

# How do salt marsh restorations help us adapt to sea level rise in Atlantic Canada?

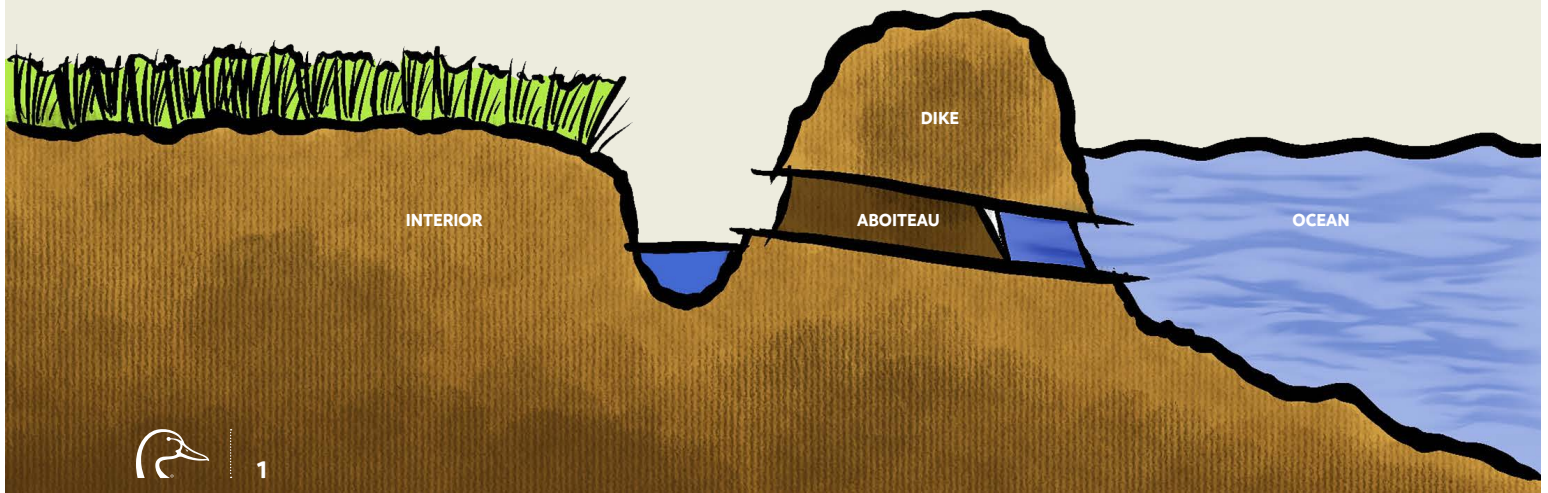
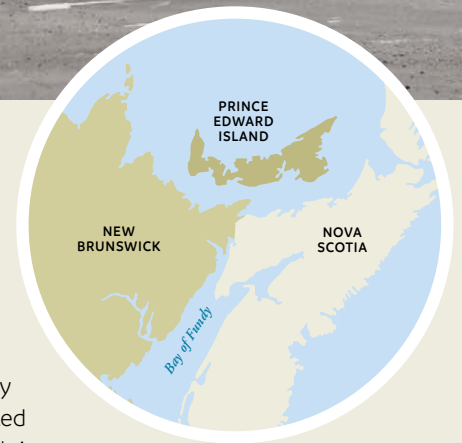
## THE SEA LEVEL RISE CASE STUDY

The Acadian Dykelands are a part of history that have shaped some of the coastal landscapes in Nova Scotia and New Brunswick, mainly along the Bay of Fundy.

Colonialism started in Canada when European explorers arrived in the 1600s on this land, home to the members of the Wabanaki Confederacy. These settlers, known today as Acadians, decided to use the lowlands (salt marshes) for agriculture, when they realized these lands had more potential for agriculture than the uplands, which consisted of cliffs and heavily forested areas. In the lowlands, soils from the salt marshes were rich in nutrients that the plants trapped when tide-water flowed in and out onto that land.

Acadians decided to build structures known as dikes (man-made walls) and aboiteaux (structures designed to keep saltwater from flowing in but allowing freshwater to leave during mid and low tides), to start using that fertile land for agriculture. This early ingenuity in technology allowed agriculture to take place on lands that were not suitable otherwise. However, over the next 400 years, this agricultural practice helped contribute to the loss of 85 per cent of salt marshes found in the Bay of Fundy. In turn, this had repercussions on the cultures of the Wabanaki Peoples and the natural ecosystems they had relied upon for generations.

