic assumptions

- Study period: 50 years
- *Status quo* over the study period
- Discount rate over 50 years: 4%

$$NPV = \sum_{t=1}^{T} \frac{B_t}{(1+i)^t} - \frac{C_t}{(1+i)^t}$$

$$CBR = \sum_{t=1}^{T} \frac{C_t}{(1+i)^t} \Big/ \sum_{t=1}^{T} \frac{B_t}{(1+i)^t}$$

NPV: Net present value
CBR: Cost-benefit ratio
B: benefits
C: costs
i: discount rate
t: year

CBA and IA

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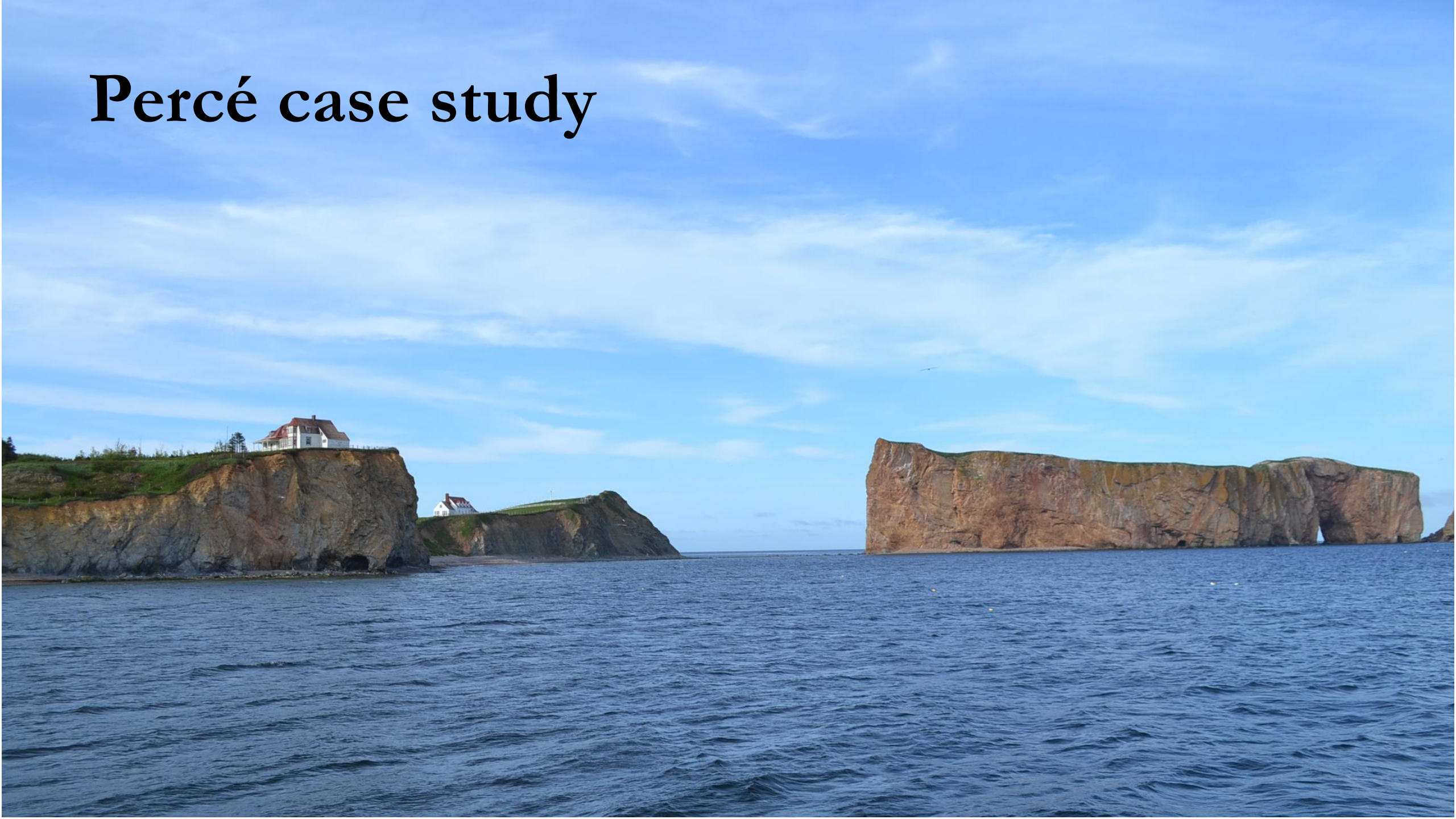
Why combining CBA and IA?

