2012 Annual Report

Arctic Landscape Conservation Cooperative

Advancing Science, Understanding Change.

LANDSCAPE CONSERVATION COOPERATIVES

Executive Summary

The Arctic Landscape Conservation Cooperative released its Strategic Science Plan in 2012, with a ten-year planning horizon. While it serves as a working product, we view it as a living document that can be revised whenever warranted. With invaluable assistance from USGS, we laid the groundwork for a Terrestrial Environmental Observation Network (TEON) that we intend to implement, but which requires additional partner funding if we are to make it an operational network. TEON details are available as appendix A to our Strategic Science Plan. Additional development of TEON plans will occur in 2013.

We are pleased to host myriad data products that are now web accessible as a result of staff efforts and LCC project funding. We have well over 100 discrete spatial data products available for download at our website, http://arcticlcc.org. Geodatabases for North Slope yellow-billed loons and threatened eiders are now posted on our site, as are many project reports and summaries, including 54 vulnerability assessment fact sheets for arctic breeding birds. We have posted a report on climate change impacts to Selawik, Alaska, and documentation of our efforts to rescue legacy data and make the information available to the public. Near real-time data streams from three of our hydrology-related projects can be accessed there as well, along with many presentations and posters developed by both staff and our collaborators. Our site contains at least a summary for each of our 50 projects.

2012 saw a shift in funding strategy for the Arctic LCC. Unlike past RFP's in which we sought products that met general criteria based on our broadly defined goals, the Steering Committee and staff crafted a targeted RFP seeking specific products (discussed below).

To promote interdisciplinary collaboration, we provided planning (but not implementation) funds for four proposed studies. The funded plans address, on a watershed scale, issues identified by our Species and Habitat Technical Working Group as high priority information needs. Feedback from PIs for being offered the opportunity to gather and collaborate on planning a study was overwhelmingly positive.

We recognize the need for improved access to geospatial data, and allocated $225K in 2012 towards fulfilling those needs. We invested in imagery that will facilitate analysis of erosion rates and other changes in the coastal zone, including filling gaps in the LiDAR coverage of the Beaufort Sea coast and processing historical (c. 1980) aerial photographs into orthorectified mosaics. We also contributed to field data collection in support of ongoing ShoreZone mapping along the Chukchi and Beaufort coasts.

We undertook a "Future Needs Assessment" to determine what land managers need most from us in order to make good land and resource management decisions in the future in the face of a rapidly warming arctic. The effort validated our focus on geophysical processes, but highlighted areas where we could improve our performance by more fully considering climate change effects on humans.

Because North Slope permafrost maps are dated and have low spatial resolution, we contracted for an updated 1:1,000,000 scale permafrost map for northern Alaska that would incorporate the best available information, as well as a prototype product at the 1:250,000 scale, to evaluate methods and costs for mapping at this higher resolution. We also contracted with arctic physical process experts to evaluate techniques for wide-scale thermokarst monitoring.

Our interdisciplinary workshop of arctic scientists and managers helped determine their needs for custom snow models and ecological applications for snow datasets. We have contracted to develop products identified by the group as high priority needs.

Ungulate forage quality is likely to change with climate. The Steering Committee saw fit to sponsor a study that will provide a basis for forecasting summer food availability and quality for caribou under future climate scenarios.

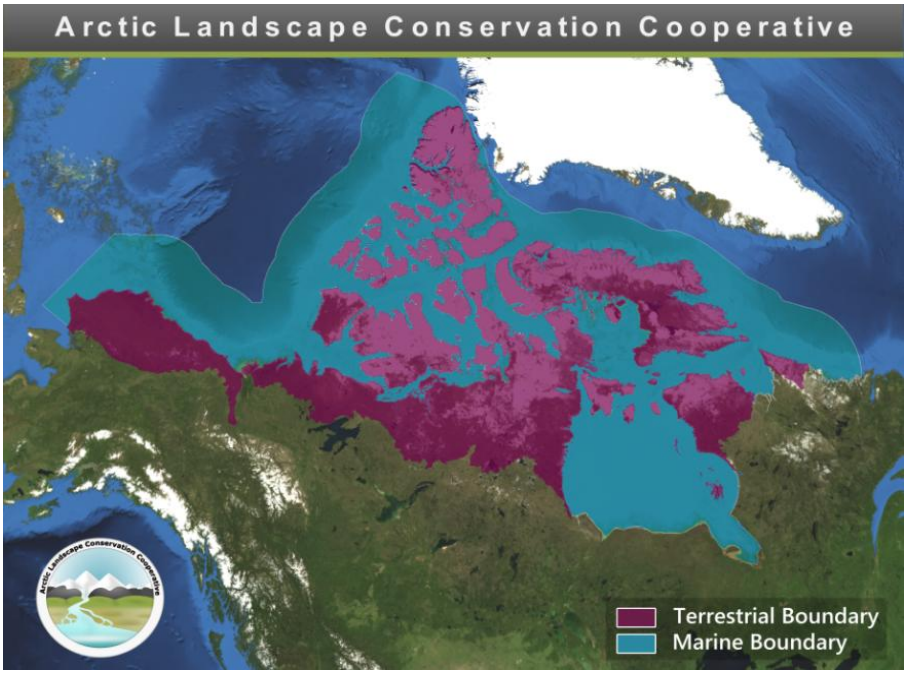
We made great strides in project tracking during 2012 through implementation of our Project Tracking System (PTS). The PTS manages the metadata and data associated with projects, and allows us to track projects throughout all stages of development. It also facilitates internal and external data sharing and discovery.

