Alaska Climate Science Center Strategic Plan

Introduction:

This document provides the first iteration of a 5-yr "Strategic Plan" for the newly established DOI Alaska Climate Science Center (AK-CSC). This version of the AK-CSC Strategic Plan provides the overall vision, major goals and approaches to CSC activities, and establishes the seven major themes which the AK- CSC will address in response to the guidance provided by the Climate Change Coordinating Committee (C-4) of the Alaska Climate Change Executive Roundtable (ACCER) and the goals and priorities of DOI and the NCCWSC. It also provides the mechanism by which the goals in this longer-term plan will be converted into 1-yr "Action Plans", and a framework for data management and integration.

The long term success of the Center will depend primarily on how well the AK-CSC coordinates and communicates with the significant programs already in place within Federal and State Agencies and in the University communities. This coordination and communication will be especially important as the AK-CSC strives to bring science to bear on the highest priority climate change and adaptation needs identified by the Alaska community. Specific activities to be undertaken as part of the annual Action Plans will come from meetings with ACCER, the C-4, and Alaska's LCCs. Action Plans will also include significant input from University Partners, particularly as this input applies to leveraging existing capabilities and avoiding duplication of effort. The AK-CSC will also sponsor workshops for the broader science and non-governmental stakeholder community to solicit input and cooperation in the continuous development and refinement this longer-term Strategic Plan.

Review and approval of this Strategic Plan and its subsequent iterations are the responsibilities of the AK-CSC Director and the NCCWSC Director. This Strategic Plan will be reviewed at least once every five years, or as dictated by the AK-CSCs mission.

I. Alaska CSC Science Planning Process

A. Stakeholder Defined Science Priorities-

The Alaska DOI Climate Science Center receives its overall guidance for National science priorities from the National Climate Change Wildlife Science Center which resides at the USGS National Center in Reston, Virginia. The NCCWSC is a component of the USGS Climate Change Mission Area and receives its guidance from its Associate Director and the Strategic Plan developed for that Mission Area.

The Alaska DOI Climate Science Center receives its overall guidance for regional science priorities from the Alaska Climate Change Executive Roundtable (ACCER) , established jointly by the U.S. Fish and Wildlife Service and the U.S. Geological Survey in 2007, and comprised of both federal and non-federal senior level agency executives from throughout Alaska. ACCER meets regularly to share information and facilitate cooperation among agencies in seeking solutions to the challenges presented by climate change. The Roundtable is a voluntary alliance of Member agencies, each with responsibilities and capacities for addressing climate change or its impacts on Alaska's natural and cultural resources. Roundtable Agency programs variously involve research,

management, regulatory and service-oriented activities, and are responsive to a variety of customers and constituencies.

The Mission of ACCER is to promote collaborative efforts in advancing the knowledge of climate change as it relates to each member's responsibilities in (1) promoting effective adaptation and mitigation strategies, and (2) resource management activities. These goals are achieved through information sharing and coordination among the ACCER partners, with an emphasis on both existing and emerging capacities. The Roundtable provides an implementing structure for three goals: (1) to identify climate change-related issues of common concern ; (2). to facilitate collaborative action by combining resources ; and (3) to ensure that efforts to address issues of common concern are complimentary and integrated.

In the fall of 2010 ACCER was formally established through the development and signing of a Charter. The ACCER Charter provides for the establishment of a second tier committee, the Alaska Climate Change Coordinating Committee (C-4). This Charter assigned C-4 responsibility for: (1) integration of the combined goals and science priorities of member agency climate change initiatives and efforts; (2) providing interagency, management-level guidance to Member agency climate change efforts including, but not limited to, Alaska Landscape Conservation Cooperatives (LCC) and the AK-CSC , and to address cross-LCC considerations and decisions; and (3) to establish statewide goals and science priorities for the AK-CSC, the NOAA Regional Climate Center, and LCC's. The C-4 membership is comprised of ACCER member agency managers, science officers, or their equivalents with sufficient authority to represent their agency on a statewide policy level. The DOI AK-CSC Director, NOAA RCC Director and LCC Coordinators are ex-officio members, while also providing staff support.

