NSERC RESNET

Envisioning Environmental Futures for the Tidal Wetlands and Dykelands of the Bay of Fundy

Workshop Report

Collaborative effort by

NSERC CRSNG · DALHOUSIE UNIVERSITY · Saint Mary's University · McGill

November 01 to 02, 2022 | Halifax, Nova Scotia

Authors:

Elson Ian Nyl Ebreo Galang[1]
Lara Cornejo[2]
Kate Sherren[2]
Elena Bennett[1]
Jeremy Lundholm[3]
Gordon Hickey[1]
Emily Hodgson[3]
Keahna Margeson[2]
Paria Nashta[2]
Polly Nguyen[2]

[1]McGill University [2]Dalhousie University [3]Saint Mary's University

Suggested Citation: Galang, E.I.N.E., Cornejo, L., Sherren, K., Bennett, E., Lundholm, J., Hickey, G., Hodgson, E., Margeson, K., Nashta, P., and Nguyen, P. (2023). *Envisioning environmental futures for the tidal wetlands and dykelands of the Bay of Fundy. Workshop report.* NSERC ResNet

Photos by E.I.N.E. Galang and L. Cornejo
Layout by E.I.N.E. Galang
Visual Elements by Emma Fitzgerald

On the cover:

Nova Scotia-based artist, Emma Fitzgerald (www.emmafitzgerald.ca), rendered a present-time snapshot of the tidal wetlands and dykelands of the inner Bay of Fundy, showcasing the parts of the dynamic landscape—including the saltmarshes, dykes, farmlands, and the communities nearby.

ACKNOWLEDGEMENT

We acknowledge the support of the Natural Sciences and Engineering Research Council of Canada (NSERC), funding reference number NSERC NETGP 523374-18. [Cette recherche a été financée par le Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG), numero de référence CRSNG NETGP 523374-18].

We want to acknowledge the following people whose services have been critical in organizing the logistical and administrative aspects of this workshop:

- Kristie McVicar, Project Manager, TransCoastal Adaptations Centre for Nature-Based Solutions at Saint Mary's University.
- Klara Winkler, Deputy Science Director, NSERC ResNet.
- Anna Pieper and Ela Vermette-Furst, Administrative Assistants, NSERC ResNet.
- Members of NSERC ResNet Landscape 1 Team (Emily Wells, Brittney Roughan, Evan McNamara).

We sincerely thank Saint Mary's University's Climate Lab Action Research Initiative (CLARi) for providing the space, facility, and equipment. We also appreciate the support of McGill University and Dalhousie University.

We also acknowledge the Making Room for Wetlands project, funded by Fisheries and Oceans Canada through the Coastal Restoration Fund Grant #17-HMAR-00533, which served as a foundation for much of the research conducted and partnerships in this landscape.

ABOUT THE WORKSHOP ORGANIZERS

We are NSERC ResNet, a pan-Canada network of researchers, students, collaborators, and societal partners who passionately work together to co-produce knowledge that will help us better understand the management, modeling, and monitoring of the natural benefits provided by key ecosystems in Canada. This Workshop was jointly organized by NSERC ResNet's Landscape 1 Group and Synthesis Team. Landscape 1 (L1) is a group that centers its work on various social and ecological dimensions of the Bay of Fundy's tidal wetlands and dykelands.

The L1 Group comprises researchers and students from Dalhousie University, Saint Mary's University, Acadia University, St. Francis Xavier University, Cape Breton University, and University of New Brunswick, closely working with societal and governmental partners across Nova Scotia. The Synthesis Team, with researchers and students from McGill University, is a group of the Project whose work aims to understand social-ecological dynamics across spatial scales and varied ecosystems.

BACKGROUND

The tidal wetland-dykeland ecosystems of the Bay of Fundy provide essential benefits or ecosystem services that support peoples' well-being and those of non-human lifeforms, such as plants and animals. These benefits range from provisions of food and fodder to regulation of key ecosystem functions, including coastal protection of communities along the Bay. These ecosystems also provide important cultural benefits, such as recreation, tourism, and educational opportunities (e.g., bird watching) (see Sherren et al., 2021[1] for a review of these benefits). However, these ecosystems also face several social-ecological drivers that can alter the relative provision of these benefits. Climate change impacts (e.g., sea level rise, changing climate patterns) — including all the management decisions, policies, and actions to address them — will be critical to the viability of these ecosystems to function in the future. In turn, the future status of these ecosystems will have significant impacts on biodiversity values, ecosystem services, and their beneficiaries.