The Arctic LCC continues its pursuit of improved data management and integration (Arctic LCC Conservation Goal 4). We have generated a Data Management Planning Questionnaire for recipients of Arctic LCC funds; a series of questions intended to help PIs through the process of properly documenting data. In addition, staff continues development of the Arctic LCC Data Management Plan. The plan will provide a data management roadmap for individual projects as well as for the Arctic LCC. In addition, we are contributing to statewide and national efforts to properly and consistently document and manage data through the Alaska Data Integration Working Group and the LCC Network Data Management Working Group.

The Steering Committee directed over $300K towards ongoing projects including: the integrated ecosystem model for Alaska; streamflow monitoring of the Upper Kuparuk, Putuligayuk, and Hulahula Rivers as well as Fish Creek; linking North Slope climate, hydrology, and fish migration; and the Arctic Shorebird demographic network.

We reached out to all of the Tribes within our geographic area in Alaska in 2011 and 2012. While most Tribes have indicated that they lack the capacity to serve on our Steering Committee, most indicated an interest in being kept informed of our activities. The Native Village of Point Lay appointed a Steering Committee representative and an alternate to help represent the views of that community to the rest of the LCC.

For more information on the Arctic LCC, visit http://arcticlcc.org, or contact Greg Balogh, Coordinator at Greg_balogh@fws.gov or Philip Martin, Science Coordinator at Philip_martin@fws.gov.



Arctic LCC Boundaries. Image by Arctic LCC staff.

Our Mission

The mission of the Arctic LCC is to identify and provide information needed to conserve natural and cultural resources in the face of landscape scale stressors, focusing on climate change, through a multidisciplinary program that supports coordinated action among management agencies, conservation organizations, communities, and other stakeholders.

Our 2012 Accomplishments

Strategic Science Plan

The Arctic LCC's Strategic Science Plan (http://arcticlcc.org/about/scienceplan/) outlines monitoring, research and modeling activities for the next ten years. We will review and revise this document at three-year intervals or as needed. The Arctic LCC will focus primarily, but not exclusively, on climate change, with an emphasis on terrestrial, freshwater, and nearshore marine systems. Within the marine system, we will focus on topics that address linkages between that system and terrestrial / freshwater systems. We describe the LCC's three Technical Working Groups (Geospatial, Species and Habitat, and Physical Processes). The plan also states the LCC's interest in, and intent to incorporate, concerns and needs of Arctic residents into its science planning process, but we have not yet determined the best way to accomplish this.

Interdisciplinary Study Plans

The Arctic LCC believes that answering questions regarding potential effects of climate change on habitats and species will require integration of information and skills from multiple disciplines, including physical and biological sciences, ecosystem and spatial modelers, remote sensing specialists, and information managers.

In an effort to promote this needed collaboration of scientists across disciplines, we launched a new effort in 2012 whereby we provided seed money to PIs to facilitate the planning, but not the implementation, of interdisciplinary studies. In our RFP, we requested that the plans address issues identified by our Species and Habitat Technical Working Group's list of high priority information needs, and that they do so on a watershed basis. The Steering Committee provided planning funding for 4 proposed topics (below). A brief description of each plan is available at the associated link. Plans in their entirety are not yet posted to our website, but are available upon request. The Arctic LCC Steering Committee will determine which study plans to implement in 2013 and subsequent years as funds become available.

Our 4 Interdisciplinary Study Plan Topics

1) **Biological Responses to Increasing Water Temperatures**
   PI and Co-PI affiliations: USGS Alaska Science Center, University of Waterloo (http://arcticlcc.org/projects/ALCC2012-06/)

2) **Climate Change Effects on Wetlands and Waterbirds**
   PI and Co-PI affiliations: FWS Migratory Bird Management, University of Missouri Department of Fisheries and Wildlife Sciences, Manomet Center for Conservation Sciences, University of Alaska, Fairbanks (UAF) Water and Environmental Research Center, Geophysical Institute, Institute of Arctic Biology, and School of Fisheries and Ocean Sciences, North Dakota State University Department of Biological Sciences, Minnesota State University Biosciences

Department, Alaska Cooperative Fish and Wildlife Research Unit (http://arcticlcc.org/projects/ALCC2012-07/)

3) **Responses of an Arctic Freshwater Ecosystem to Climate and Land-use Change**
PI and Co-PI affiliations: UAF Water and Environmental Research Center, BLM, USGS Alaska Science Center, US Army Corps of Engineers Cold Regions Research and Engineering Laboratory, USFWS Fairbanks Fisheries Office, ADFG, and Colorado State University (http://arcticlcc.org/projects/ALCC2012-08/)