The development of annual Action Plans for the AK-CSC will be closely coupled to the Alaska LCCs' planning and project identification processes in terms of both the timing of those activities as well as the priorities and projects identified. Participation by the AK-CSC Director on the C-4 Committee and in LCC Steering Committee meetings will serve to ensure that this coordination takes place.

Table 1. Specific roles and responsibilities of ACCER and C-4 in the development of 1-yr Action Plans. For clarity's sake, the process has been divided into four distinct phases.

- PHASE I: ACCER identifies broad priorities from within core ACCER/CSC mission areas.
- PHASE II: C-4 representatives work with AK-CSC Director to refine their agency's ACCER priority statements into specific questions or themes.
- PHASE III: CSC Director translates questions/themes into 1-yr Action Plan.
- PHASE IV: C-4 representatives seek comments on the 1-yr Action Plan from their respective ACCER members, and suggest revisions to CSC Director.

Table 2. Specific roles and responsibilities of LCC partners in the development of 1-yr Action Plans. The progression of activities follows the phases outlined in Table 1.

- During PHASE II: LCC Coordinators review broad priorities from ACCER, and make suggestions to C-4 as to how these priorities can be converted into specific questions or themes.

- Prior to PHASE III: LCC Coordinators work with AK-CSC Director to identify common areas of interest and/or opportunities to leverage resources within the LCCs and the broader community.

- PHASE III: CSC Director translates questions/themes into 1-yr Action Plan.

- During PHASE IV and Beyond: LCC Coordinators work with CSC Director and University CSC PIs to identify opportunities for collaboration and/or cooperation.

Table 3. Specific roles and responsibilities of University partners in the development of 1-yr Action Plans. The progression of activities follows the phases outlined in Table 1.

- During PHASE II: University CSC PIs review broad priorities from ACCER, and make suggestions to AK-CSC Director as to how these priorities can be converted into specific questions or themes.

- Prior to PHASE III: University CSC PIs work with CSC Director to identify common areas of interest and/or opportunities to leverage university resources, programs, etc.

- PHASE III: CSC Director translates questions/themes into 1-yr Action Plan.

- During PHASE IV and Beyond: University CSC PIs work with CSC Director and LCC Coordinators to identify opportunities for collaboration and/or cooperation.

II. Vision statement for the AK-CSC :

“ Improve the understanding of how Alaska’s ecosystems, natural resources, and cultural resources will respond to changing climate regimes, while supporting effective management, sustainable use, and sustainable communities.”

III. Major goals of the AK-CSC

1. Support high quality research projects and other scientific activities, both strategic and long-term, identified through the partnership processes established by the Alaska Climate Change Executive Roundtable and its membership**,** and the Landscape Conservation Cooperatives, and the National Climate Change and Wildlife Science Center.

2. Improve and quantify the capacity to downscale GCM’s for climatic variables significant to predicting landscape scale ecosystem response in northern latitudes, including the development of standardized methodologies.

3. Improve understanding of the relative vulnerability of key Alaska ecosystems and ecosystem services to the effects of climate variability and climate change, including: (i) fresh water supplies; (ii) landscapes, including wildlife habitat; (iii) native and cultural resources; and (iv) ocean health; and the specific threats to those resources, including (i) invasive species; (ii) wildfire risk; (iii) sea-level rise; and (iv) melting ice/permafrost.

4. Support interdisciplinary activities at regional and larger scales which are aimed at integrating physical climate models with ecological, habitat and population response models in order to better understand natural systems and the human communities they support.

5. Inform partnership driven climate-change adaptation actions by improving the capacity to forecast and respond to effects of change. Specifically, this goal will be accomplished through the integration of research activities, including long-term monitoring of both physical and biological system components, and by providing feedback as part of the adaptive management process.