*Below: Dikes are walls constructed of soil built to stop saltwater from entering salt marshes. An aboiteau is a tunnel with a flap built into the dike. At low tide, the flap opens to allow freshwater captured within the dike to drain from the land to the ocean (if not, freshwater would accumulate on the land to become artificial lakes). During high tide, the flap closes; this prevents saltwater from flowing back onto the land. Over many years, the former salt marsh loses much of its salinity and as a result, the land becomes suitable for agriculture.*



At the start of the 20th century, the Canadian economy was struggling. The price of hay went down and farmers had less money to invest in the maintenance of the dikes. Then, the Great Depression hit in 1929, which meant there was little to no money available to maintain the dikes. Lack of maintenance caused some of the dikes to fall apart. Since that time, the federal and provincial governments have invested money to repair and maintain the dikes. Meanwhile, the way communities use the land that the dikes protect has also changed. Some agricultural land has been abandoned and new buildings, offices, malls, homes and transportation routes have been built over the fields. Some neglected dykelands have also since been restored to natural salt marshes.

Today, the consequences of climate change — which include sea level rise and the increasing severity of storms — is putting coastal areas under a lot of pressure, including on the aging dikes. Comparing the 2050 climate projections to the current dikes' capabilities indicates that the dikes will not be sufficient to protect the inland from sea-level rise and storm surges.

**We need to prepare for sea-level rise but how do we best adapt? What are the possible solutions? Is it one or multiple combined approaches that can help? This is what you will research and explore throughout this case study.**



*Ducks Unlimited Canada would like to acknowledge the ancestral and unceded territory of the Wabanaki Confederacy, whose land was developed into the Acadian Dykelands by European settlers dating back to the early 1600s, which is the land this case study alludes to. This territory falls within the Peace and Friendship Treaties signed by the Mi'kmaq, Wolastoqey, Passamaquoddy and Penobscot peoples prior to 1779, and recognizes and affirms the existing rights of Indigenous Peoples by the Canadian Constitution.*





## PART 1

**Location: Atlantic Canada**

**Before looking ahead for solutions, let's look at the past – perhaps it can show us a way forward. Answer questions 1-5 individually or in a group.**

- 1
  - a) Where is the Bay of Fundy?
  - b) Describe one special characteristic of the Bay of Fundy.
- 2
  - a) Which Indigenous Nations are members of the Wabanaki Confederation, and what is the geographical area of their ancestral homeland?
  - b) Describe how the Wabanaki historically used the land in the Bay of Fundy.
  - c) List, in chronological order, the different groups of explorers that settled in the Bay of Fundy and how they interacted with the Wabanaki (naming their dates of arrival, countries of origin and the languages they spoke).
  - d) Describe in general how the land use changed with the arrival of the explorers in 1600 to 1970.

**Today, climate change effects are already being felt in Canada. Let's look at what's ahead of us, so we can prepare a climate change adaptation strategy.**

- 3
  - a) How is climate change causing the sea level to rise?
  - b) What is the impact of a warmer ocean on storms?
  - c) What is the impact of those storms on coastal regions?
  - d) What can you do to help reduce climate change?
- 4 Research how much the sea is predicted to rise in Atlantic Canada by 2100.
- 5 What is the difference between a climate change solution and adapting to climate change?

## PART 2

**Now that we have a better understanding of what the natural landscape used to look like in the region and of climate change, let's start to think about how to adapt to, and at the same time, lessen climate change.**

There are multiple considerations to reflect on. Separate into groups, each group researching one consideration (A, B or C).

### Consideration A: Restore Salt Marshes

- 1 What is a salt marsh?
- 2 How can salt marshes protect us from sea level rise and storm damage?
- 3 How can salt marshes help us reduce greenhouse gases?
- 4 What benefits (ecological, societal and economic) do salt marshes provide?
- 5 What is the process to convert a dykeland back to a salt marsh?
- 6 What might be the type of permits and or assessments that need to be completed? Why?





- 7 What kinds of human activities/interests would benefit from restoring salt marshes?
- 8 Once a salt marsh is restored, how much maintenance does it require?
- 9 Find examples of restored salt marshes in the Atlantic region.
- 10 Is a salt marsh a climate change solution or climate change adaptation?