[1]https://doi.org/10.1139/facets-2020-0073

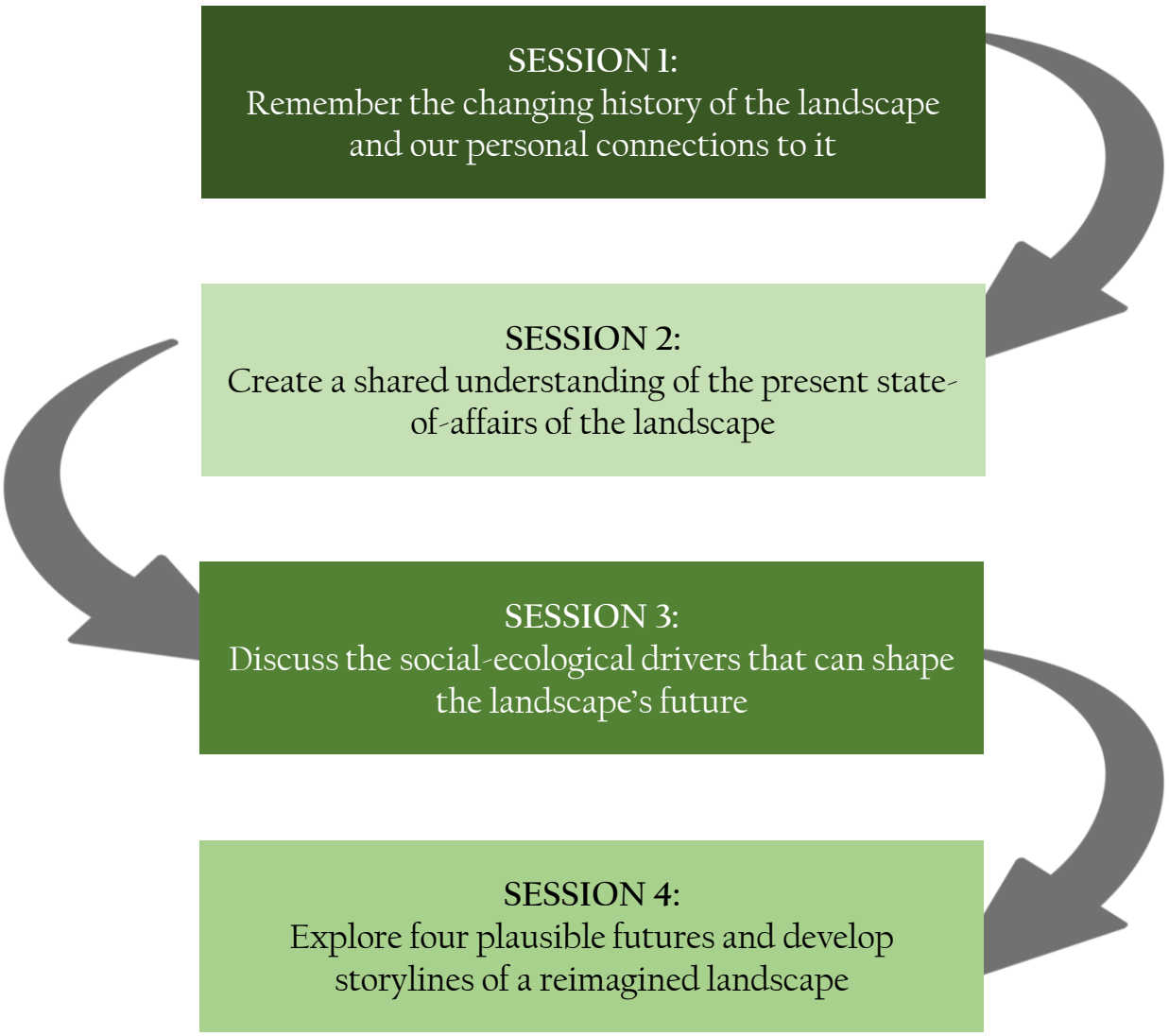
We co-organized the *Envisioning Environmental Futures Workshop for the Tidal Wetlands and Dykelands of the Bay of Fundy* to explore the various environmental futures that can plausibly happen given the present social-ecological drivers these ecosystems face. We engaged 18 actors from diverse organizations in Nova Scotia, co-imagining the different storylines or scenarios of the plausible futures for the tidal wetlands and dykelands of the Bay of Fundy in 50 years (or by 2072). These scenarios reflect what we think may happen not only to the bio-physical but also to tightly linked social, political, cultural, and economic conditions around these ecosystems if we take different approaches to climate change and allow particular values to dominate decision-making. In this report, we share our process and outputs in hopes of catalyzing conversations and inspiring planning toward sustainable and resilient management of the tidal wetland-dykeland ecosystems of the Bay of Fundy in the wake of uncertain futures.

Workshop participants. From left to right: (lower row) John Cormier, Jennifer Graham, John Atkinson, Karel Allard, Gordon Smith, Gavin Scott, Simon Greenland-Smith, Graeme Matheson, Mimi O'Handley, Jeremy Lundholm, Claude de Grace, John Brazner, Paria Nahsta, Tony Bowron, Bob Pett, Lara Cornejo; (upper row) Alex Cadel, Carolyn Marshall, Kate Sherren, Danika van Proosdij, Paul Smith, Paula Noel, Elson Galang; (not in the picture) Elena Bennett, Emily Hodgson, Keahna Margeson, Polly Nguyen

THE WORKSHOP PROCESS

We conducted the workshop on November 1 to 2, 2022, at the Climate Lab Action Research Initiative (CLARi) Space of Saint Mary's University, Halifax, engaging 18 actors from federal, provincial, and local governmental agencies, civil society and non-governmental organizations, and research groups across Nova Scotia. We followed a collaborative process called "Participatory Scenarios Planning," which brings together diverse perspectives in creating different storylines for alternative versions of plausible futures of a particular system (in this case, the tidal wetland-dykeland ecosystems of the Bay of Fundy).

We began the workshop with a land acknowledgment and welcome to the traditional Mi'kmaw territories. Elder Ann LaBillois, Mi'gmaw Elder from Ugpi'ganjig (Eel River Bar) and Dalhousie University's Indigenous Elder-in-Residence, led the opening, reminding us to always reflect and consider in our actions the inherent connections we have to all things around us. It was then followed by a short introductory program that included overviews of workshop organizers, motivations and goals of the workshop, etiquette and expectations among everyone in the room, and a welcome speech from the President of Saint Mary's University Robert Summerby-Murray. Four sessions followed, each corresponding to a step of the Participatory Scenario Planning process.

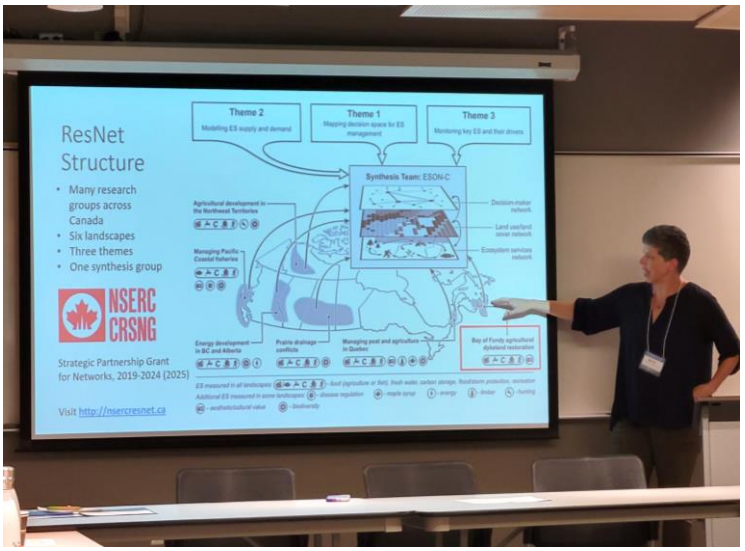


SESSION 1: Remember the changing history of the landscape and our personal connections to it

We watched an excerpt from the documentary Unnatural Landscapes (dir. Bernar Hebert) showing an overview of the history of the tidal wetland-dykeland ecosystems, from its original form as salt marshes to the installation of the dykes and aboiteaux to drain these marshes which paved the way for agricultural settlements in the surrounding communities. The documentary highlighted how these ecosystems had undergone dynamic changes for millennia and continue to change, given emerging challenges. After watching the excerpt, we shared our favorite memories about the ecosystems, whether through personal or professional experiences. Our memories were reminders of our shared but diverse connections with these ecosystems. This roundtable sharing also served as our formal self-introductions.