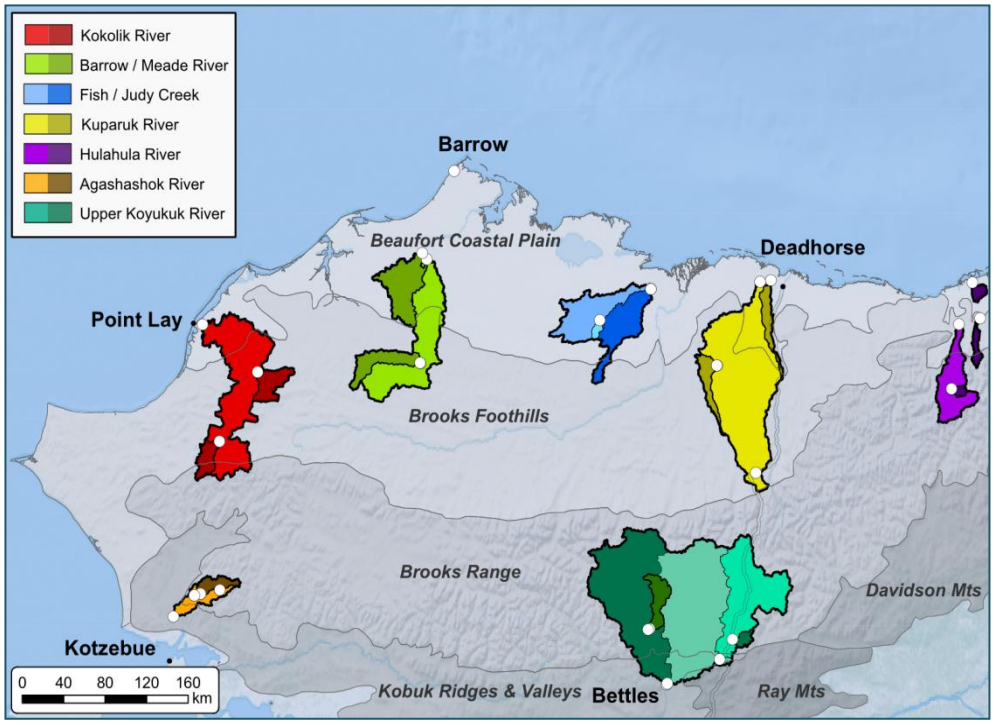
4) **Marine Food Web Response to Runoff**
PI and Co-PI affiliations: College of William and Mary's Virginia Institute of Marine Sciences, Skidaway Institute of Oceanography, UAF School of Fisheries and Ocean Sciences (http://arcticlcc.org/projects/ALCC2012-09/)

The TEON plan was authored by Dr. Benjamin T. Crosby, Idaho State University, with financial assistance from the USGS Alaska Science Center. TEON outlines a strategy of focusing observation activities in a limited number of focal watersheds that: (1) collectively represent the diversity of landscape settings and dominant ecological processes at the ecoregional scale; (2) take advantage of existing science/logistics capacity; and (3) provide opportunities to build on existing long-term data archives. Parameters measured and protocols used will be consistent among sites and include a common suite of variables relevant to diverse users (e.g. hydrology, meteorology, permafrost). In 2013, the Arctic LCC will continue preparatory work, including peer review of the TEON plan, development of a data management plan, and collaboration with partners to develop a business plan that outlines organizational roles and funding strategies.
Partner: USGS

Our Big Initiative

Terrestrial Environmental Observation Network (TEON)

Over the last decade, many have called for establishing a network of persistent Arctic monitoring sites, but no one has stepped up to the task. The Arctic LCC is working toward filling this longstanding gap by completing a detailed proposal for creation of a Terrestrial Environmental Observation Network (TEON) to collect, distribute, and synthesize long-term observational data essential to our understanding of a changing hydroclimate/ permafrost regime on life in Arctic Alaska (http://arcticlcc.org/about/scienceplan/).



Location of TEON watersheds. White circles show general location of data collection stations; ecoregions are shown in gray. Image by Arctic LCC staff.