6. Develop an information collection and sharing architecture consistent with DOI policies and the ACCER Alaska Data Integration effort that will be required for every project funded by the ALK-CSC, and will be used to maximize the effectiveness of that data across DOI and its partners**.**

IV. Three Overarching Premises

Climate Change is having—and will continue to have—a significant impact on Alaska's resources and human populations. In order to provide realistic forecasts of potential changes, the AK-CSC, working in collaboration with the larger scientific community, must identify the main factors that shape ecosystem structure, dynamics, and energy flow. Scientists and managers must to be able to distinguish between natural and human-induced variability, so that both can be addressed to accomplish sustainable management. Three overarching premises emphasize this variability and encompass the broad spectrum of scientific, management and human issues associated with ecosystem change. They provide an umbrella under which appropriate research efforts and other strategies can be identified, and they provide a means to develop and test related hypotheses.

1. Natural variability in the physical environment influences ecosystem structure and services;

2. Human impacts superimpose additional changes, including increased levels of contaminants, habitat
alterations, and increased mortality of certain species that may initiate ecosystem change; and

3. Natural and/or human-induced changes affect people who live and work in the region, forcing adaptation to the changing environment, ecosystem, and management scheme.

V. Five Science-Based Approaches

The AK-CSC will field a program of research, scientific cooperation and collaboration to discover how Alaska's ecosystems respond to climate change and how these responses will vary over time and space. Five basic research approaches will be applied: (1) applied research into improving the capacity to downscale and apply GCMs, including identification of factors affecting performance ; (2) monitoring and development of indices to detect changes in ecosystem components and provide data for modeling and context for process studies; (3) integration of physical climate models with ecological, habitat, and population response models; (4) retrospective studies to maximize use of existing long-term observational records; and (5) modeling to synthesize, extrapolate in time/space, test ideas, and produce future scenarios. These approaches will encompass efforts to address pressing, shorter-term needs, and longer-term, interdisciplinary efforts centered on integrated

ecosystem research. Overall, this portfolio of short and long-term programs and activities will support the AK-CSC's mission to "Improve the understanding of how Alaska's ecosystems, natural resources, and cultural resources will respond to changing climate regimes, while supporting effective management, sustainable use, and sustainable communities".

VI. AK-CSC Themes

The eight general thematic categories identified below will served as the primary basis for AK- CSC research, collaboration and cooperative activities. Specific Goals will be established within each theme by the ACCER Climate Change Coordinating Committee for both short-term tactical, as well as long term strategic science priorities. Specific projects and activities will be funded and tracked within the context of these Themes.

1. Downscaling and application of GCM's and/or production of variables with significance to ecological forecasting.

The task of developing meaningful and relevant downscaled parameters of interest relevant to the twelve eco-regions (Figure 1), three major marine ecosystems (Figure 2) and five LCCs (Figure 3) that make up Alaska is extremely challenging. Due to its tremendous size, major latitudinal and longitudinal gradients, vast coastal regions, massive interior continental regions, the highest and most extensive mountain regions in North America, and unique arctic environments in the north, Alaska encompasses a tremendous diversity of ecological and climatic conditions, all of which are experiencing significant shifts in climate and documented ecosystem responses. The size and diversity of the AK-CSC region of interest with its inherent difficult access issues, coupled with an extremely limited observational network and lack of long-term climate stations will require a highly adaptive and sophisticated strategy to achieve predictive capacities for modeling future climate regimes and potential system responses. To maximize the effectiveness of the AK-CSC's investment in this theme it will be imperative to work closely with the physical and biological research community to develop future scenarios that are most relevant to vulnerability and adaptation actions identified by the resource management agencies.

2. Conceptual model development for identification of key drivers and response variables.

The development of conceptual models has been identified as a stand-alone research theme because of the significance of the role of these models in bringing together the current hypotheses and understanding of ecosystem processes and drivers of change, their importance in communicating these understandings, and their role in identifying where research dollars should be invested most effectively to improve our understanding and inform decisions making.