SESSION 2: Create a shared understanding of the present state of the landscape

Researchers of NSERC ResNet L1, including Kate Sherren, Jeremy Lundholm, Evan McNamara, and Lara Cornejo presented their group's research findings on social and ecological dimensions of the ecosystem services provided by the tidal wetland-dykeland ecosystems of the Bay of Fundy. These research findings come from a range of research projects, from undergraduate honors projects, graduate theses, and post-doctoral research, fully or partially supported by NSERC ResNet.



We then reflected on these research findings by asking: "Which of these findings surprise and/or concern you the most?" and "Is there any information that reinforces or contradicts your knowledge or observations?". This reflection exercise aimed to solicit reactions and responses to these research findings, enriching these further beyond the scientific standpoint.

SESSION 3: Discuss the social-ecological drivers that can shape the landscape's future

We divided into three small groups to discuss and list the potential drivers that we believe can affect the tidal wetland-dykeland ecosystems, guided by the following questions:

⇒ What ecological changes do you observe, know, or acknowledge in the tidal wetland-dykeland ecosystems of the Bay? What do you think are causing these changes?

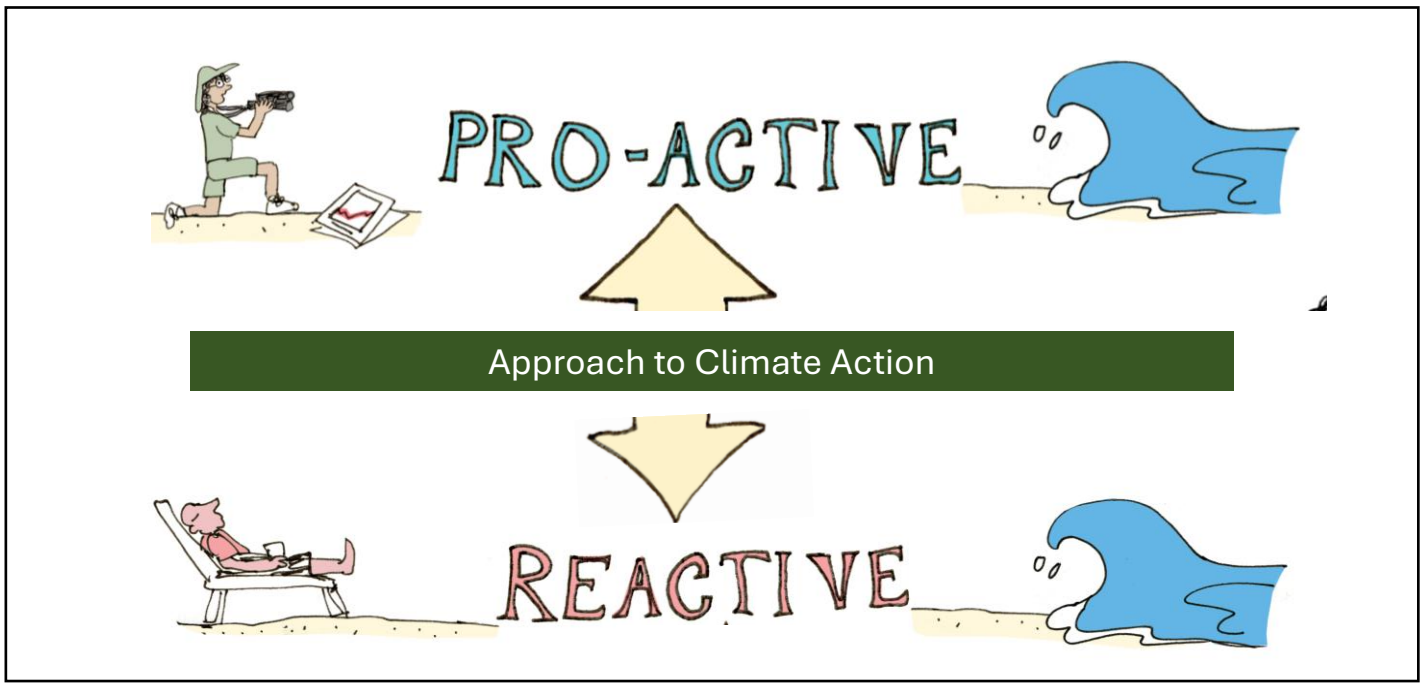
⇒ Are there particular social drivers, issues, or phenomena you think or believe strongly affect the tidal wetland-dykeland ecosystem of the Bay?