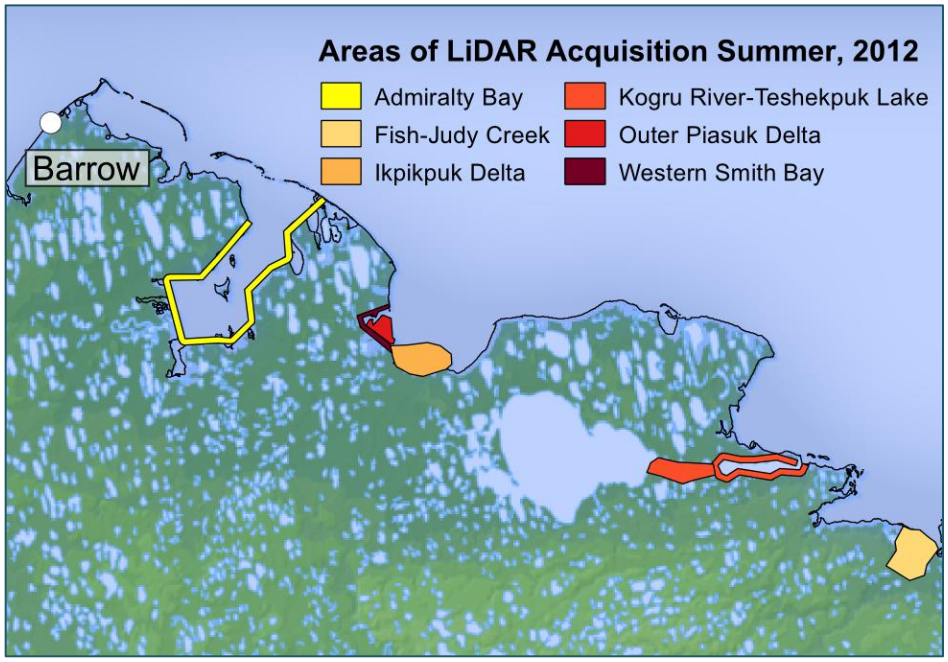
Geospatial Data Acquisition

The Steering Committee made the determination that continued acquisition of geospatial data of interest to multiple partners should remain a priority, but left it to the Coastal Processes and Geospatial Technical Working Groups to decide exactly what products to obtain within their allotted $225k budget. The working groups determined that their highest priorities were to obtain additional LiDAR data along the coast where previous data collection efforts had left gaps (http://arcticlcc.org/projects/ALCC2012-05/), and to create orthomosaics of historical imagery to show the past shoreline position. These two products will help us understand coastal erosion rates throughout the area covered by the imagery (http://arcticlcc.org/projects/ALCC2012-11/). The working groups also thought it important to contribute to multi-agency intertidal resource mapping of the Arctic via the ShoreZone effort (see below).

Partners: USGS, BOEM, UAF, Alaska Satellite Facility, Nuka Research and Planning Group LLC, and Coastal & Ocean Resources

Future Needs Assessment for Arctic Alaska Land and Resource Managers

In an effort to verify that we are addressing management information needs in a strategic manner, the Arctic LCC Steering Committee decided to engage land managers in a conversation focused on the future. They undertook an assessment of emerging science and information needs identified by land and resource managers working in Alaska's Arctic, with a focus on needs related to decisions linked to climate change. Typically, management decisions are made based overwhelmingly on current conditions and the immediate information needs. The series of hour-long interviews addressed: the importance of climate change relative to other sources of change in affecting future resource management decisions; adaptation actions that managers might expect to take in the future as ecological systems change; and how the Arctic LCC can most effectively provide information to management agencies. We consolidated the feedback from 27 interviewees representing one state agency, seven federal agencies and two borough governments.



Areas of LiDAR Acquisition. Image by Arctic LCC staff.

A primary product of the Future Needs Assessment is a prioritized list of 46 science and information needs in 4 categories: physical parameters and processes; biological parameters, processes and responses; applied information and decision support tools; and human environment and cultural resources.

The Steering Committee found that the results of the Future Needs Assessment largely validated the direction that the Arctic LCC has taken in its work to date including: projects accomplished by staff or funded 2010-2012; interdisciplinary project plans we solicited; and the scientific focus outlined in the 2012 Strategic Science Plan. However, staff believes that the feedback

indicated a need to focus more on community subsistence harvest systems and change, and on human dimensions of change – effects of climate change on residents of the Arctic.
Partners: Udall Foundation's U.S. Institute for Environmental Conflict Resolution and the 27 individuals who participated in our survey.
http://arcticlcc.org/projects/ALCC2012-03/

Updated Permafrost Map

Permafrost is ubiquitous throughout the Arctic LCC geography, and it has profound implications for nearly every facet of ecology and land management. Improved permafrost mapping has been identified as a science need by the North Slope Science Initiative, Alaska Climate Change Strategy, and the Alaska Climate Change Executive Roundtable. The permafrost map of Alaska was originally drawn in 1965 at a scale of 1:2,500,000 with minor updates in 2008 at a scale of 1:7,200,000. This project will result in a new map at 1:1,000,000 scale or better, and will incorporate information derived from satellite imagery, vegetation and land cover mapping, soil maps, permafrost modeling, site-specific research results, and boreholes. A separate component of the project will map permafrost for a single 1:250,000 quad to assess methods and costs of mapping at that level of resolution for other areas.
Partners: UAF Institute of Northern Engineering, Department of Civil and Environmental Engineering, the Geographic Information Network of Alaska, and Alaska Ecoscience.
http://arcticlcc.org/projects/ALCC2012-10/

ShoreZone: Arctic ShoreZone Shore Stations and Mapping for the Northwest Alaska Coastline

ShoreZone is a coastal habitat mapping system that has been widely applied within Alaska. To date, approximately two thirds of Alaska shoreline has been mapped. The mapping system records georeferenced geomorphological and biological information about the coastal zone; all coastal imagery (video and photos) and data are available on the ShoreZone website. These data provide an important baseline dataset with applications that include resource mapping, oil spill contingency planning, and oil spill response (http://arcticlcc.org/projects/ALCC2012-01/).

Arctic LCC funds supported image acquisition of ~3,000 km of coastline, from Pt. Hope to Wales. In a separate effort, we supported additional field work that complements the ShoreZone coastal habitat mapping efforts along the Beaufort coast (http://arcticlcc.org/projects/ALCC2012-04/).
Partners: NOAA, BOEM, NPS, Western Alaska LCC.