### Consideration B: Improve Dikes

- 1 What is a dike?
- 2 How many miles of dikes exist in Nova Scotia and when were they constructed over time?
- 3 Research other countries that have a similar dike system to the Atlantic Coast.
- 4 Today, what is the use of the land that the dikes are protecting?
- 5 In general, what needs to be done to maintain a dike in good condition?
- 6 What needs to be done to the current dikes to protect us from sea level rise?
- 7 Is a dike a climate change solution or climate change adaptation?

### Consideration C: Involve the Community

- 1 What is consensus?
  - a) Briefly explain consensus in a sentence or two.
  - b) What are the benefits of using consensus decision-making?
  - c) What are the drawbacks of using consensus decision-making?
  - d) What are some challenges you think can arise from land that is used in different ways for different reasons by different people?
- 2 What is change?
  - a) Briefly explain change in a sentence.
  - b) Identify the multiple changes people of the region are being confronted with today.
  - c) Why can change be difficult?
  - d) List the benefits that residents of the Bay of Fundy will gain, if they adapt to the sea level rise quickly and if climate change solutions are taken.
- 3 What is a climate change adaptation plan?
  - a) Briefly explain climate change adaptation in a sentence or two.
  - b) List the different Indigenous communities/individuals/groups/government departments to include.
  - c) List the different perspectives each participant will bring to the discussion.
  - d) How would you weigh everyone's perspectives in a decision-making process?



## Helpful Terms

**Dikes and levees:** Man-made walls or embankments built to prevent flooding from the sea, rivers or lakes.

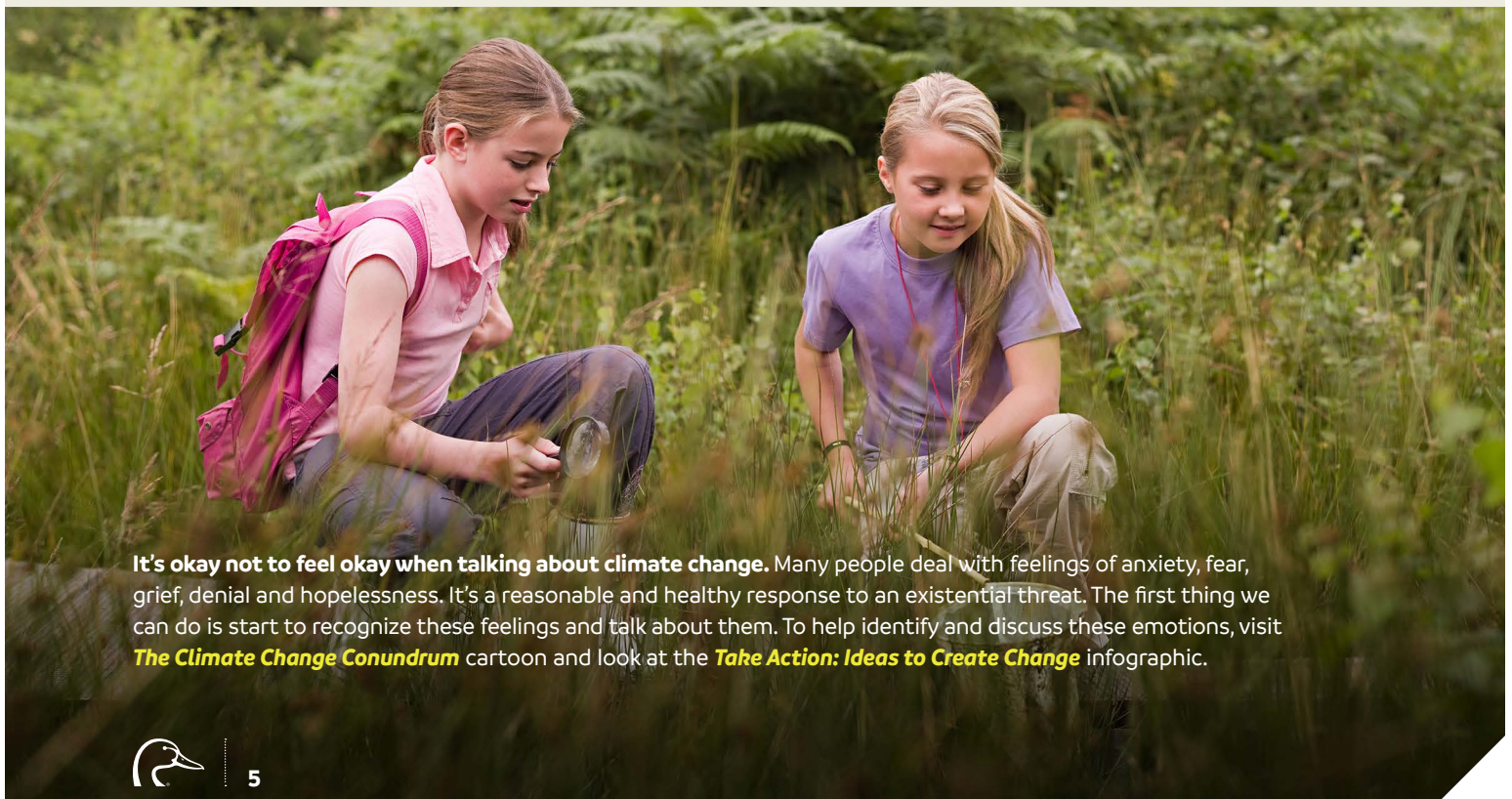
**SLR:** Abbreviation for sea-level rise.