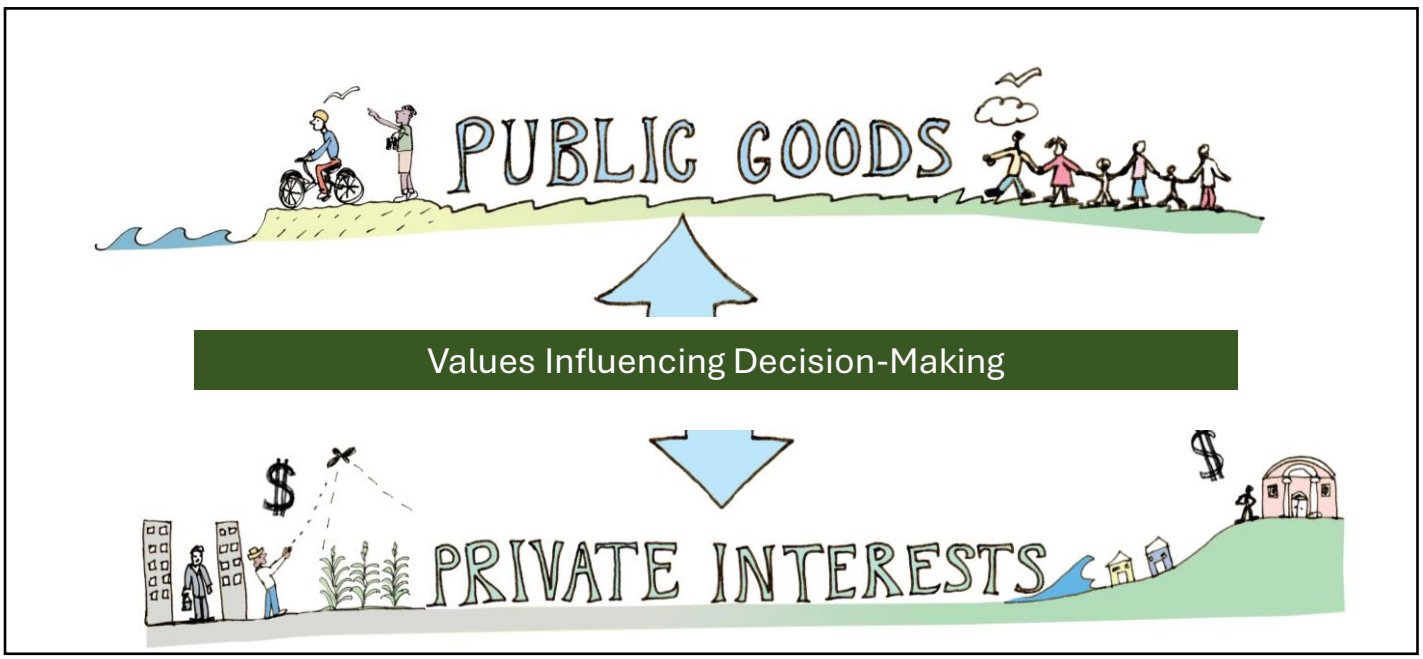
Each participant shared their thoughts about these questions, listing and discussing the drivers with their small group. Each group then classified the drivers they have listed based on the extent of their collective knowledge, from "we know a lot about this driver" to "we know nothing." Each group also listed and discussed environmental shocks that might have profound impacts on the tidal wetland-dykeland ecosystems of the Bay of Fundy.

We then convened to identify two key drivers based on the outputs of the small groups. Drivers involving approaches to climate actions and values influencing decision-making were co-identified as common themes across the different drivers listed by all groups. These drivers became the backbone of the next session or the storytelling of plausible futures.

Social-Ecological Drivers

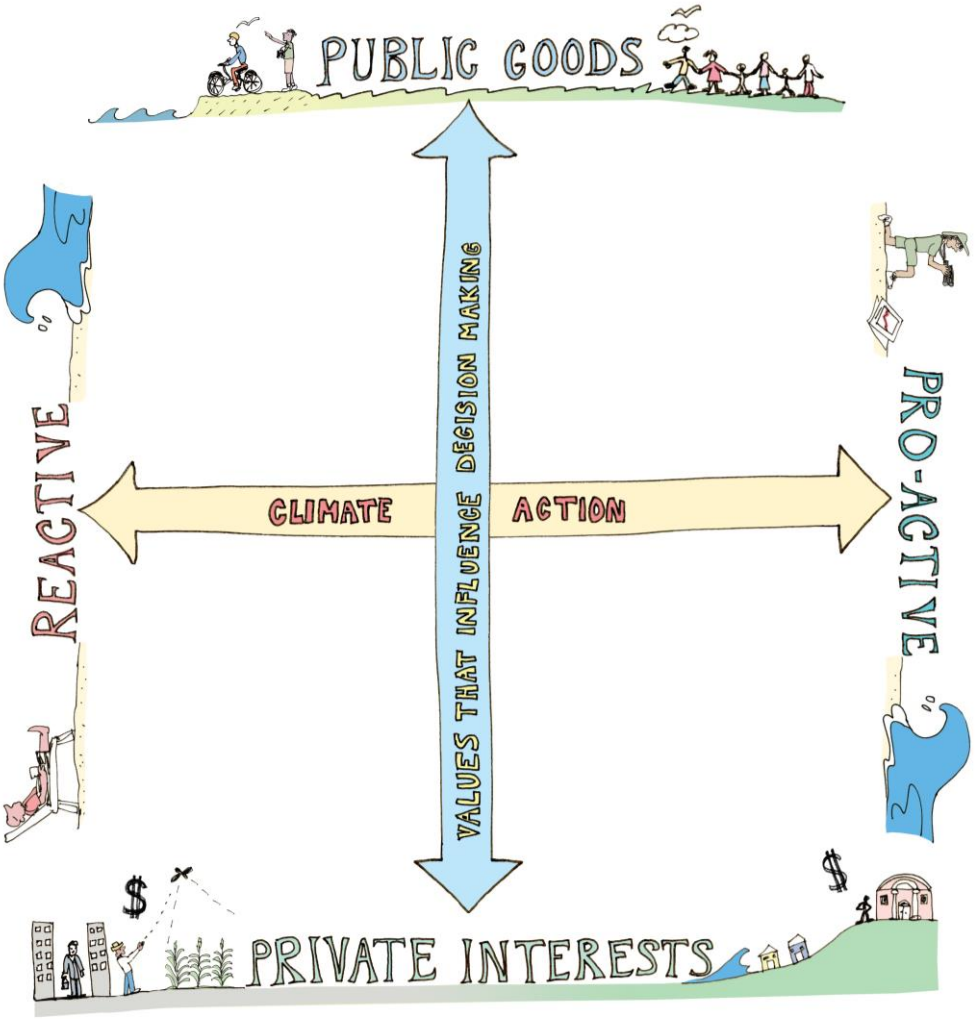
At the end of Session 3, we collectively chose the most commonly voiced but uncertain drivers that will shape the storylines of our futures: whether individuals and organizations will take a more proactive or reactive approach to climate actions and whether decision-makers will prioritize public goods or private interests in their decision-making.





SESSION 4: Explore plausible futures and develop storylines of a reimagined landscape

We identified four plausible futures (see Futures Matrix below) for the tidal wetland-dykeland ecosystems. Each of these futures is imagined to be shaped by the most uncertain forms of the key drivers and their potential interactions as guided by our main question: "What would happen in 50 years to the tidal wetland-dykeland ecosystems when these drivers become the dominant conditions?". Participants were free to select which future they wanted to participate in and co-imagine stories of the landscape.