Example of Alaska ShoreZone imagery.
http://mapping.fakr.noaa.gov/szflex/

Effects of Changing Habitats on Ungulate Forages

The growing season in Arctic Alaska is short, but this is the critical time of year when mammals must regain body resources lost during pregnancy, lactation and the long winter. As climate warms, the growing season lengthens. But it is not clear how changes in the growing season might impact forage. The goal of this project is to assess how variation in length and timing of the growing season influences availability and quality of forages important to caribou and other large herbivores, with a focus on the geographic area used by the Western Arctic caribou herd. This project leverages ongoing work on summer habitats for

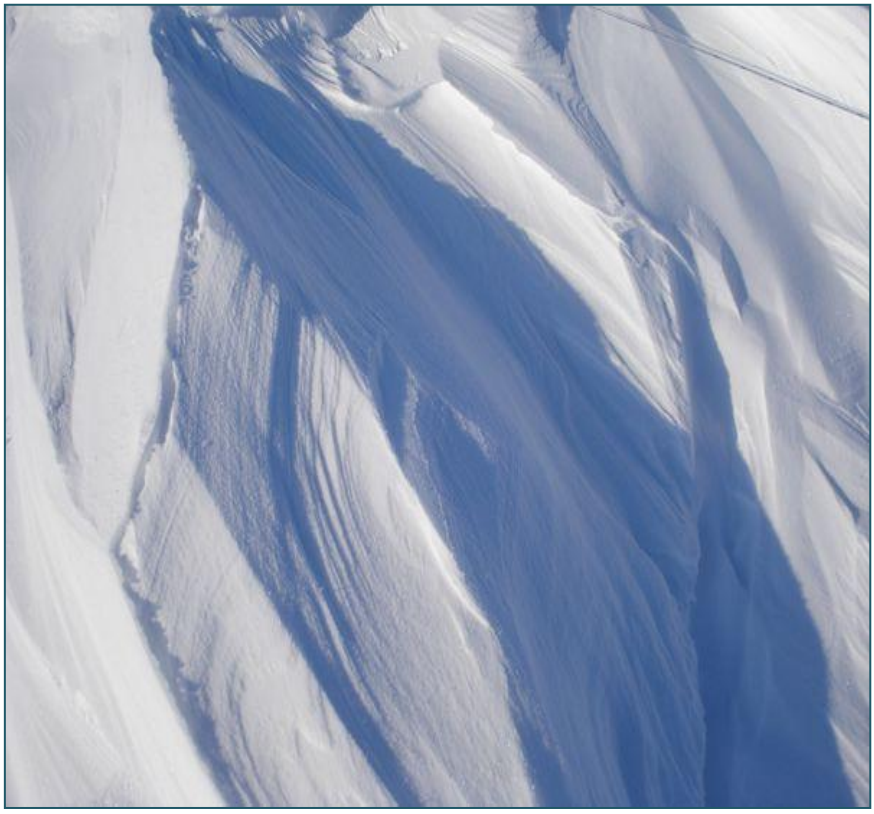
the Teshekpuk and Central Arctic caribou herds.
Partners: BLM, NPS; USGS Alaska Science Center.
http://arcticlcc.org/projects/ALCC2012-12/

Thermokarst Monitoring

Thermokarst (erosion caused by the effects of melting ground ice) sculpts the arctic landscape. Thermokarst-related surface disturbance alters hydrology, carbon and nutrient flux, vegetation, and stream sediment-loading. Lake expansion, lake drainage, and development of drainage networks due to thawing ice wedges are examples of thermokarst processes that may be accelerating as climate warms. These processes affect availability and quality of fish and wildlife habitat, but the rate and extent of thermokarst-driven surface change at the landscape scale is poorly quantified. This project will review the types of thermokarst events typical of northern Alaska, as well as current and past efforts to assess thermokarst processes at broad scales. In addition, the report will compare scale, costs, and strengths, and weaknesses of different monitoring approaches.
Project Lead: USGS Alaska Science Center
http://arcticlcc.org/projects/ALCC2012-12/

SnowDATA: Snow Datasets for Arctic Terrestrial Applications

Snow is a dominant feature at high latitudes. Snow conditions profoundly affect a wide range of hydrologic and ecosystem components and processes, including those related to ecology of flora and fauna, surface energy, moisture stores and nutrient fluxes. Snow datasets currently do not exist at the required spatial and temporal scales needed by scientists, land managers, and policy makers. The goal of this project is to produce snow datasets for Alaska's Arctic that can be used in a wide range of climate, hydrologic, and ecosystem applications. Output variables will include snow onset and snow-free dates, snow depth and density, occurrence of icing events, storm frequency, snowmelt runoff, snow water equivalent, and other parameters to be determined through discussion with user groups. These will be simulated on a 2-km grid, over a domain approximating the northern two-thirds of the state, on a daily time increment from 1980-present. Other domains will be simulated at higher spatial resolutions for specific applications identified by users. Simulations using climate change projections will be undertaken if funding allows.
Partners: USGS Alaska Climate Science Center, Colorado State University.
http://arcticlcc.org/projects/ALCC2012-02/



The wind near Barrow, Alaska has carved and packed this snow surface. Photo by Sveta Berezovskaya http://ine.uaf.edu/werc/people/sveta-stuefer/sveta-snow-and-water-research/

Data Management

Improving data management and integration is one of the Arctic LCC's four conservation goals. The LCC has focused efforts on facilitating data management and sharing both within and outside the LCC network. To that end, staff have generated a Data Management Planning Questionnaire for Arctic LCC-funded PIs (http://arcticlcc.org/about/policy/data-management/); a series of questions intended to help PIs through the process of properly documenting data. In addition, staff are developing the Arctic LCC Data Management Plan. Our plan will provide a data management roadmap for PIs and for the Arctic LCC.

