Goals and Objectives for the North Coast Work Group

A starting point for discussion

Mission

Provide resource managers and local communities with projections and tools for visualizing anticipated change for different time periods and climate change scenarios within Alaska's Arctic coastal zone where sea ice and permafrost play critical roles (defined here to include the coastlines within the Beaufort Sea and Northern Bering - Chukchi Sea Large Marine Ecosystems, Figure 1). Activities in support of this mission will include:

- Characterize and quantify current and recent North Slope coastal processes (e.g., storm surge and inundation, erosion, sedimentation and geomorphic change).
- Project future processes and consequent ecosystem/habitat change, using a broad-based, integrated, model-driven approach.
- Communicate the results of these projections through development of web-based visualization tools, including maps.

Preliminary activities – within 1 year (within FY 2014)

- *Develop an annotated bibliography identifying and summarizing all of the significant references relating to Arctic Coastal Processes*.

- *Define the requirements of a visualization tool for managers and public users to visualize coastal zone change*. For example, what are the habitats of greatest interest, what are their locations/extents, and how are they projected to change in selected time periods in this century? Similarly, what is the current flooding extent of the 1, 5, 25, 50, and 100 yr storm and how is the flooding extent projected to change in selected time periods in this century? The visualization tool will be seen as the endpoint toward which the activities of this Working Group should ultimately be directed.

- *Evaluate the international Arctic Coastal Dynamics database (portion overlapping the Beaufort and Bering-Chukchi Large Marine Ecosystems) as a spatial database that serves our modeling objectives.*

- Choose 3-5 "demonstration domains" for model development, including representative coastal villages, sensitive wildlife areas/habitats, and geomorphological environments.

Goals and Objectives

Our overarching goal is to provide resource managers and communities with tools and information needed to plan for anticipated coastal change. Our approach is strongly focused on modeling, both as the means by which we provide plausible scenarios of change to stakeholders, and as a guide to identifying critical data gaps. We acknowledge that substantial data deficiencies are common within our area of interest, inevitably affecting the reliability of forecasts. We also recognize the need to provide the best current available information to decision-makers. We will endeavor to do both: produce the best interim products we can in the short-term, while moving toward improved iterations in the long-term. We envision the Work Group as an incubator for generating proposals and coordinating work that leads toward products identified below.

The objectives detailed below reflect the LCC focus on natural resource conservation. They are grouped by "threads" which reflect aspects of coastal change considered most relevant, including erosion, flooding, and the combined effects of environmental changeon high-value habitats such as coastal wet sedge meadows, lagoons, and river deltas. We expect that the modeling tools and data sets developed to meet these objectives will have broader application for a variety of end-users, including community and infrastructure planning.

Thread	Short-term Objectives (1-3 year)	Long-term Objectives (3-10 years)
A. Projection of rates of **shoreline change and shoreline position** in selected time periods for the remainder of this century.	1. Assemble catalog of all available historical shoreline positions for the region . 2. Project future shoreline position by extrapolating historic rates into the future. a. Linear extrapolation based on erosion rate data from last 10 years. b. Non-linear extrapolation based on erosion rate data since circa 1950's and based on available environmental data (Figure 2). 3. Design and implement web application to display projected shoreline position. 4. Define target user groups; review existing Needs Assessments, conduct further assessments to pin down their priority information needs (the	1. Account for deposition of eroded sediments. 2. Implement methodology determined under short-term goals, Item 6, to project coastal erosion rates and position for the remainder of the century. It is expected that different modeling approaches might be needed in different coastal settings.

	'targets' for the projection & visualization effort). 5. Update Arctic Coastal Dynamics database with estimated historical erosion rates. 6. Develop a process-based modeling framework or methodology to project future shoreline position in the "demonstration domains". a. Examine available data on shoreline change, shoreline character, and environmental conditions and define the dominant erosion mechanism associated with those segments. Different types of models may be used in different coastal settings. b. Develop methodology for projecting erosion rates. The methodology should incorporate subsidence and sea level rise. It should incorporate SNAAP (or equivalent) projections of meteorology, sea temperature, and sea ice. It should also make use of available data on soil character (e.g., grain size and ice content). c. Convene group of experts to review methodology. d. Methodology for calculating erosion rates will be validated by comparing calculations with available measurements and by evaluating input data. e. Consider developing an Arctic version of Xbeach – a process-based geomorphic change model.	

B. Current and projected **frequency and intensity of flooding** by storm surges in selected time periods for the remainder of this century.	1. Assess the available environmental data that would be used for the hind-casting and forecasting 2. Evaluate the methodology by comparing calculations and measurements. 3. For the selected demonstration domains, model storm surge and coastal inundation for a set of past and future time periods accounting for projected sea level rise, subsidence, glacial rebound, meteorology, and ocean/sea ice condition. 4. Based on the storm surge and inundation modeling, compute an annual inundation index (or some other index of inundation frequency and intensity) that incorporates vegetation type. 5. For the selected demonstration domains, display projections of inundation on web visualization platform.	
C. Current and projected distribution and quantity of **coastal wet sedge meadow and salt-killed vegetation.**	1. Develop relations between annual inundation index (or equivalent) and vegetation type. 2. Develop successional model for saline vegetation types, including potential role of peat deposition and periodic inundation.	1. Integrate flooding model with successional model to project future distribution of saline wet sedge meadow and salt-killed vegetation.