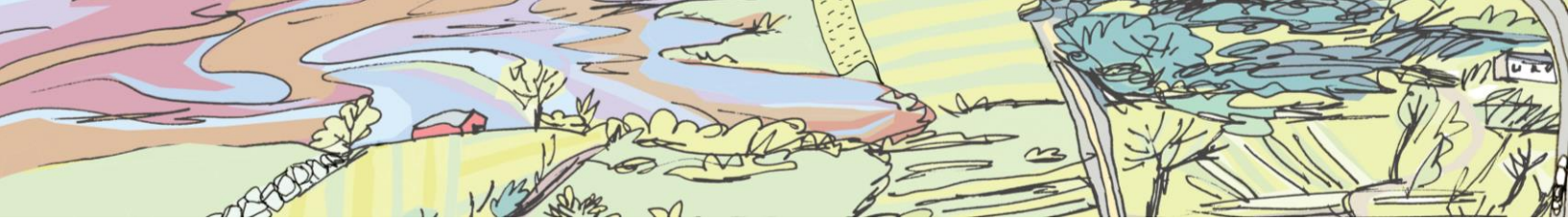
Futures Matrix. Each quadrant of the matrix corresponds to one storyline of the future:

1. Proactive Approach with Public Goods
2. Proactive Approach with Private Interests
3. Reactive Approach with Public Goods
4. Reactive Approach with Private Interests

Each group dug more into the implications of their drivers toward the future their group was exploring, discussing questions such as:

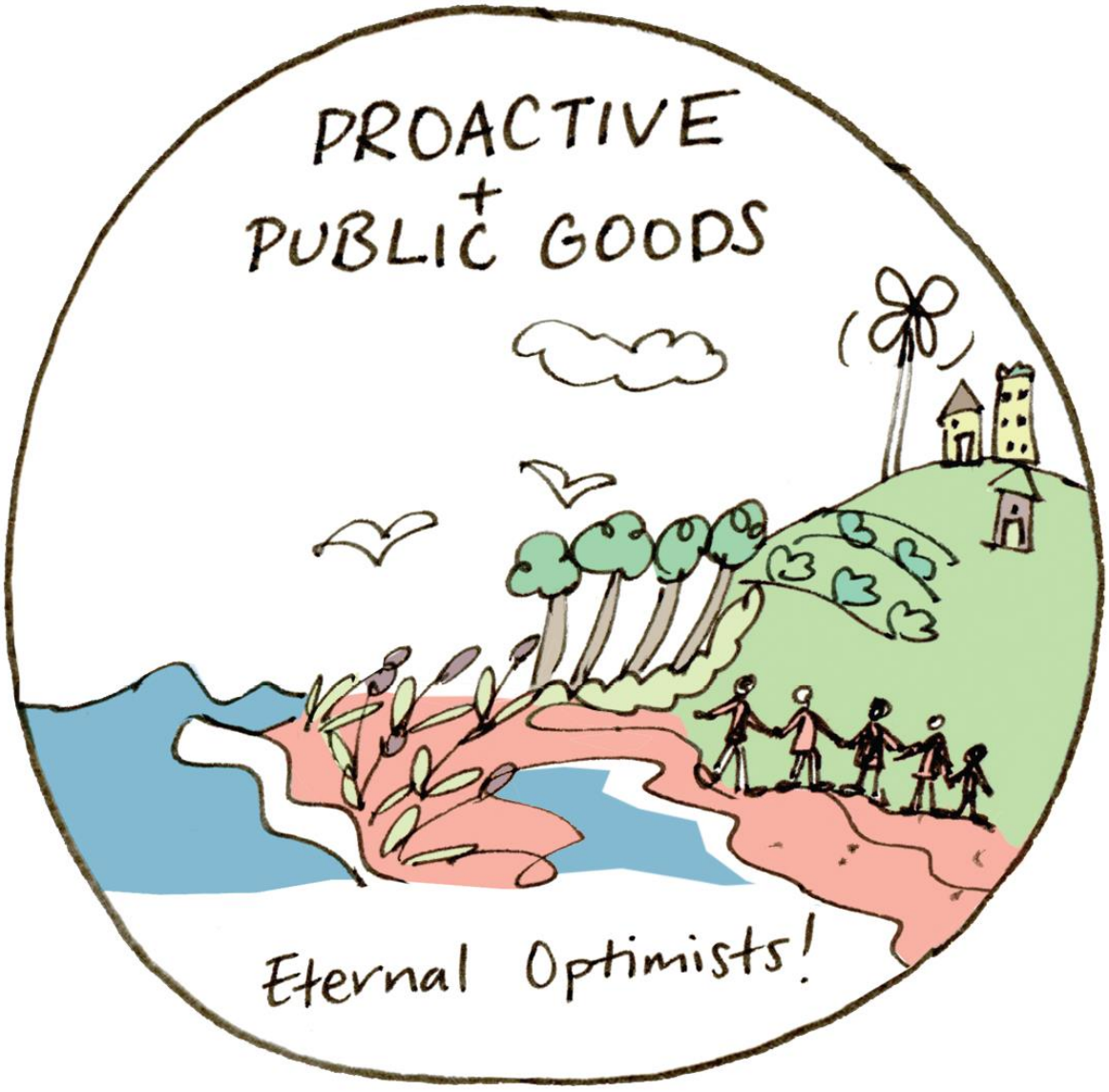
⇒ What could be the most significant environmental changes in the tidal wetlands and dykelands of the Bay under this driver?
⇒ What would be the social changes in communities along (and/or dependent on) the tidal wetlands/dykelands when this driver becomes dominant?
⇒ Will there be needs for technological implementation and innovation (including infrastructure) in a future dominated by this driver? What will these technological innovations mean for the tidal wetlands and dykelands?
⇒ What are the future economic implications of this driver? Will these serve as threats or opportunities for the industries and sectors that depend on the tidal wetlands and dykelands?
⇒ What changes in policies related to the tidal wetlands and dykelands might happen because of this driver?

Through these reflective discussions, each group then co-developed their storylines on how their future will unfold, reimagining the biophysical aspect of the ecosystem (e.g., flora, fauna, landscape configuration, etc.) and the socio-economic conditions (e.g., farming systems, lifestyles) in communities and institutions across scale. We also asked each group which actors, groups, or communities in the Bay of Fundy they perceive will benefit or be at a disadvantage in such a future. At the end of the session, each group shared creative presentations of their storylines.