Externally, the Arctic LCC is focused on providing both direct access to data products generated with Arctic LCC funds and integration of that data with data produced by other entities. The Arctic LCC is committed to making all data products available to the public through arcticlcc.org. The Arctic LCC is an active participant in the Alaska Data Integration Working Group (ADIwg, http://www.aoos.org/adiwg/). The development of the Arctic LCC Project Tracking System (PTS) will enable us to share project information using web services conforming to the ADIwg Project Metadata Standard. This standard will facilitate discovery of projects through common data "portals". ADIwg is currently working towards a common Data Metadata Standard which will facilitate data discovery.

Internal to the National LCC Network, the Arctic LCC participates in data management-related national working groups and projects. The Arctic LCC Data Manager chairs the LCC Network Data Management Working Group (DMWG). Arctic LCC staff co-authored *Data Management Best Practices Part 1: LCC Funded Science*, which outlines data management recommendations for projects funded by LCCs. Arctic LCC staff are active participants in the Integrated Data Management Network project (IDMN). The IDMN is funded by the National LCC Network and aims to provide tools that facilitate data integration and sharing among LCCs and with partners.

Arctic LCC staff ensure that all project metadata is kept current and is discoverable through the Geographic Information Network of Alaska (GINA, http://www.gina.alaska.edu/). When GINA adopts ADIwg data metadata standards, our data metadata will become discoverable through that portal as well.

Muskoxen. USFWS Photo

Our Products

Spatial

Aquabase

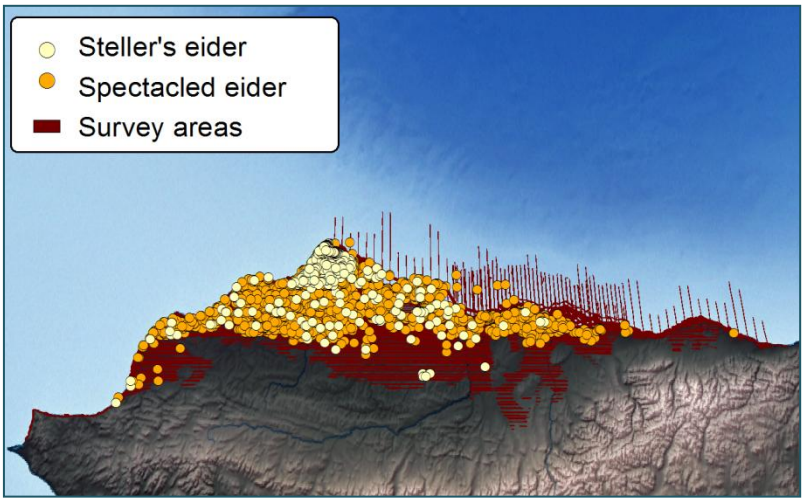
The distribution and abundance of fishes in Alaska's Arctic is poorly known, especially for resident species. Only a few of Alaska's arctic watersheds have been the subject of fisheries or water quality studies. Aquabase is a geodatabase that links freshwater fish and hydrological information with referenced waterbody locations. Presently, the spatial extent of the dataset covers Alaska's central and eastern North Slope, between the Kuparuk River and the US/Canada border. The data within Aquabase will prove valuable for habitat assessment, modeling activities, and planning of industrial activities.
Partners: USFWS; UAF Alaska Cooperative Fish and Wildlife Research Unit
http://arcticlcc.org/projects/ALCC2010-03/

Predicted Habitat Suitability Indices and Species Richness for Selected Shorebird Species

The Arctic Coastal Plain of Alaska is an important region for millions of migrating and nesting shorebirds. Climate change has the potential to notably alter their breeding habitat. These habitat suitability indices "fill in the gaps" where observations are sparse and provide the information necessary to identify important regions for nesting shorebirds. Additionally, these data can be used to better understand potential impacts of different climate change scenarios and different infrastructure development scenarios.
Partners: USFWS; Manomet Center for Conservation Science
http://arcticlcc.org/projects/ALCC2010-02