D. Current and projected condition of **coastal lagoon habitat** in selected time periods for the remainder of this century.	1. Identify physical and biogeochemic characteristics of lagoons essential to maintaining biological productivity. 2. Develop methodologies for hindcasting and projecting physical and biogeochemical conditions in lagoons. 3. For physical changes, the following approach is suggested: a) Collect remote sensing and other data that document morphodynamic change in the barrier island and lagoon system during the past several decades. b) Develop a morphodynamic model to explain the observed morphodynamic change in the barrier island and lagoon system. The model should include sediment input into the system from coastal erosion, and riverine processes. c) Calibrate and validate the models using observed data. 4. For the projection of biogeochemical conditions, it will be important to identify the role of riverine input with regard to nutrients, sediment, carbon, temperature and salinity. It will also be important to identify nutrient and sediment input due to coastal erosion. Finally, it will be important to take into account climate change impacts on sea temperature and ice. Biogeochemical models should be validated with data.	1. Use the morphodynamic model to project morphodynamic change in the barrier island and lagoon system. Determine whether the North Slope barrier island system is likely to remain intact given a future with sea level rise and significant reduction in Arctic ice. 2. Project future biogeochemical change in lagoons. 3. Project future coastal lagoon habitat based on the above.

E. Current and projected condition of **river delta coastal barrens** (i.e., mud flats) in selected time periods for the remainder of this century	1. Gather data on river delta systems such as topography, subsidence, sediment deposition rates, spatial extent, river flow, and riverine sediment input. 2. Build a conceptual model of river delta physical change.	1. Build a quantitative model of river delta change based on conceptual model and available data. 2. Assess the model with available data. 3. Project the condition of the deltas into the future. For example, determine whether deltas are likely to receive sufficient sedimentation to keep up with sea level rise.