**Climate change:** A change in the average conditions—such as temperature and rainfall—in a region over a long period of time. NASA scientists have observed Earth’s surface is warming, and many of the warmest years on record have happened in the past 20 years.<sup>1</sup>

## Useful links to start your research

- + CTV News: Projects will help Nova Scotia prepare for rising sea levels, storms  
<https://atlantic.ctvnews.ca/projects-will-help-nova-scotia-prepare-for-rising-sea-levels-storms-1.4383685>
- + Ducks Unlimited Canada, 2019, On The Rise – DUC & Sea Level Rise. 4:09.  
<https://youtu.be/IA6KNU4zkhs>
- + Government of Nova Scotia: Dykelands  
<https://novascotia.ca/natr/wildlife/habitats/dykelands/>
- + Government of Nova Scotia: Office of Aboriginal Affairs  
<https://novascotia.ca/abor/office/what-we-do/negotiations/current-status/>
- + Maliseet Nation Conservation Council: <https://maliseetnationconservation.ca/#mncc-projects>
- + Mi’kmaq Conservation Group: <https://mikmaqconservation.ca/our-story/>
- + National Geographic: Examples of Dikes  
<https://www.nationalgeographic.org/encyclopedia/dike/>
- + Native Land Digital Map: <https://native-land.ca/>
- + NSERC ResNet Strategic Network: Bay of Fundy  
<https://www.nsercresnet.ca/landscape-1---bay-of-fundy.html>  
<https://novascotia.ca/agri/documents/MARITIME-DYKELANDS.pdf>
- + Unama’ki Institute of Natural Resources: <https://www.uinr.ca/>

<sup>1</sup> Earth Science Communications Team at NASA’s Jet Propulsion Laboratory/California Institute of Technology. What is climate change? Retrieved from <https://climatekids.nasa.gov/climate-change-meaning/>



**It’s okay not to feel okay when talking about climate change.** Many people deal with feelings of anxiety, fear, grief, denial and hopelessness. It’s a reasonable and healthy response to an existential threat. The first thing we can do is start to recognize these feelings and talk about them. To help identify and discuss these emotions, visit [The Climate Change Conundrum](#) cartoon and look at the [Take Action: Ideas to Create Change](#) infographic.