Threatened Eider Geodatabase

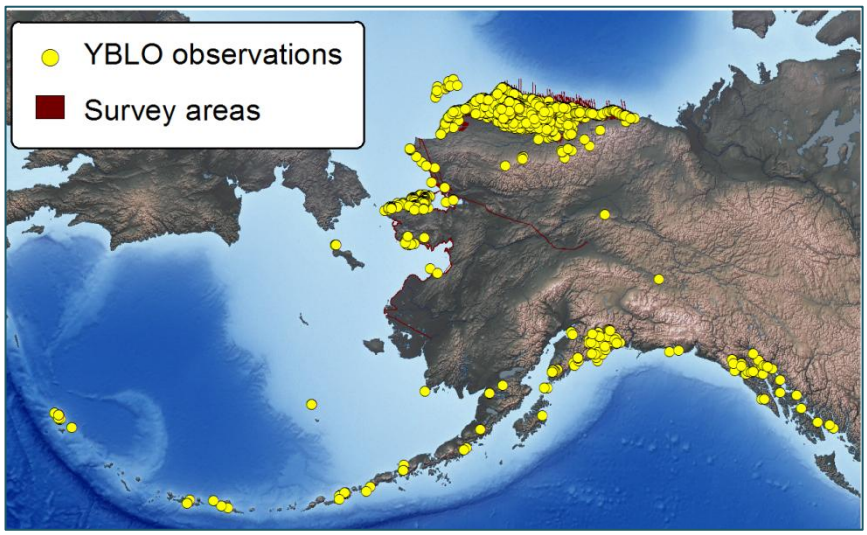
Early in 2013, the Arctic LCC released the Threatened Eider Geodatabase to the public through arcticlcc.org. This database synthesizes existing information and serves as a repository for Spectacled and Steller's eider distribution and survey information collected in the future. We believe that this database will facilitate both the NEPA and ESA Section 7 consultation processes for North Slope development as well as keep investigators apprised of the best available eider distribution information.
Partners: USFWS; ABR, Inc.
http://arcticlcc.org/projects/ALCC2010-10/



Example of a map generated using data from the Threatened Eider Geodatabase, 2012 Edition. Image by Arctic LCC staff.

Yellow-billed Loon Geodatabase

The yellow-billed loon is designated as a candidate species under the Endangered Species Act. But due to its expansive range throughout remote habitats at extremely low densities, little is known about the species. The original yellow-billed loon database was released to the public in 2008, but the updated version of the database is now available from our website. As with the Threatened Eider database, we believe that this database will facilitate both the NEPA and ESA Section 7 consultation processes for North Slope development as well as keep investigators apprised of the best available yellow-billed loon distribution information.
Partner: BLM
http://arcticlcc.org/projects/ALCC2010-14/



Example of a map generated using data from the Yellow-billed Loon Geodatabase. Image by Arctic LCC staff.

Western Arctic Coastal Plain Lakes and Associated Drainage Gradients

When thermokarst occurs along lake margins, it can cause them to increase in size, or cause them to drain. This dataset depicts lakes in the western portion of the Arctic Coastal Plain and their associated drainage gradients. The report indicates that lake expansion is likely to increase as lakes thaw earlier and freeze later, while active layers surrounding lakes become deeper. A small increase in lake drainage rate is predicted to cause a disproportionately large increase in lake loss as lake shores expand into nearby drainage gradients, become tapped, and drain partially or fully. We host the investigator's final report on this topic, along with spatial data layers for lakes with drainage gradients, coastline features, and digital surface models from interferometric synthetic aperture radar data.
Partners: UAF, Geophysical Institute Permafrost Lab
http://arcticlcc.org/projects/ALCC2010-09

Web Applications

Improving Data Sharing by Enhancing Communication: Secure Data Services

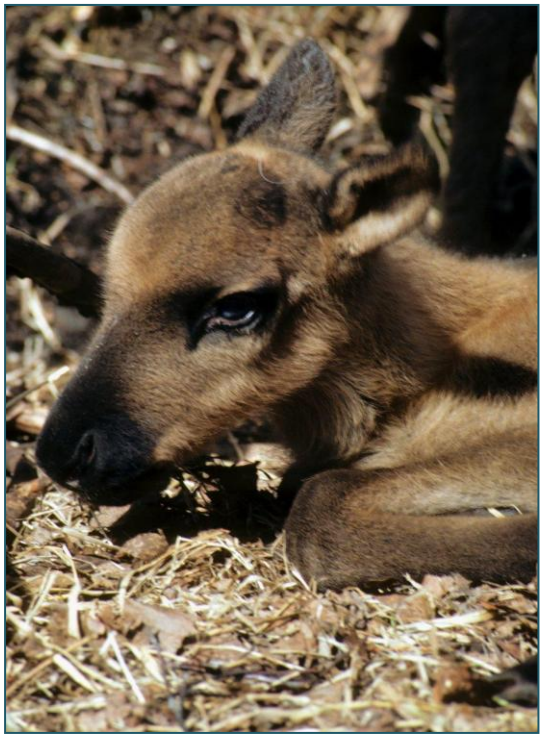
The Secure Data Services (SDS) system is designed to facilitate communication between data providers and data users. SDS is hosted and maintained by the Geographic Information Network of Alaska (GINA). When SDS is activated, users downloading Arctic LCC datasets are given the option of providing their contact information and a description of how they will use the data. Providing this information is voluntary, users that prefer to remain anonymous can easily bypass the system and access data. The information provided by data users can be accessed at a later time by data providers. The information may be used to contact data users about updates to products or provide additional information about a dataset.
Partners: UAF, GINA
http://arcticlcc.org/projects/ALCC2011-19/

Project Tracking System

The Arctic LCC has developed a Project Tracking System (PTS) to manage the metadata and data associated with projects. The PTS was operational for much of 2012, and has allowed us to monitor projects throughout all stages of development, from receipt of proposals through delivery of all final products. We monitor all stages of the contracting process, and have mechanisms for auto-reporting when each interim and final report or product is nearly due or overdue.

In addition to project management, the PTS facilitates the process of internal and external data sharing and discovery. The PTS allows LCC staff to access and manage project data from anywhere on the internal network using a web browser. It will allow us to implement the Alaska Data Integration Working Group standards, which will facilitate discovery of project information over the internet.