- Allows to integrate in the analysis of adaptation options the environmental, social and economic costs and benefits
- Provides a thorough analysis of alternatives
- Helps to gain social acceptability by considering all project's impacts into the economic analysis
- Points to the most important and most valued impacts for stakeholders

Type or source of costs and benefits	Costs originating from negative impacts	Benefits originating from positive impacts
Related to erosion	- Loss of land - Loss of residential or commercial buildings - Loss or damage to public infrastructure - Emergency evacuation	
Related to flooding	- Damage to land - Damage to residential or commercial buildings - Damage to public infrastructure - Emergency evacuation - Traffic congestion or detour - Debris clean-up	
Economic	- Reduced land value - Loss of goods and commercial revenues - Loss of trade - Loss of tourism revenues - Loss of fishing revenues	- Gain in tourism revenues
Environmental	- Loss of natural habitats - Loss of fish spawning grounds	- Improvement in natural habitats - Improvement in fish spawning grounds
Social	- Loss of sea view and access - Decline in the coast's recreational use - Reduced quality of life (anxiety, insecurity, etc.) - Deterioration in the landscape - Deterioration in historical and cultural heritage	- Improvement in the coast's recreational use - Improvement in quality of life (security) - Improvement in the landscape

Percé case study



1. Non-intervention

2. Beach nourishment (BN)

3. Beach nourishment with groynes (BNG)

4. Riprap (RR)

5. Rubblemound revetment (RV)

6. Seawall with deflector (SD)

Percé Case Study

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Major impacts considered in the CBA:

Environment:

Disruption of spawning areas

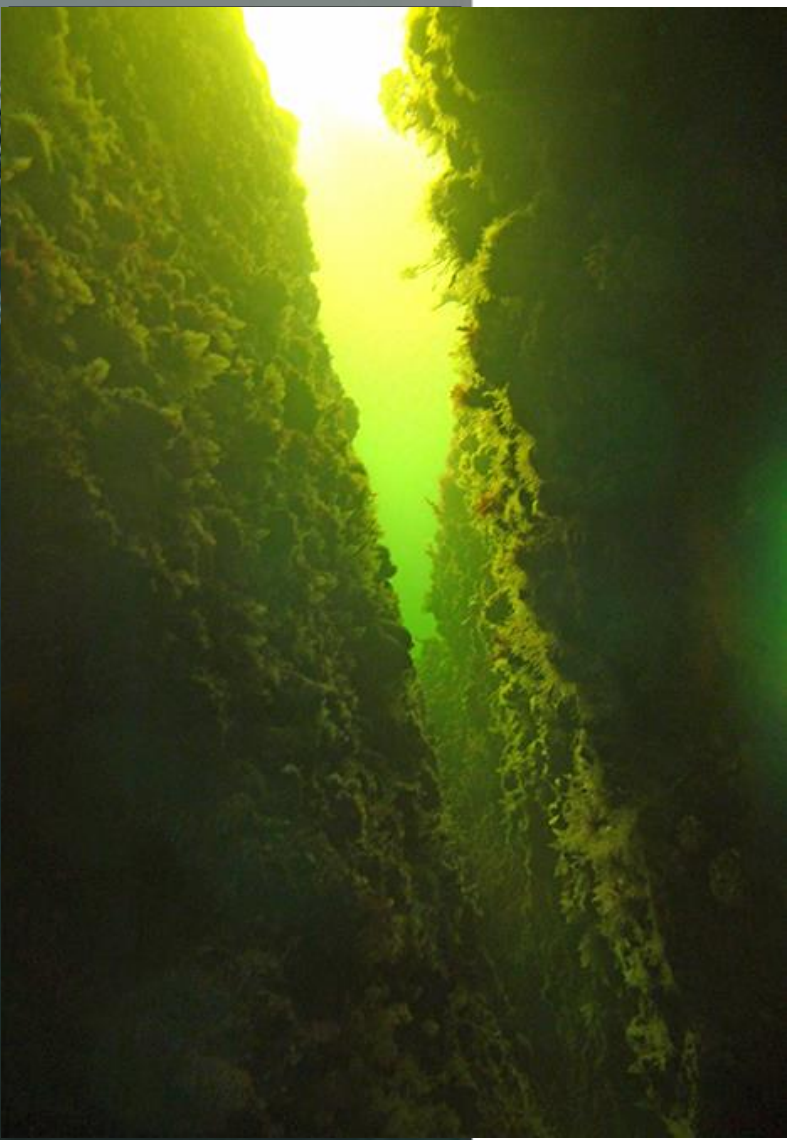
Destruction of lobster habitat and biodiversity

