



Documenting social vulnerabilities, developmental shifts, and sea-ice change at four Arctic sites



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Introduction

The rapidly changing Arctic has prompted stakeholders to document and research how these changes presently affect communities and ecosystems¹⁻³ and how they will continue to create change moving forward^{4,5}. Seascape changes in the Arctic directly impact coastal Indigenous communities as ice is an integral aspect of their well-being and survival⁶, and alerts others who seek to develop the Arctic that the sea-ice advance is later, and retreat is sooner. These conditions create more tourist opportunities²; affect Native food sovereignty and health⁸; and have recently spurred an increase in policy creation that requires the consideration of environmental effects in Federal decision making⁷. Figure 1 further describes the connections between the climate change, development, cruise tourism, coastal communities, and policies.

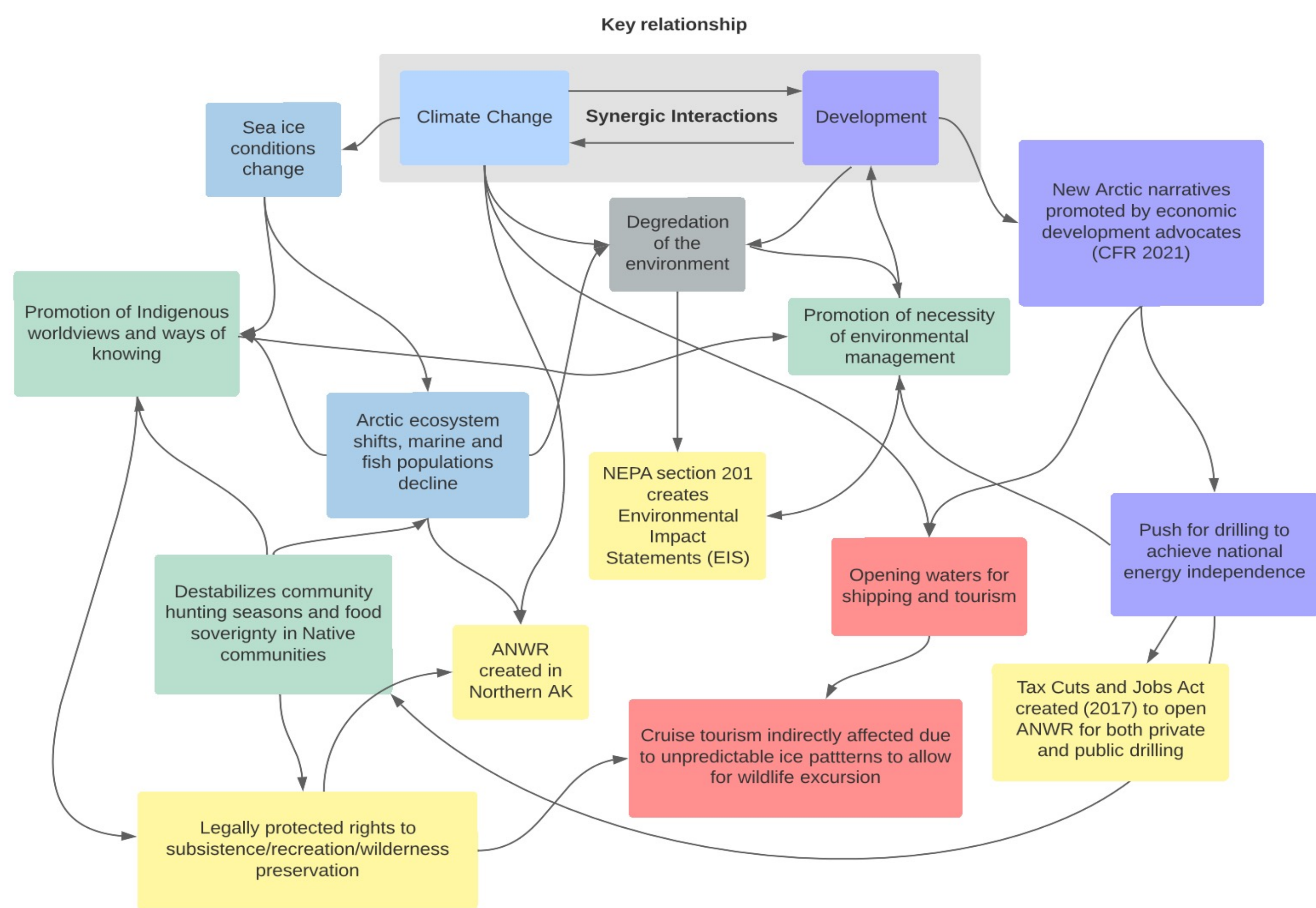


Figure 1: A concept map showing the interconnected nature of the three projects, created with Lucidspark software.