The PTS is developed and designed to operate on open source software. This will avoid licensing costs and proprietary data formats, while facilitating adoption of the PTS application by other LCCs or partners. PTS source code, metadata, and documentation is available from our website.
Project Lead: Arctic LCC
http://arcticlcc.org/projects/ALCC2012-1001



Caribou calf. USFWS Photo.

Outreach

Tribal Outreach Efforts in 2012

This year was the first in which a Tribe (The Native Village of Point Lay) was represented on our Steering Committee. This resulted from our tribal outreach efforts spanning 2011 and 2012, and which included multiple contacts with all tribal entities in our geographic area within Alaska.

Our outreach package contained background material on the Arctic LCC and other LCCs in Alaska, a statement indicating why we desired tribal representation on our Steering Committee, and if tribal capacity allowed, on our technical working groups. We provided a list of questions to promote discussion at Tribal Council meetings to help them determine their interest in engaging with the Arctic LCC. We followed up with each Tribe, including a trip to Barrow to meet with the Inupiat Community of the Arctic Slope, to determine their respective level of interest in engaging in our efforts.

Outreach to Local Governments

Both the North Slope Borough and Northwest Arctic Borough governments have been invited to join our Steering Committee. The Northwest Arctic Borough expressed interest in participating on the Arctic LCC Steering Committee and appears poised to appoint a representative.

Governance Changes in 2012

The Steering Committee modified the Arctic LCC charter in 2012. Notable changes included a modification of the Steering Committee's definition of a quorum and addition of a section that explicitly states the LCC's previously agreed-upon geographic scope and operational focus (http://arcticlcc.org/about/).

Our Recent Tools, Reports, and Publications

Assessing Climate Change Vulnerability of Breeding Birds in Arctic Alaska http://arcticlcc.org/projects/ALCC2011-11/, including 54 species-specific fact sheets assessing vulnerability to climate change.

Development of Shorebird Distribution Maps for the North Slope of Alaska Using Geospatial Habitat Modeling: the First Step in Assessing Effects of Climate Change. http://arcticlcc.org/projects/ALCC2010-02/

Findings of Anaktuvuk River Fire Recovery Study: 2007-2011. http://arcticlcc.org/projects/ALCC2011-10/

Hydroclimate Observations in Arctic Alaska: Analysis of Past Networks and Recommendations for the Future. http://arcticlcc.org/projects/ALCC2010-04/

Integrated Ecosystem Model Final Report: A collaborative project for the Arctic Landscape Conservation Cooperative. http://arcticlcc.org/projects/ALCC2010-05/

Landscape-level Ecological Mapping of Northern Alaska and Field Site Photography. http://arcticlcc.org/projects/ALCC2011-06/

Predicting Breeding Shorebird Distributions on the Arctic Coastal Plain of Alaska. http://arcticlcc.org/projects/ALCC2010-02/

Predicting Future Potential Climate-Biomes for the Yukon, Northwest Territories, and Alaska: A climate-linked cluster analysis approach to analyzing possible ecological refugia and areas of greatest change. http://arcticlcc.org/projects/ALCC2010-01/

Wing imprints in the snow. USFWS Photo

Presentations, Papers, and Posters

Balogh, G.B. 2012. Arctic Landscape Conservation Cooperative; Addressing Climate Change until Nothing Freezes Over. Inupiat Community of the Arctic Slope, 12 March, 2012 ICAS Tribal Council Meeting, Barrow, Alaska.

Balogh, G.B. 2012. State of the Arctic Landscape Conservation Cooperative. Briefing of Staff to Senator Murkowski, 15 August, 2012, Anchorage, Alaska.

Bradley, J. 2012. Arctic LCC Project Tracking System Webinar. 10 May, 2012.

Jenkins, J.L. 2012. Arctic Landscape Conservation Cooperative: Advancing Science, Understanding Change. Northwest Arctic Borough 2012 Second Annual Subsistence Mapping Conference. 23-26 October 2012, Kotzebue, Alaska.

Martin, P.D., B.M.Jones, and L.H. Erikson. 2012. Arctic Landscape Conservation Cooperative Coastal Process Studies. Poster Presentation, Alaska Marine Science Symposium, 16-17 January 2012, Anchorage, Alaska.

Martin, P.D. 2012. Organizing committee and break-out group leader. U.S. Arctic Observing Coordination Meeting. 20-22 March 2012, Anchorage, Alaska.

Martin, P.D., 2012. Tundra to Tropics: Collaborative Development of Ecological Models in Data-sparse Environments, Part 1. 27-28 March 2012, Denver, Colorado.

Martin, P.D, 2012. Whither Water? Hydrologic Concerns of the Arctic Landscape Conservation Cooperative. 16 May 2012. American Water Resources Association, Alaska Section, Northern Region. Fairbanks, Alaska.

Martin, P.D. 2012. Alaska Landscape Conservation Cooperatives: Scientific Priorities and Collaborative Opportunities. NASA ABoVE Workshop, 13-15 June 2012, Boulder, Colorado.

Martin, P.D. 2012. Break-out Group Leader, Toolik Field Station Environmental Data Center. Toolik Field Station Future Directions Workshop. 2-4 August 2012. Portland, Oregon.

USFWS Photo

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