3. Terrestrial Ecosystem Vulnerability and Response.
4. Marine Ecosystem Vulnerability and Response.
5. Human Community Vulnerability and Response.

Vulnerability , as defined by DOI in its Strategic Response to Climate Change, is the degree to which a system is susceptible to, or unable to cope

with, adverse effects of climate change, including climate variability and extremes. ***Vulnerability assessments*** are scientific activities (research, synthesis, modeling, monitoring) undertaken with the intent of identifying, quantifying, or evaluating the degree to which natural or cultural resources are likely to be affected by changing climatic conditions. Vulnerability assessments may address one or more of the following factors:

- *Sensitivity* of the resources in question to climate change
- Likely *exposure* of the resources in question to climate change
- *Adaptive capacity* of the resources in question to climate change.

The AK-CSC, working collaboratively with and in support of the ACCER membership and the Alaska LCCs, will facilitate, support or undertake Vulnerability assessments for Terrestrial, Marine, and Human Communities in Alaska and northern latitudes at a range of geographic scales and time frames. These assessments may address individual species or ecosystem elements, with the goal of identifying the vulnerabilities affecting the assessment target, or may be done to evaluate relative vulnerabilities of multiple targets across a geographic area. It is also recognized that these assessments may be used to look for new and emerging opportunities for research, management and monitoring.

6. Development of advanced forecasting and modeling techniques.

Because of the limitations of both historical and current physical and biological observational data, the AK-CSC will seek to develop advanced modeling techniques which serve to extend available information, in statistically valid ways, to understand current conditions and forecast future states under different climate scenarios. The integration of physical climate models with ecological, habitat, and population response models—all of which are essential for both vulnerability assessments and decisions regarding adaptation actions—will require the use of parametric as well as knowledge-based modeling structures. Identification of existing advanced structures and the development of new modeling techniques will also serve to help drive the monitoring parameters and levels of precision required to adequately answer the most pressing needs.

7. Integrated scientific programs.

The full potential of the AK-CSC will only be realized if it promotes a multidisciplinary, ecosystem wide program that cuts across scientific disciplines and begins to address critical questions regarding ecosystem structure and function and how ecosystem components are influenced by changing climate regimes, natural variability, and human activities. New comprehensive, integrative scientific understanding at ecosystem levels will provide one of the most important, long-term outcomes of the NCCWSC and the network of regional CSCs.

VII. Monitoring Strategies

Monitoring is seen as a highly important, crosscutting, integrative activity required to support all seven of the AK-CSC Themes. Without established baseline conditions, the capacity to assess trends in physical conditions and biological populations through monitoring is extremely difficult. Vulnerability assessments can only occur if trends are known or can be predicted based on observed changes in climate regimes and some

knowledge of what the ecosystem responses will be based on the scientific record. Monitoring will be critical to: (1) improve downscaling model performance; (2) evaluate and refine the conceptual models that try and explain the primary components and drivers of change for ecosystems and populations of interest; (3) validate and improve the predictive capacities of coupled bio-geophysical models; and (4) to monitor the outcomes of the adaptive actions that the resource management community will prescribe so as to inform and improve upon the next generation of planning and decision making.

Given its current structure, potential staffing levels, and the DOI/USGS model for funding CSCs, it is not feasible for the AK-CSC to take the lead in long-term, comprehensive monitoring projects. Likewise the AK-CSC lacks critical monitoring-related infrastructure and capacities that are found elsewhere in the state and region (e.g., USGS water programs and the National Park Service Inventory and Monitoring program). As such, the AK-CSC will initially focus on (1) critical gaps in the existing monitoring network as they relate to AK-CSC scientific activities and (2) activities aimed at facilitating the development of longer-term and sustainable monitoring programs to meet partner needs.

