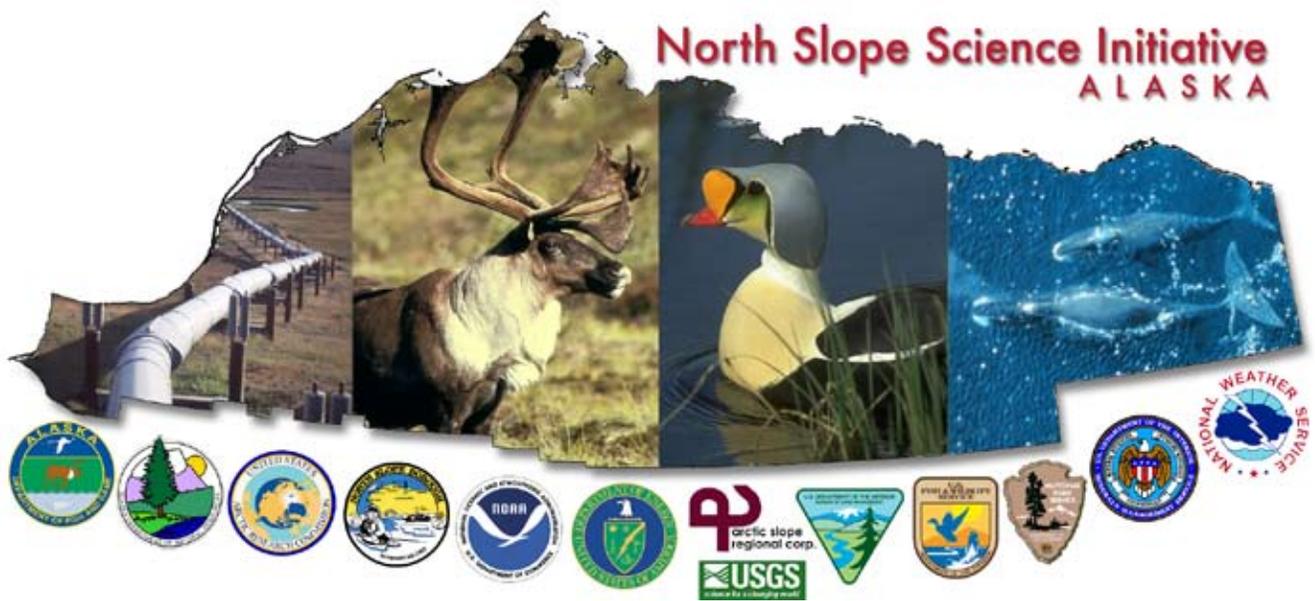


# *North Slope Science Initiative* 2010 Report to Congress



North Slope Science Initiative  
ALASKA

<http://www.northslope.org>



## Scope, Mission and Vision

The North Slope Science Initiative (NSSI) was developed by local, state and federal governments with trust responsibilities for land and ocean management, to facilitate and improve collection and dissemination of ecosystem information pertaining to Alaska's North Slope region, including coastal and offshore regions. The **mission** of the NSSI is to improve scientific and regulatory understanding of terrestrial, aquatic and marine ecosystems for consideration in the context of resource development activities and climate change. The **vision** of the NSSI is to identify those data and information needs management agencies and governments will need in the future to develop management scenarios using the best information and mitigation to conserve the environments of the North Slope. The NSSI adopts a strategic framework to provide resource managers with the data and analyses they need to help evaluate multiple simultaneous goals and objectives related to each agency's mission on the North Slope. The NSSI uses and complements the information produced under other North Slope science programs, both internal and external. The NSSI also facilitates information sharing among agencies, non-governmental organizations, industry, academia, international programs and members of the public to increase communication and reduce redundancy among science programs.

## 2005 Legal Mandate

Under the provisions of the Energy Policy Act of 2005 (PL 109-58), each year the Secretary of the Interior shall publish a report that describes the studies and findings on the Initiative. This is the third such report and describes NSSI's background, scope, mission and vision, objectives, administrative structure, and accomplishments, and outlines future directions based on identified issues on the North Slope and in the adjacent marine environment.

## Credits

John F. Payne, Ph.D., Executive Director, North Slope Science Initiative and the collective Oversight Group are the principal authors of this report with input and review from the Senior Staff Committee.