The Storylines

ETERNAL OPTIMISTS



Long-term benefits for all interest groups and future generations through nature-based solutions

In 2072, we imagine this future includes

⇒ Nature-based solutions (NBS) and management approaches are prioritized as we recognize that dyking and topping up dykes are unsustainable and insufficient in the face of climate change.

⇒ Equitable access to diverse ecosystem services for all interest groups becomes the collective aspiration.

⇒ Harmonized collaboration among organizations across levels (i.e., local to federal) for the management of the tidal wetland-dykeland ecosystems of the Bay of Fundy.

⇒ Active consultation and participation of all interest groups when it comes to decisions and actions implemented in the landscape.

⇒ Management approaches that account for the needs of future generations and non-human lifeforms such as plants and animals.

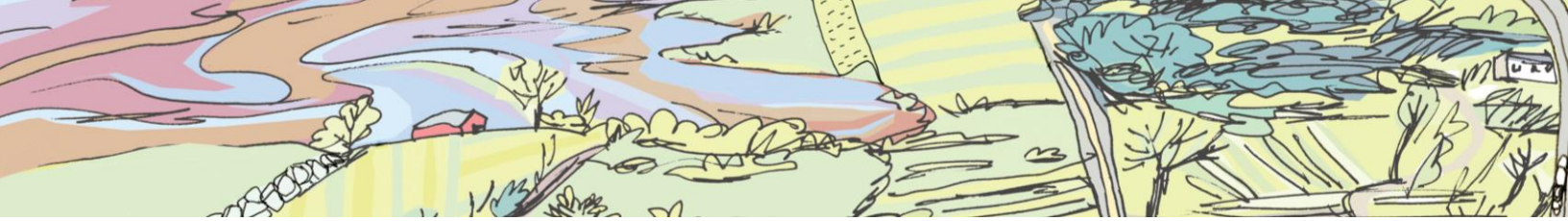
⇒ More Intertidal Sedimentary Environments (ITSE), including mud flats, resulting in higher biodiversity and more pollinators.

⇒ New ways of farming along the Bay of Fundy that would put less pressure on the tidal wetlands but are also adaptive to climate change impacts.

⇒ Potential shift of diets along Bay of Fundy communities due to awareness of the carbon contribution of animal-based agriculture.

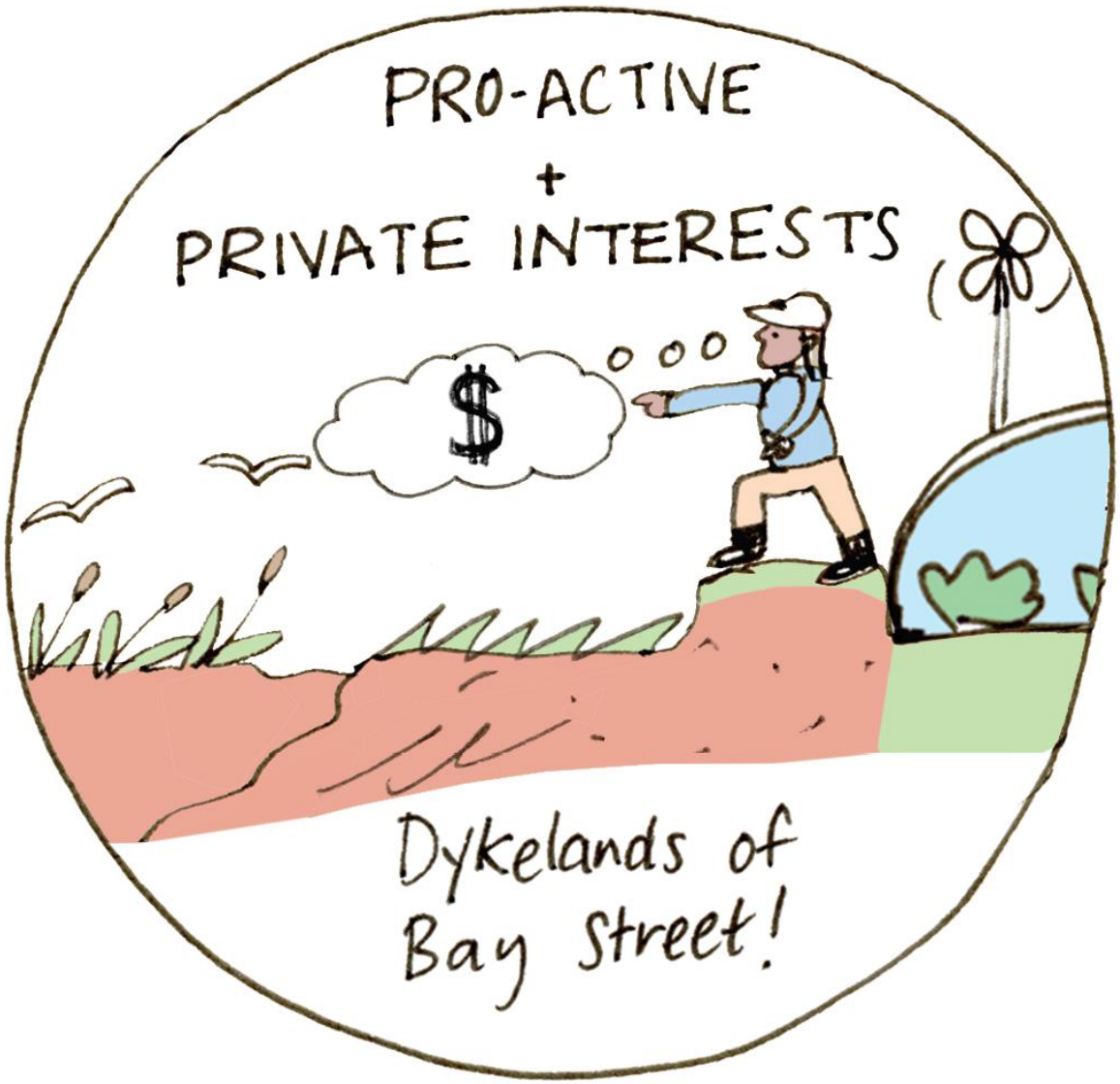
⇒ Communities are well educated not only with the ecological values of the Bay but also with its cultural and historical importance for the Indigenous peoples and Acadian heritage.