A significant challenge for the AK-CSC will be in finding a balance between funds needed for process- oriented research versus funds to support inventory and monitoring required in a region where even the most fundamental of baseline bio-physical conditions have not been established for the wide range of eco-regions found within the state, nor for most resident wildlife populations. The AK- CSC will need to be highly collaborative and leverage the capacities resident in the ACCER Federal and State member agencies, the University of Alaska, and the Alaska LCCs. One of the first tasks for the AK-CSC will be to work with LCCs, university partners and other key stakeholders to inventory ongoing and proposed monitoring programs and to identify gaps where investments in monitoring will bring the greatest return. This process will serve to identify opportunities for the AK-CSC to help initiate new monitoring activities and/or to collaborate with other organizations and their programs.

VIII. Other approaches and partnerships for AK-CSC

1. **Local and Traditional Knowledge**

- Local and traditional knowledge (LTK) refers to an array of information, understanding, and wisdom accumulated over time. LTK is based on experience and often shared within a group or community. This knowledge may be the product of an individual's time on the land or sea (local knowledge) or it may be accumulated over generations and perpetuated within a culture (traditional knowledge). The AK-CSC will explore ways to use LTK, including the formulation of research hypotheses, documenting existing LTK, recording observations, fostering collaborative analysis, collaborating on specific projects, and exploratory research. The LTK effort must meet standards as high as those applied to the rest of the scientific program.

2. **Cooperative Research and Decision Support with other Institutions**

- The AK-CSC will seek to leverage its investments in science capacity, projects, and data with its partners in the research and resource management communities to the maximum extent possible. This will be achieved through close communication and coordination with those entities. At every opportunity the AK-CSC will seek out cooperation and collaboration with other institutions doing complementary work so as to minimize redundancies and to integrate their efforts and products into the science needs identified by ACCER. The AK-CSC will seek to bring the collective knowledge of the science community into the decision framework of the agencies involved in the development of climate change adaptation strategies, including the development and testing of novel ways of framing and presenting information for climate-sensitive decisions

3. **Education and Outreach**

- The AK-CSC will support research that is useful to those who live and work in the region.

Education, outreach, and community involvement are thus crucial elements of an effective science plan. Each project is required to have an education and outreach component which should include efforts to disseminate research findings and other information to various groups and individuals. These efforts may be general in nature, such as the use of web sites or other broadly distributed media, or they may be specific and targeted, such as presentations in stakeholder meetings. Education and outreach also provide opportunities for stakeholders to give feedback to ACCER, but the emphasis will be on the dissemination of information generated by the AK-CSC's science program.

4. **Community involvement**

- Effective community involvement is broader than the transfer of information through education and outreach. It includes those activities, but also provides a substantive role for communities to help shape AK-CSC activities. The underlying principle is that communities should be aware of what the AK-CSC is doing and why, and have their voices heard in determining program direction. The AK-CSC should be responsive to community interests and provide additional information about research being planned or underway in specific areas. Researchers should advise communities and people involved or affected by the studies of the purpose and time-frame of the research and any potential implications. It is also recognized that communities and their members may want to participate in research and other AK-CSC activities, and the center will help develop the capacity for them to do so.

IX. Data Management and Integration

The AK-CSC's science program must be of the highest quality, with results viewed as unbiased, based on sound science, and useful to resource managers. To maintain high quality research, the AK-CSC will implement strict procedures for reviewing proposals, avoiding conflicts of interest, and protecting confidential information. When the research is completed, the AK-CSC expects significant findings to be promptly submitted for publication, with authorship accurately reflecting contributions of those involved. Investigators will be required to share any related data, information or supporting materials in accordance with the NCCWSC Data Policy. Annual reports are required for all AK-CSC sponsored activities, and these reports must address progress on the sharing of data and research findings. The AK-CSC will comply with federal requirements for protection of intellectual property, including patents, inventions, and copyrights.