Economic:

Change in regional tourism traffic

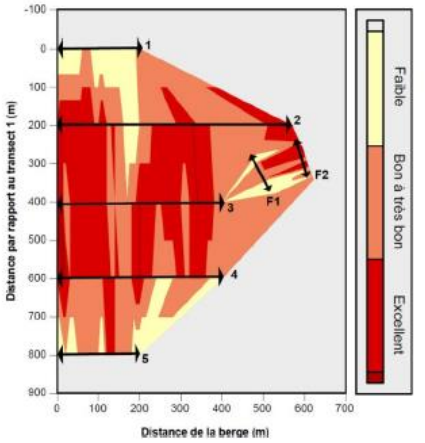
Lost productivity of lobster fishing

Percé Case Study



Preliminary characterization of the seabed

- Changes in natural habitats
- Delimitation of good and poor lobster habitat
- Compensations calculated according to the sea encroachment area for each solution
- Construction cost of an artificial reef



Source : RPPSG (2014)

OURANOS

Project

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Percé Case Study

Variation in the number of nights spent in the Gaspesie region

	Number of nights/year	Economic impact compared to present situation	Impact in %
Present situation	1 524 546		
Non-Intervention	1 205 020	(41 665 451) $	- 21 %
Rubblemound revetment	1 370 168	(20 116 296) $	- 10 %
Riprap	1 362 603	(21 017 495) $	- 11 %
Seawall	1 406 455	(15 195 273) $	- 8 %
Beach nourishment	1 559 294	4 274 289 $	+ 2 %
Beach nourishment with groynes	1 550 190	3 363 414 $	+ 2 %

Beach replenishment

Back to a natural coastline

Protection against storm surge and against erosion

Improvement of access and recreational use of the sea

Improvement of the landscape

Increase in tourism traffic in the Gaspesie region by 2 % (35 000 nights/year)

Lessons learned

Consultative approach as in IA

- Ongoing dialogue over the 2-year study period
- Contribute to easing the data access
- Raise the results acceptance
- Increase endorsement

Combining CBA and IA can bring important benefits

- Documentation and quantification of most of the major impacts that will be studied in the IA

Lessons learned

Integrate climate change in the analysis

- Many projects don't integrate climate change in their design or in the IA
- Overlooking climate in CBA or in IA can lead to poor investment and maladaptation

Quantify and document non financial impacts

- Highly important for projects financed with public funds
- Can lead to implementing another alternative than the most financially profitable

Lessons learned

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Sustainable coastal communities

- Communities are tooled with a mass of information to make well-informed decision making
- Provides a framework to analyze and synthesize this information
- Raise awareness of climate change impacts in the future
- Engage and empower by the consultation and knowledge transfer process

Thank you for your attention!

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Economist

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