Research Questions

- 1.) How does sea-ice change influence where cruise tourism increases and decreases within the Arctic circle, specifically in Svalbard, Norway?
 - This project provides more research into the polar cruise tourism sector that has shown mixed outcomes due to "last-chance" marketing.
- 2.) How has analyzing and observing changing sea-ice conditions in the Bering and Chukchi Seas produced multiple narratives regarding the future Arctic? What are the consequences of these narratives?
 - This project dives into why and how stakeholder concerns and knowledge is formed and illustrates the importance of self-reflexivity when producing narratives.⁹
- 3.) How does the federal government balance both economic advancement and environmental risks in the Arctic National Wildlife Reserve in Alaska?
 - By looking into the federal economic and environmental legislation in the USA, this project asks the question: "to drill or not to drill?", if legislation can appease both the development of the United States and the importance of ecosystems. Figure 2 visually displays the four study sites for the REU projects.

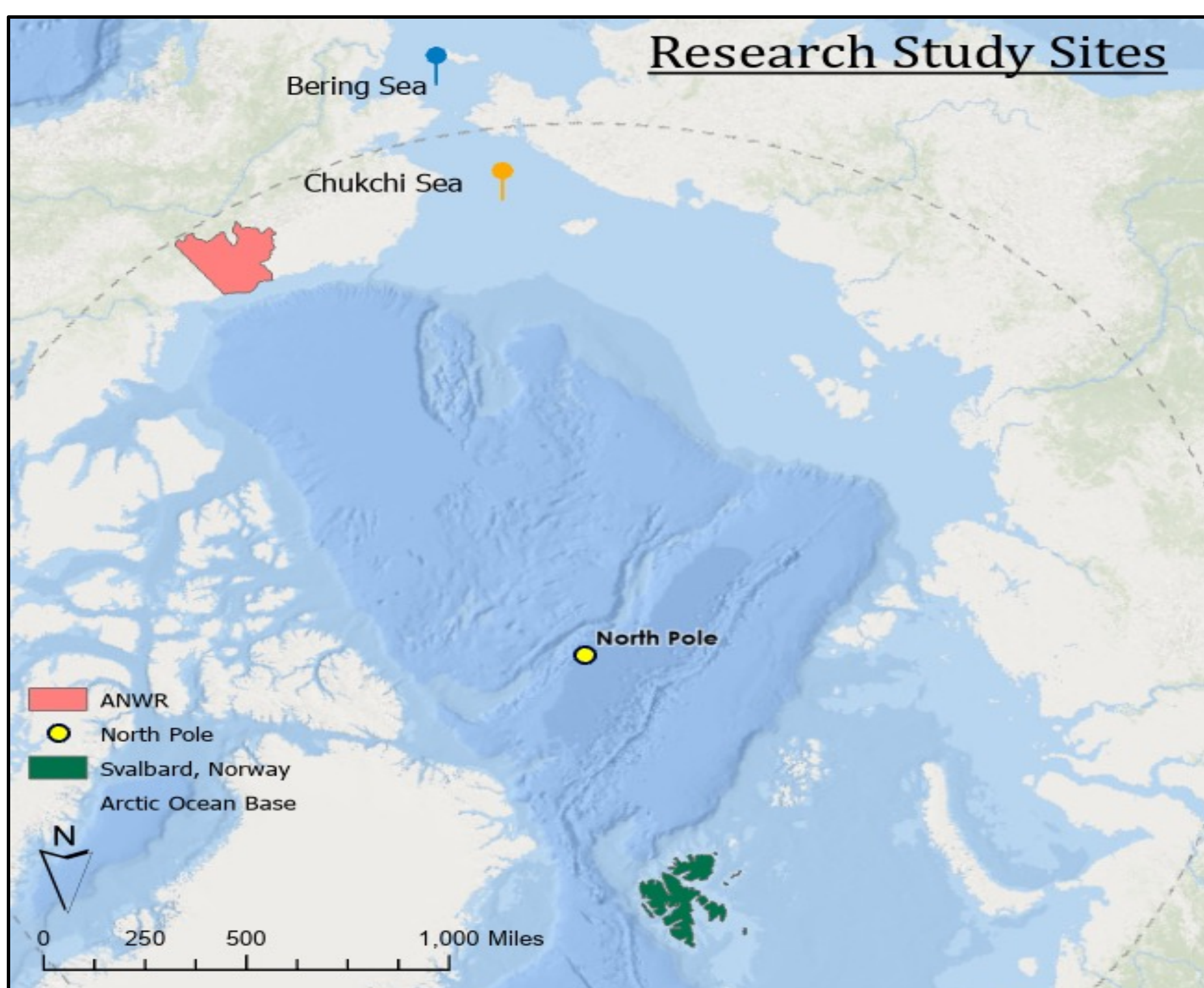


Figure 2. The four study sites for each of projects. Svalbard, Norway for cruise tourism, the Bering Sea and Chukchi Sea for coastal communities, and the Alaska National Wildlife Refuge (ANWR) for policy.