1. Data Management

The data management framework for the AK-CSC will employ the concept of "Dual Data Management Cycles". In this framework data will be managed for two separate but tightly linked purposes: (1) to support the immediate and flexible needs of researchers; and (2) to provide for the long-term preservation and wide accessibility of data for decision support by agencies and the public. These two cycles serve different needs and strategies for addressing both must be included in project Data Management Plans (DMP). All Principle Investigators must submit a DMP to the AK-

CSC Director prior to project initiation. Transfer of funds and other project-related functions may be contingent upon the approval of the DMP by the AK-CSC Director. Data will be managed under the Research portion of the DMP while research is active and data has not been made available to the public. Once the research has concluded or data has been made public, management will transition to the Long-term provisions of the DMP. Project Investigators will be provided with assistance in completing their DMPs if requested.

Both portions of the DMP will observe the data requirements set by the Department of Interior's Climate Change Data System Design Team (DSDT), National LCC and CSC data policies, the Alaska Climate Change Executive Roundtable (ACCER), and any documented AK-CSC extensions.

2. Data Integration

Data integration is achieved through the application of shared data standards and the use of shared data infrastructure or related systems. For the AK-CSC the term "data standards" encompasses applicable laws and policies and standards for naming, domains, vocabularies, ontologies, data types, data structure types, data formats, file organization, and metadata. The AK-CSC will adopt and document the applicable data standards in cooperation with the Principal Investigators and in accordance with the project priorities set by ACCER, and in direct coordination with the NCCWSC/CSC Data Management Strategy and the DOI Climate Data working group.

X. AK-CSC Science Expertise and Skills.

The overall long-term staffing plan for the AK-CSC will be developed with the objective of building capacity to meet the major science needs identified above, while minimizing redundancy with the USGS Alaska Science Center and the University of Alaska. A secondary consideration will be to keep long-term fixed salary costs low enough to allow maximum flexibility in terms of moving funding into science activities.

A. Core Staff-
   1. Center Director
   2. Science Program Manager/Assistant

B. Science Staff- (Potential positions to be considered for hiring)
   1. Applied Climate Scientist
   2. Social Scientist
   3. Population Modeler
   4. Hydrologic Modeler
   5. Statistician or Bioinformatics Expert

XI. Geographic Context.

The area serviced by the AK-CSC will coincide the boundaries of the five Landscape Conservation Cooperatives operating in the region. Initially the AK-CSC will focus on areas inside Alaska itself, but may expand to adjoining areas as its mission and the needs of ACCER dictate. Any activities outside of Alaska will be contingent upon funding and approval by the NCCWSC. The primary focus of the AK-CSC will be on terrestrial, freshwater or near-shore marine ecosystems, but may also expand to meet the needs of ACCER.