⇒ We see that this future may require significant financial capital, including high taxes, especially during transitions towards NBS.



The Storylines

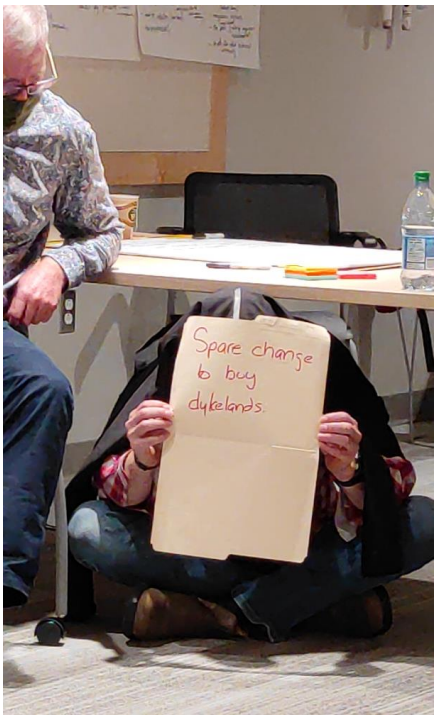
DYKELANDS OF BAY STREET

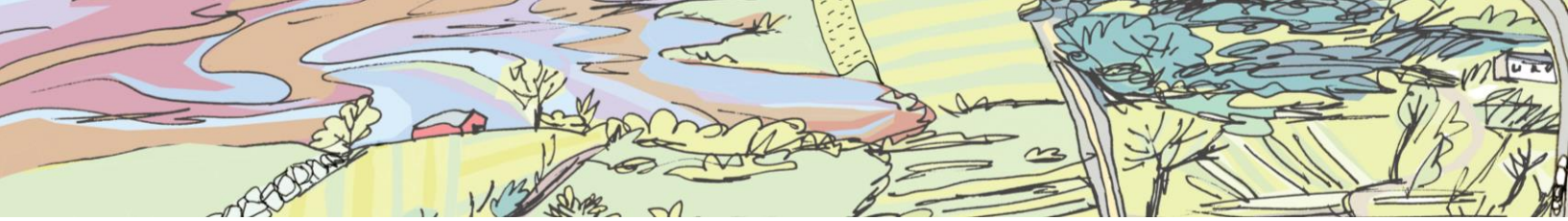


Entrepreneurs drive credit-based innovations for nature-based solutions

In 2072, we imagine this future includes

- ⇒ Nature-based solutions (NBS) and management approaches are prioritized as we recognize that it is a more economical way to protect the livelihoods and industries that depend on the ecosystem services of the Bay of Fundy.
- ⇒ Private sector, with support from governmental organizations, leads investments and proactive strategies for climate change.
- ⇒ Entrepreneurs lead the adoption and implementation of new climate change mitigation and adaptation eco-technologies such as carbon removal and green energy infrastructures.
- ⇒ Protection and management of tidal wetlands and dykelands become a private enterprise, which facilitates market-based NBS such as putting carbon credits on restored marshlands.
- ⇒ Access to tidal wetlands and dykelands for recreational and touristic purposes will require user fees as part of the privatization process.
- ⇒ Farming along the Bay of Fundy becomes more climate-smart, such that agri-land segments are optimized based on the most suitable produce for that segment (i.e., production is driven primarily by suitability instead of solely relying on market demands).
- ⇒ Sustainable farming will dominate the farming system, as this will be more profitable given higher awareness among ecologically conscious consumers.
- ⇒ Rise in inequality for those who lack capital in a private-driven transition (e.g., small family farms, Indigenous communities).





The Storylines

NO ONE LEFT BEHIND... BUT THE KIDS

Equitable access to ecosystem services for all interest groups but only sustainable for the short term

In 2072, we imagine this future includes

⇒ Equitable policies and allocation of resources for all interest groups in the Bay of Fundy become central to the management of the tidal wetlands and dykelands.

⇒ All interest groups are actively engaged in decision-making to ensure everyone's needs are accounted for, ranging from agri-food production, fishing, tourism, bird watching, and other leisure activities

⇒ Addressing climate change impacts, however, remains a lesser focus, with many policy and implementing organizations only engaged in planning with minimal actions to mitigate or adapt to climate change impacts.

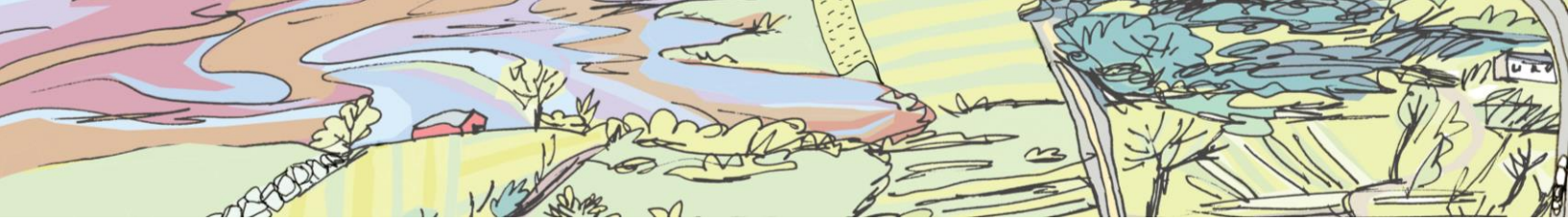
⇒ Climate change projects remain at piece-meal implementation such that there is minimal collaboration between governmental, non-governmental, and sectoral organizations.

⇒ As 2072 gets closer, increasing impacts of climate change cause the decline of ecological conditions in the Bay of Fundy, in turn causing ecosystem services to decline significantly.

⇒ Past 2072, the likelihood of practicing equity becomes more challenging as demands for these ecosystem services continue to grow (i.e., causing a rise of tension among interest groups).