Methodology

Cruise tourism:

- Analyze sea-ice concentration from the NSIDC (Table 1) to determine sea-ice extent, advance, and retreat from 1979-1988 and 2011-2020.
- Using Arctic Ship Traffic Data from PAME as seen in Table 1, cruise ship port locations, pathways, and length from arrival to departure will be mapped using ArcGIS Pro.
- Statistical analysis will be done in Excel to determine changes in revenue of Arctic cruise land and water-based activities pertaining to Svalbard, Norway.

Coastal Communities:

- Perform search queries in literature databases to collect broad range of research regarding sea-ice change in Bering and Chukchi sea regions
- Analyze sea-ice concentration from NSIDC from years with most literature
- Perform code analysis in NVIVO to select fundamental beliefs and values and define narratives by analyzing approaches and discussion showing subsequent definitions
- Perform statistical analyses to analyze how narratives appear in literature

Policy

- Analyze environmental legislation that has been passed in the US government from National Environmental Protection Act (NEPA, 1970) until the Inflation Reduction Act (2022)
- Analyze economic legislation that has been passed from the Federal Lands Policy and Management Act (FLPMA, 1976) until Inflation Reduction Act (2022)
- Analyze legal cases from the state of Alaska to determine both positive and negative impacts of federal legislation
- Perform coding analysis in NVIVO to distinguish impacts on the economic shape of Alaska and state of the people and environment in ANWR

Table 1: Data Sources used in Projects

Project	Cruise Tourism	Coastal	Policy
Source 1	PAME Arctic Ship Traffic Data	Google Scholar	Google Scholar
Source 2	National Snow and Ice Data Center (NSIDC)	NSIDC	Library of Congress

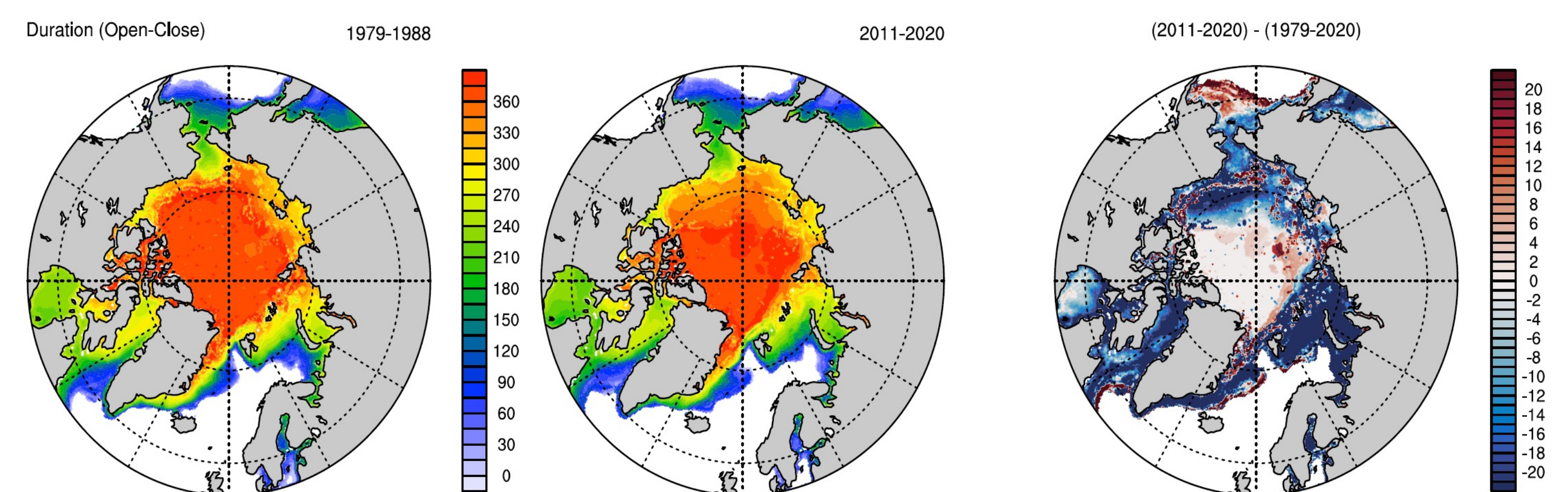


Figure 3: The mean open-close sea-ice extent from 1979-88, 2011-2020, and the difference between the two mean outcomes for the Arctic Region.

Expected Outcomes

Cruise tourism:

- Decreasing sea-ice extent and decreased time-period between sea-ice advance and retreat (Figure 3).
- Either increases in cruise tourism due to "last-chance" marketing or decreases due to decrease sea-ice extent limiting water-based activities.

Coastal Communities:

- Western epistemological/ontological bases dominating research literature
- Western narratives will appear more frequently in popular media and policy despite holistic Indigenous approaches proving more sustainable/less extractive.

Policy:

- Rising inflation of gas prices will force the Biden Admin to open up ANWR for leasing
- Native Alaskans will continue to feel pressures from federal government and climate change on their lands

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Acknowledgements

We acknowledge support from a grant from the National Science Foundation Navigating the New Arctic Grant #2022644. We also would like to thank Dr. Laura Landrum and Dr. Julio Postigo for their mentorship during our REU projects.