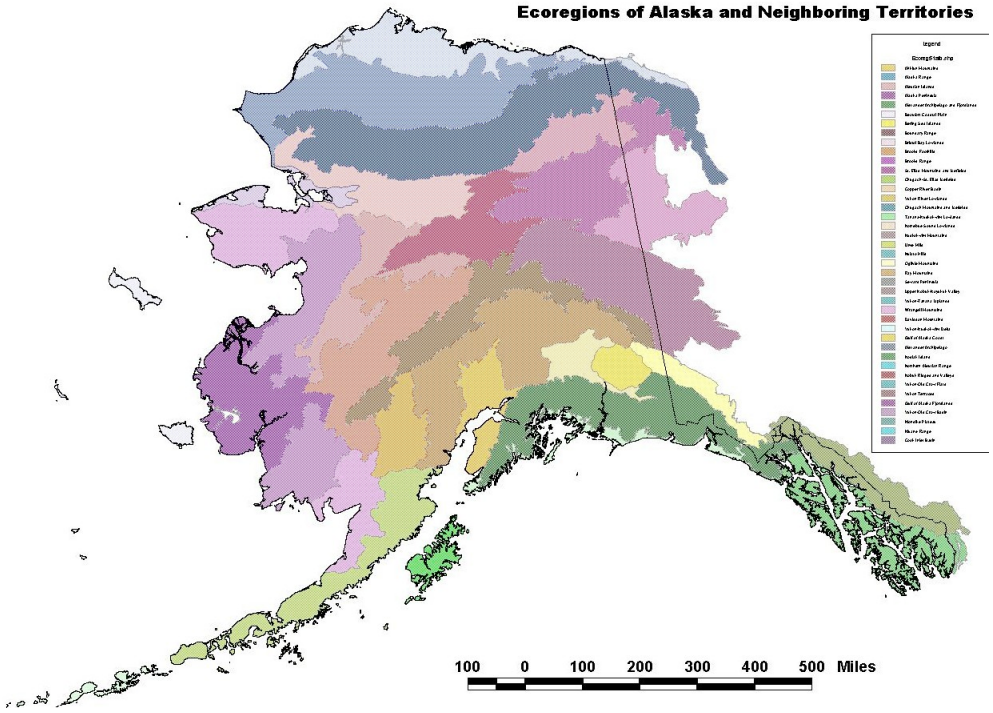

Figure 1. Major eco-regions of Alaska.

Fig. 2-1 Three large marine ecosystems off Alaska.

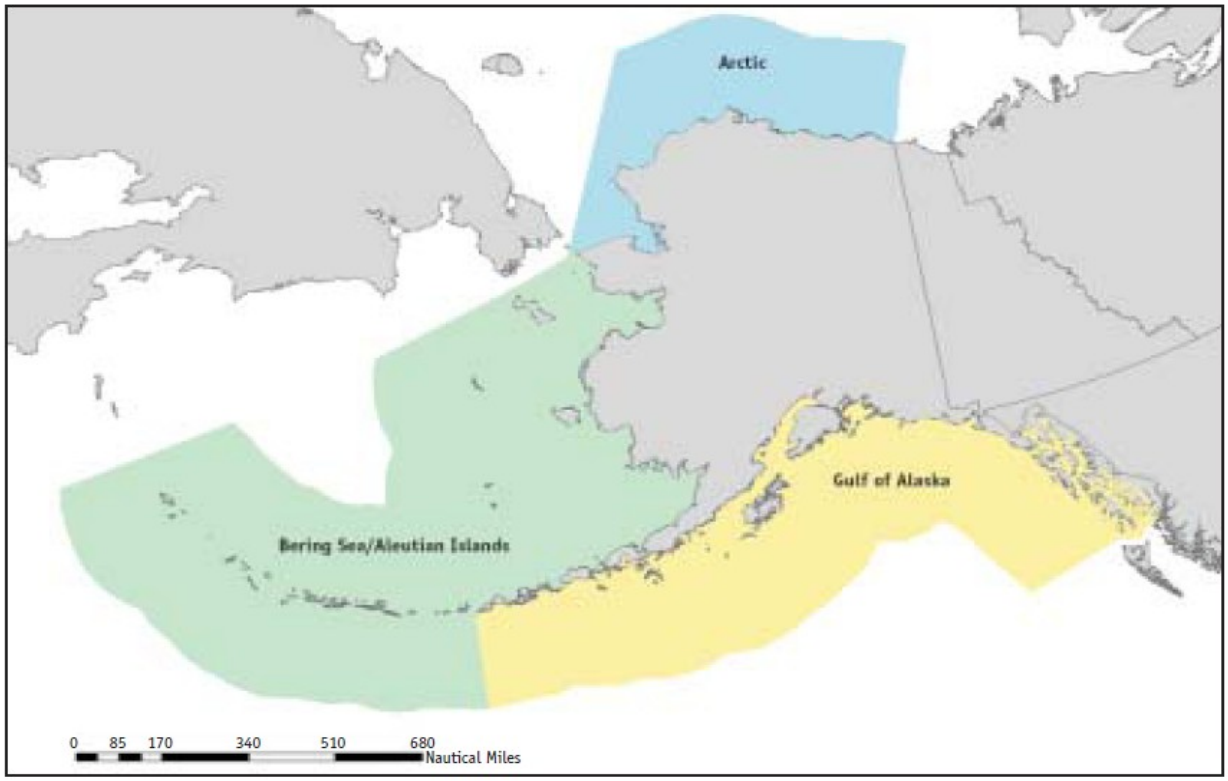

Figure 2. Major marine ecosystems of Alaska.