## PART 3

### It's time to develop a climate change adaptation plan.

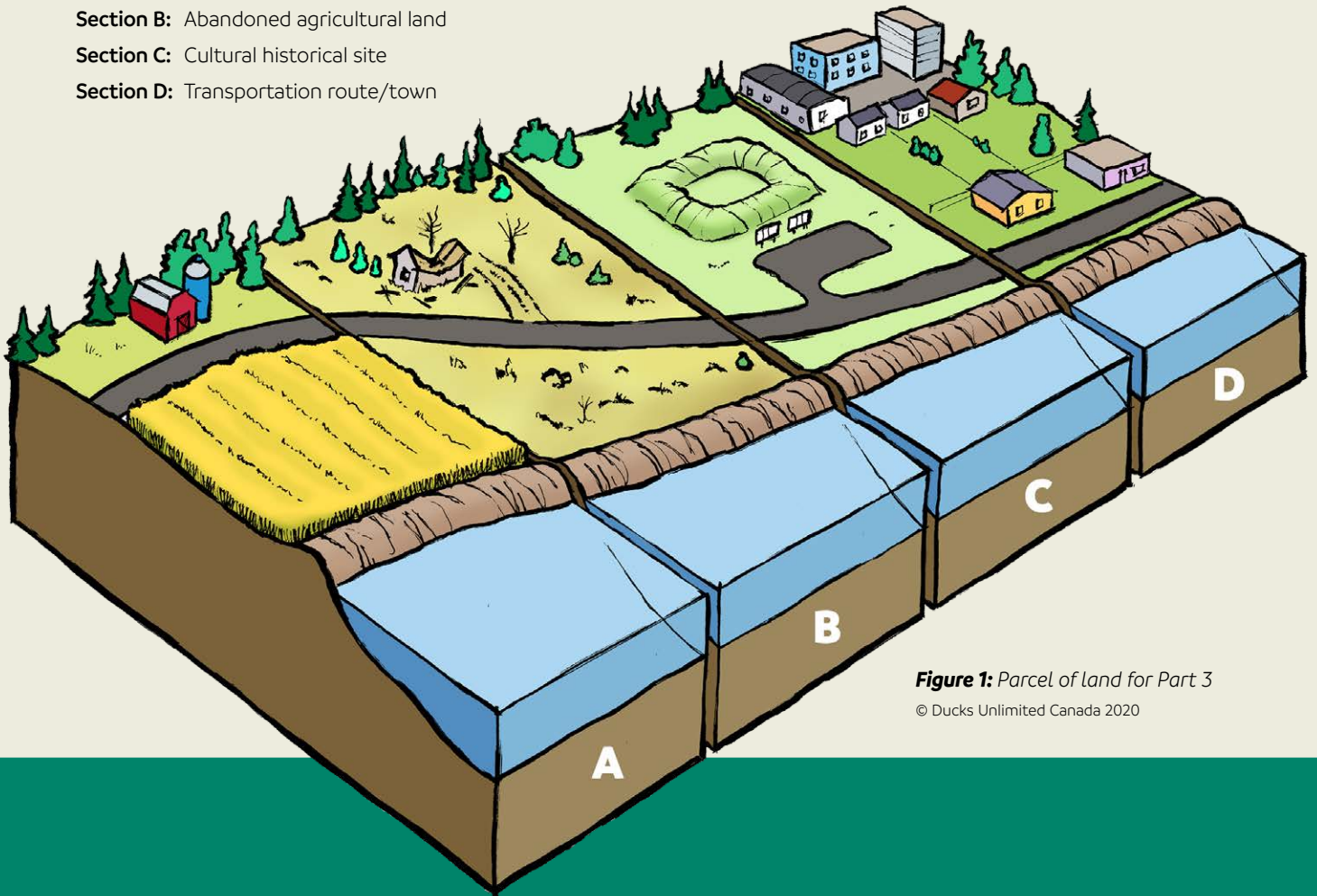
Form multiple groups — that each have at least one member of the groups A, B and C — to work together to find a climate change adaptation plan for the parcel of land (see illustration). The groups will develop a climate change adaptation plan that incorporates salt marsh restoration and dike upgrades — or both upgrades — to protect this land from sea-level rise.

**Section A:** Agricultural land

**Section B:** Abandoned agricultural land

**Section C:** Cultural historical site

**Section D:** Transportation route/town



**Figure 1:** Parcel of land for Part 3

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### Present your findings in a 500-word document or a three-minute oral presentation.

Make sure to identify:

- ⊕ the problem
- ⊕ who to involve in your plan
- ⊕ which solutions to use in each section of the land

Once the plan is done, upload it to the **WCE (Wetland Centres of Excellence) hub**. You will then get access to the case study video explainer, highlighting DUC conservation and science staff that will explain how they would approach the issue at hand.



**Meet some of DUC's Atlantic conservation specialists who specialize in salt marsh research and helped create this case study.**



**Nic McLellan** grew up in Sackville, N.B., where he developed a keen interest in biology and the outdoors. Nic has worked for DUC as a research biologist since 2007, is a member of DUC's Institute for Wetland and Waterfowl Research, and oversees the science program in Atlantic Canada, including projects associated with the Beaubassin Research Station and beyond. These research projects focus on a range of topics including freshwater and salt marsh restoration, productivity in managed wetland systems, anadromous fish passage in watersheds with DUC fishways and waterfowl ecology.



**Adam Campbell** grew up on the marsh in Sackville, N.B. He is head of of conservation delivery for DUC in Atlantic Canada, and is responsible for managing all new wetland restoration projects in the region. He is committed to continuing his knowledge and impact on wetland conservation, restoration and enhancement in Atlantic Canada. Adam holds a master's degree from Acadia University and a BSc. in biology from Mount Allison University.



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