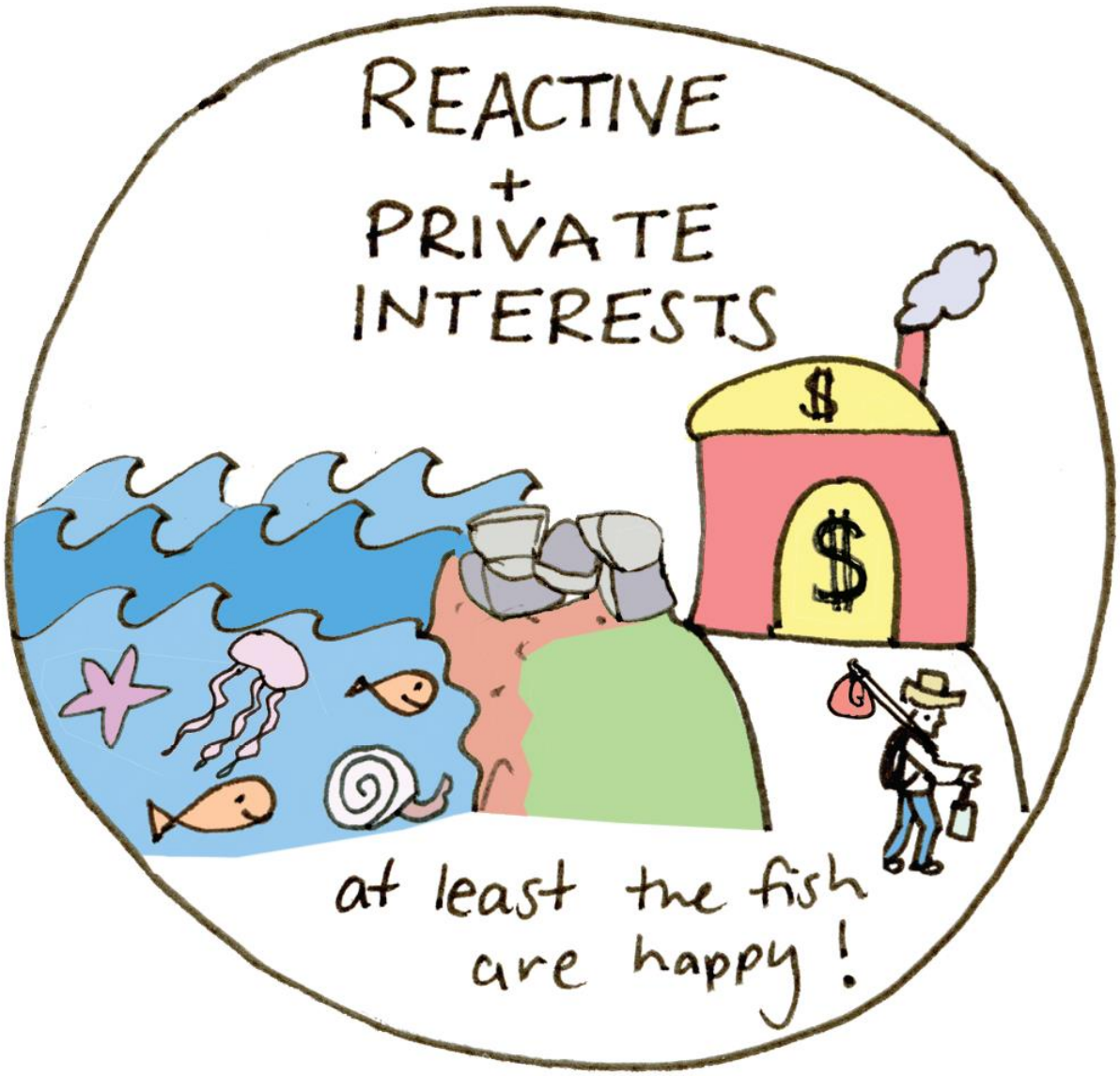
⇒ Governments across levels will scramble to implement quick-fix solutions such as topping up dykes, but this proves to be inadequate.

⇒ Intergenerational resentment is apparent for succeeding generations post-2072.



The Storylines

AT LEAST THE FISH ARE HAPPY



Corporate exploitation of ecosystem services and eventual decline of ecological condition

In 2072, we imagine this future includes

⇒ Management of the tidal wetland-dykeland ecosystems of the Bay of Fundy is shaped by the economic interests of powerful individuals and interest groups, especially those of big industries and corporations.

⇒ Profiteering of industries and corporations dictate how ecosystems and what ecosystem services are being used (e.g., farming is strongly market-driven, rapid residential development along the Bay to provide for increasing market demands for housing near coastlines).

⇒ Addressing climate change remains the lowest priority across organizations, with topping up the dykes the default option to keep seawater out of farms, commercial, and residential spaces.

⇒ Topping up dykes proves very inefficient and unsustainable, leaving smaller family farms and family-run commerce to suffer, eventually abandoning their lands.

⇒ With land abandonment, big industries and corporations partner with tech companies to take advantage of the situation by developing superfarms, storm management technologies, genetic technologies, and automation that would allow them to continue meeting their economic needs.

⇒ This privatization by corporations causes other ecosystem services, such as tourism and recreation, to decline.

⇒ Eventual loss of tidal wetlands leads to more open marine spaces for fishes and other marine life to flourish.

CONCLUSION

Through our Participatory Scenario Planning Workshop, we were able to co-imagine four plausible environmental futures for the tidal wetland-dykeland ecosystems of the Bay of Fundy. We imagined how the landscape might unfold under different scenarios, exploring both ecological and social plausibility. We acknowledge that the storylines may be further enriched and revisited as new perspectives and information are brought in. Nonetheless, our workshop allowed participants to carefully reflect on the pros, cons, and other implications for the ecosystems, people, and livelihoods given the specific approaches to climate change and management decisions within the context. Additionally, the workshop provided a safe space for participants to share their ideas and experiences and listen to each other– promoting exchange, understanding, and collaboration. Imagining the future also sparked discussions about the present situation and challenges of climate adaptation and its implications for broader ecosystem viability.

Overall, the workshop contributed to strengthening the partnerships needed to advance decision-making processes, highlighting collaboration as one of the key elements for the sustainability of complex landscapes. We further acknowledge that the success of our workshop was possible from years of previous projects and continuous collaboration among participating organizations. We hope this report is useful to spark new ideas for future research in this landscape, such as multi-temporal mapping of dykelands, assessments about the impact of landscape changes on different population groups, and more participatory initiatives. More importantly, we hope that our results can guide policies, programs, and practices for a more resilient Bay of Fundy.

NSERC

RESNET

NSERC CRSNG

DALHOUSIE UNIVERSITY

McGill

Saint Mary's University

Visit us at https://www.nsercresnet.ca/

Contact us at resnet.nrs@mcgill.ca