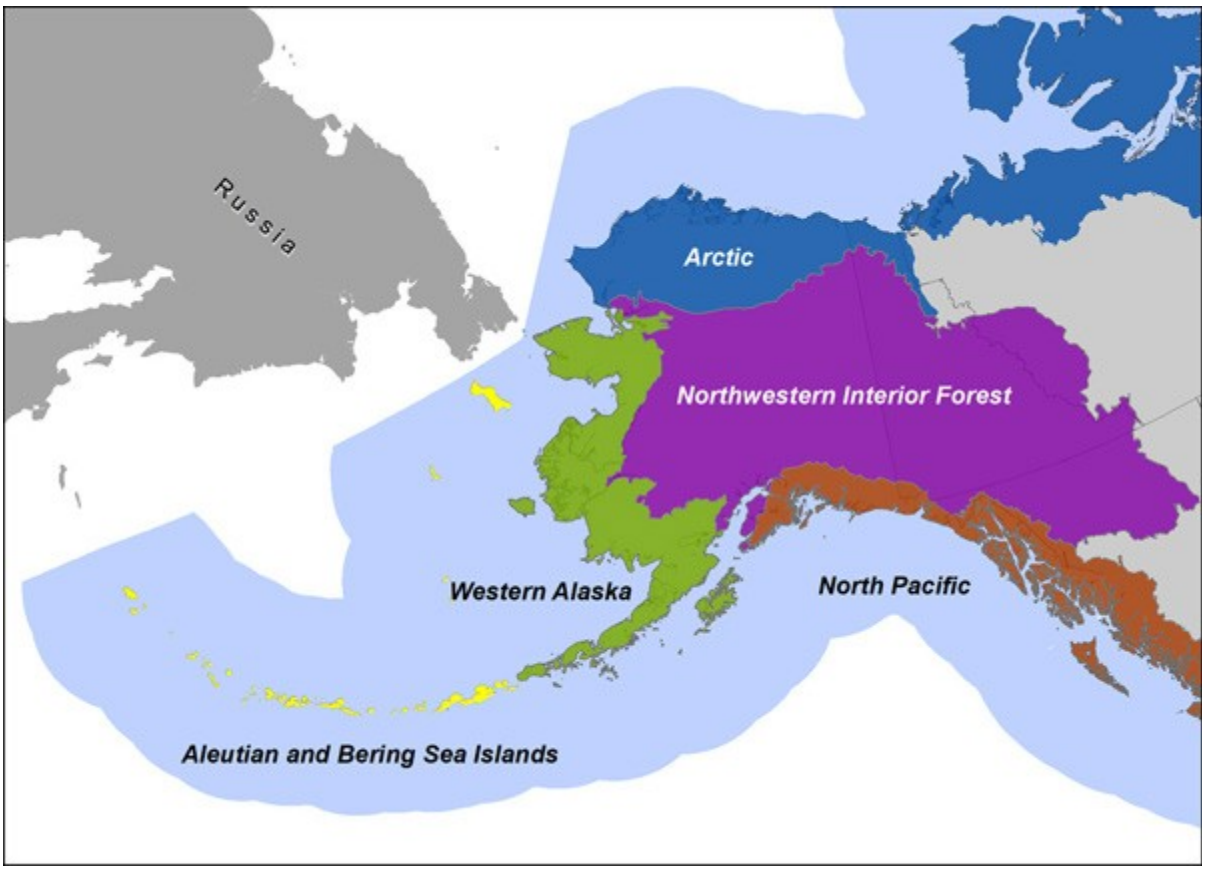

Figure 3. Proposed boundaries of the five Landscape Conservation Cooperatives operating in Alaska.