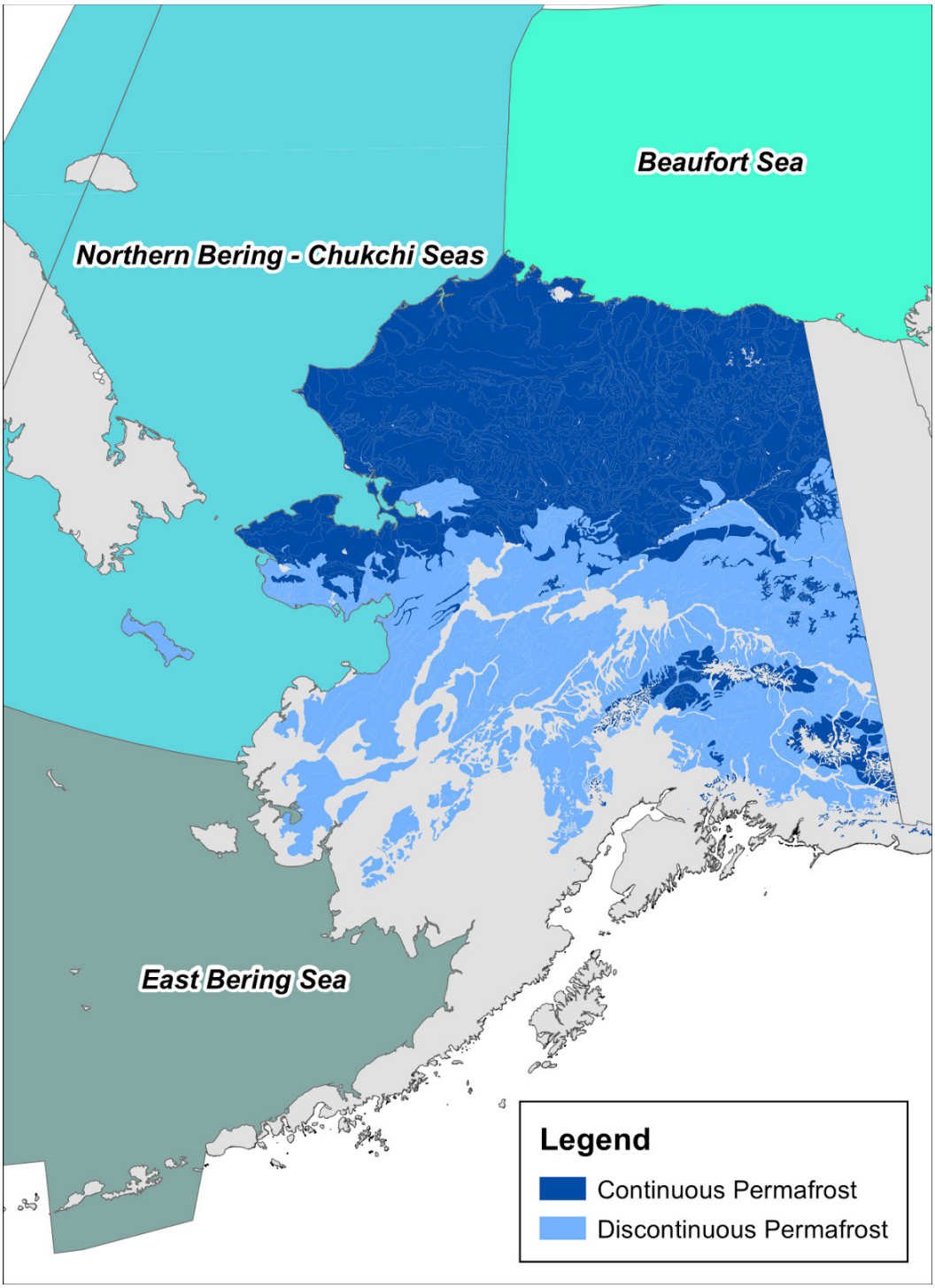

Figure 1. Beaufort Sea and Northern Bering - Chukchi Sea Large Marine Ecosystems which are the areas of interest for Arctic Coastal Processes Working Group.

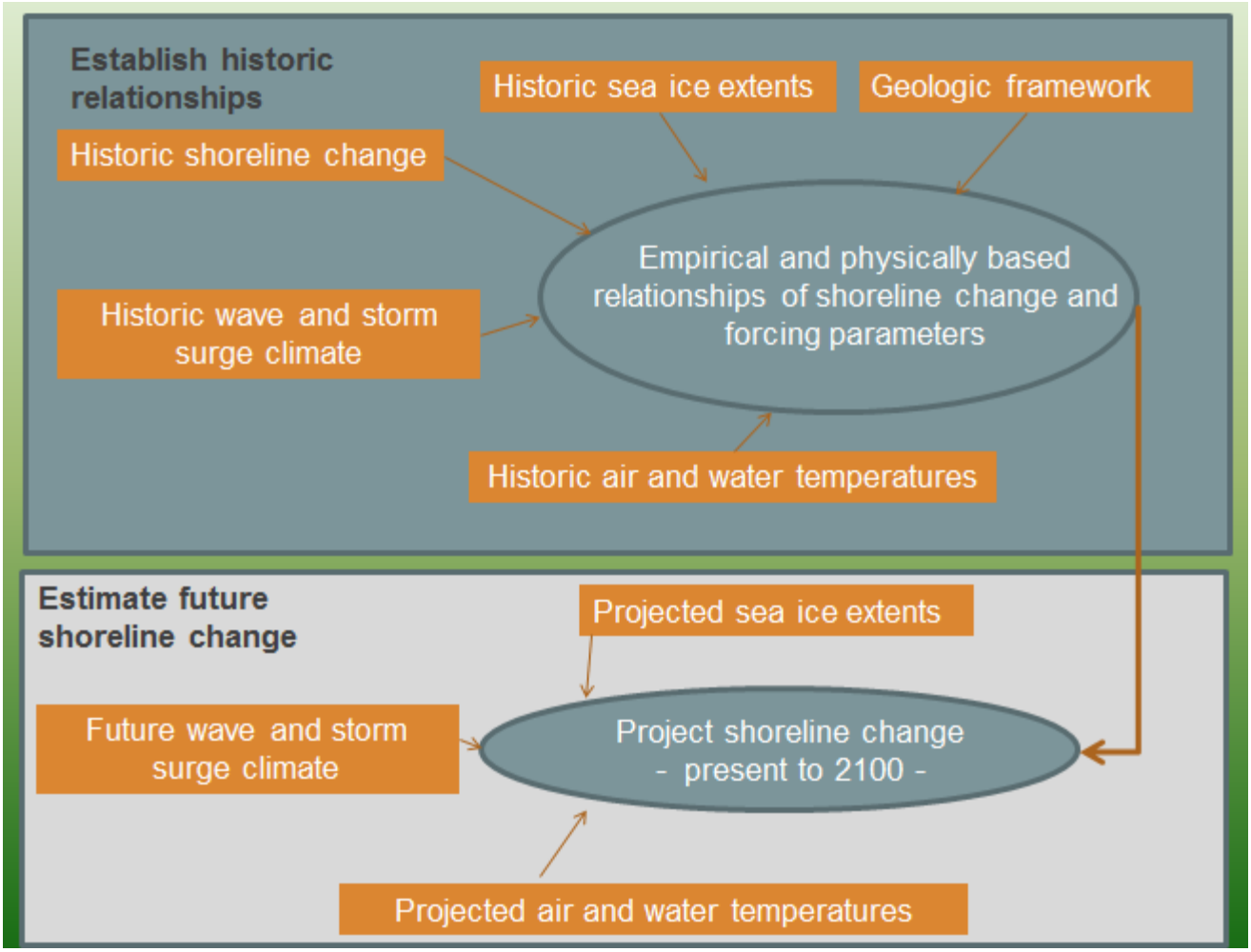

Figure 2. Schematic of approach for short-term goal A.2. Note that much of the data needed to build models for establishing the historic relationship between shoreline change and forcing parameters are now available, as are the 'future' forcing conditions. Short-term objectives should focus on the ellipse in the upper panel, keeping in mind the goal of producing shoreline change maps based on empirical models.