# North Slope Science Initiative

## 2010 Report to Congress

### Executive Summary

The North Slope of Alaska is America's Arctic. This vast 231,000 km<sup>2</sup> (89,000 mi<sup>2</sup>) area, and the adjoining Chukchi and Beaufort Seas are home to a diverse array of fish, wildlife, and plant resources that support a vibrant subsistence culture, and is believed to have some of the largest oil, gas and coal potential remaining in the United States.

Managers must sustain these resources and plan for safe energy exploration and development in the rapidly changing climate. The unparalleled challenges and opportunities of a changing arctic climate are creating a growing need in the public and private sectors for accurate, up-to-date information and better ways to support climate-related and development decisions for the North Slope. The Arctic is experiencing changes of such magnitude that enhanced, coordinated and sustained observation, research and monitoring is critical.

This is why federal, state, and local governments collectively formed the NSSI; formally authorized under the Energy Policy Act of 2005 (Section 348). The NSSI's broad legislative mandate integrates federal, state and local research and service. The membership of NSSI is increasing collaboration and coordination among its membership and with industry, academia, non-governmental organizations, the



North Slope Land Status. (Information on this map should be used for graphic display only.) (BLM)

## Executive Summary (Continued)

public, and the pan-Arctic community so to base management decisions on accurate and comprehensive information and science now and in the future.

This third NSSI Report to Congress highlights its 2010 and cumulative accomplishments.

In 2010, the NSSI and its Science Technical Advisory Panel made major progress in several areas:

- ◆ Provided an effective forum to coordinate and integrate shared concerns and science needs of North Slope resource managers;
- ◆ Identified the first 13 in a series of “emerging issues” and the science needed to address them for the North Slope and its offshore waters. This deliberative process involved: (1) the NSSI Oversight Group members compiling a targeted list of emerging issues; (2) the Senior Staff Committee clarifying associated management concerns for these issues; and then (3) the Science Technical Advisory Panel outlining scientific approaches to each issue to credibly address each concern. These are discussed on page 24, and a comprehensive document is available on the NSSI website (<http://www.northslope.org/>);
- ◆ Extensively updated and improved the NSSI website as a gateway for public information and access to North Slope science projects;
- ◆ Revised the NSSI-GINA Catalog on the NSSI website for access to satellite imagery, scientific data and project tracking;
- ◆ Represented NSSI on the steering committee for the U.S. Department of the Interior, Arctic Landscape Conservation Cooperative;
- ◆ Continued substantial and meaningful cross initiative communication and information management through the shared resources of the Arctic Landscape Conservation Cooperative, Alaska Natural Heritage Program, North Slope Borough and the State of Alaska;
- ◆ Began the first phase of a cooperative North Slope-wide digital land cover map; and
- ◆ Coordinated extensively with member agencies and academic institutions. This includes the National Science Foundation, U.S. Arctic Research Commission, Interagency Arctic Research Policy Committee, non-governmental organizations, industry, and the greater pan-Arctic community.

For NSSI to continue its success as a forum, to coordinate research and monitoring activities (including workshops), and to meet the management needs and challenges facing America’s Arctic, it is essential that NSSI have adequate and consistent funding, and stable staffing. The NSSI has begun to consolidate core data, information sharing, and address concerns on permafrost, hydrology, erosion, fire regime, social and economic challenges, increasing marine activities, an array of species of shared interest, and more, and the needs are great. Each broad category requires both short- and long-term budget planning. Since its inception, the NSSI has evolved into an effective organization that can meet the challenges facing resource managers on the North Slope and its offshore waters. Its interagency interactions and coordination among federal, state and local levels is making a positive, respected, and lasting impact across the North Slope. Much of its work, however, has only just begun.

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## Legislative Purpose and Objectives of the North Slope Science Initiative

The NSSI was formally authorized in Section 348, Energy Policy Act of 2005 (Public Law 109-58). The legislative purpose and objectives are stated below:

§(a)(2) The **purpose** of the Initiative shall be to implement efforts to coordinate collection of scientific data that will provide a better understanding of the terrestrial, aquatic, and marine ecosystems of the North Slope of Alaska.

§(b) **Objectives:** To ensure that the Initiative is conducted through a comprehensive science strategy and implementation plan, the Initiative shall, at a minimum—

1. identify and prioritize information needs for inventory, monitoring, and research activities to address the individual and cumulative effects of past, ongoing, and anticipated development activities and environmental change on the North Slope;
2. develop an understanding of information needs for regulatory and land management agencies, local governments, and the public;
3. focus on prioritization of pressing natural resource management and ecosystem information needs, coordination, and cooperation among agencies and organizations;
4. coordinate ongoing and future inventory, monitoring, and research activities to minimize duplication of effort, share financial resources and expertise, and assure the collection of quality information;
5. identify priority needs not addressed by agency science programs in effect on the date of enactment of this Act and develop a funding strategy to meet those needs;
6. provide a consistent approach to high caliber science, including inventory, monitoring, and research;
7. maintain and improve public and agency access to—
  - a. accumulated and ongoing research; and
  - b. contemporary and traditional local knowledge; and
8. ensure through appropriate peer review that the science conducted by participating agencies and organizations is of the highest technical quality.

Note: Objectives will be referenced here after by (Obj.#).

## Background and Need for the North Slope Science Initiative

The North Slope of Alaska is a vast area of the polar arctic encompassing 231,000 km<sup>2</sup> (89,000 mi<sup>2</sup>) – roughly the combined size of America’s eastern seaboard states from Maine to Maryland. The offshore areas of the Chukchi and Beaufort Seas add another 295,000 km<sup>2</sup> (114,000 mi<sup>2</sup>) to the scope. Within these areas are considerable natural resources, including what the U.S. Geological Survey (USGS) believes are among some of the largest oil, gas and coal potential areas remaining in the U.S.. The North Slope is also home to an abundant and diverse array of native fish, wildlife, and plant resources that support the vibrant subsistence culture of the Iñupiat people who reside in this area. Balanced and scientifically informed management of fish, wildlife, subsistence, and energy resources continues to be an essential goal of agencies, Alaska residents, and industry.

The North Slope’s wetland, coastal and offshore habitats support a wide variety of important fish and wildlife populations. Over 200 species of birds migrate to the North Slope each summer to nest and raise their young. Hundreds of thousands of waterfowl (including the threatened spectacled and Steller eiders), shorebirds and many others make the North Slope their summer home, migrating to



Male spectacled eider. (USFWS)

the North Slope from nearly every U.S. state and as far away as South America, Africa, Asia, and Antarctica. The North Slope is home to four caribou herds, about 400,000 animals and more than half of Alaska's caribou. These caribou make up a significant portion of the wild native foods the local residents harvest. The North Slope's offshore areas provide marine mammal habitat for the polar bear, four species of ice seals, walrus, and several whale species. Marine mammals comprise over 60% of the annual subsistence harvest. Freshwater fishes, particularly whitefish species (e.g., Aanaakliq, Pikuktuuq, and Qaaktaq) and Dolly Varden (Iqalukpik), are also an important food source. (See table on page 4, Endangered, Threatened, and Candidate Species of the North Slope and Adjacent Seas) The North Slope is the largest contiguous region of wetlands within the Arctic (CAVM Team 2003), in large part due to the continuous presence of permafrost beneath the surface.



**Wainwright residents celebrate the whale festival with a traditional blanket toss. (NSSI)**

All of the North Slope is above the Arctic Circle and is where global forces have long converged. For the Inuits, the North Slope was a pathway for the spread of their culture eastward across the North American Arctic. In modern times, whalers followed the bowhead whales into the pack ice; military contractors constructing a network of Distant Early Warning Radar Stations brought the first large-scale development to the region; and oil companies developed a large industrial complex. Today, the North Slope is a pan-Arctic focal point of growing global awareness for the observation and assessment of the near- and long-term impacts of climate change.

These resources and their development patterns are of vital global importance, and are crucial for survival for people living on the North Slope who depend on them for their subsistence and economic well-being. Federal, state and local agencies manage the resources to maintain healthy fish and wildlife populations and their habitats in a productive environment. The laws and regulations governing oil and gas development and protecting the North Slope's environments are among the most stringent in the U.S., and Alaska is proud of its track record.

Industry has successfully reduced the footprint of development through continued technological improvements, expanding into new areas with directional drilling that targets oil reservoirs several miles from the main drill site. Grind and inject facilities have replaced the earlier reserve pits for holding drilling wastes. These facilities return the materials to formations underground. Ice roads have replaced gravel roads for exploration activities. Alaska has a strong record of incorporating new technologies for exploration and development activities to reduce impacts to the environment.

Resource managers are actively seeking ways to adapt to the rapidly changing arctic environment. The impacts of climate change on the Arctic have both regional and global implications, and likely will have increasingly significant worldwide environmental and societal consequences (IPCC 2007). These Arctic-wide changes are of such magnitude and rate that enhanced, coordinated and sustained

## Endangered, Threatened, and Candidate Species of the North Slope and Adjacent Seas

Species	Status	Lead Agency	Species	Status	Lead Agency
 Bowhead whale ( <i>Balaena mysticetus</i> )	Endangered	NMFS	 Ringed seal ( <i>Phoca fasciata</i> )	Candidate	NMFS
 Fin whale ( <i>Balaenoptera physalus</i> )	Endangered	NMFS	 Spotted seal ( <i>Phoca largha</i> )	Candidate	NMFS
 Humpback whale ( <i>Megaptera novaeangliae</i> )	Endangered	NMFS	 Bearded seal ( <i>Erignathus barbatus</i> )	Candidate	NMFS
 Polar bear ( <i>Ursus maritimus</i> )	Threatened	USFWS	 Yellow-billed loon ( <i>Gavia adamsii</i> )	Candidate	USFWS
 Steller's eider ( <i>Polysticta stelleri</i> )	Threatened	USFWS	 Kittlitz's murrelet ( <i>Brachyramphus brevirostris</i> )	Candidate	USFWS
 Spectacled eider ( <i>Somateria fischeri</i> )	Threatened	USFWS	For more information on these and other special status species, visit: <a href="http://www.adfg.state.ak.us/special/esa/esa_home.php">http://www.adfg.state.ak.us/special/esa/esa_home.php</a> <a href="http://fakr.noaa.gov/protectedresources/">http://fakr.noaa.gov/protectedresources/</a> <a href="http://alaska.fws.gov/fisheries/endangered/index.htm">http://alaska.fws.gov/fisheries/endangered/index.htm</a>		

observation, research, and monitoring is more vital than ever before. The Study of Arctic Environmental Change (SEARCH) and the International Study of Arctic Change (ISAC), both International Polar Year legacies, identify three components for adapting to change: observing change, understanding change, and responding to change.

The collective NSSI is only one of the organizational entities within the larger Arctic science and resource management community who serve to address areas within each of the three components. The NSSI works within the greater community to move forward with well-planned and coordinated inventory, monitoring and research strategies. NSSI works to: (1) document the magnitude, variation and rate of changes as they occur, and places them in the context of past environmental change; (2) understand the causes and consequences of current changes; (3) predict the magnitude, variation, rate, and consequences of future Arctic and global change; and, (4) identify effective adaptive management practices appropriate to Arctic change.

## The NSSI and New National Initiatives:

In 2010, the U.S. Departments of Interior (DOI) and Commerce (DOC) each announced new national initiatives containing regional nodes that will bring significant new capacities to the science needs throughout Alaska and the Arctic. On Sept. 14, 2009, the Secretary of the Interior signed Secretarial Order Number 3289, “*Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources.*” This order created a *Climate Change Response Council*, chaired by the Secretary, to coordinate activities within and across the bureaus and to develop and

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The North Slope Science Initiative (NSSI) was developed by local, state and federal governments with trust responsibilities for land and ocean management, to facilitate and improve collection and dissemination of ecosystem information pertaining to Alaska's North Slope region, including coastal and offshore regions.

**NSSI Mission and Vision:**  
The mission of the NSSI is to improve scientific and regulatory understanding of terrestrial, aquatic, and marine ecosystems for consideration in the context of resource development activities and climate change. The vision of the NSSI is to identify those data and information needs management agencies and governments will need in the future to develop management scenarios using the best information and mitigation to conserve the environments of the North Slope. The NSSI adopts a strategic framework to provide resource managers with the data and analyses they need to help evaluate multiple simultaneous goals and objectives related to each agency's mission on the North Slope. The NSSI uses and complements the information produced under other North Slope science programs, both internal and external. The NSSI also facilitates information sharing among agencies, non-governmental organizations, industry, academia, international programs and members of the public to increase communication and reduce redundancy among science programs.

**NSSI Data Products:**  
In 2009, the University of Alaska, Geographic Information Network of Alaska (GINA) implemented the NSSI Data System (<http://catalog.NorthSlope.org/>) for access to imagery, scientific data, and project information relevant to the North Slope. The system made over 200 GIS data layers available through this public portal. This effort is well on its way to becoming a "one-stop shop" and will serve as a comprehensive distributed network that offers data and information to specialists, managers, staff, academia, and the general public. To help insure the data products are always up to date, the NSSI has tasked a STAP standing subcommittee on GIS/Remote Sensing to provide recommendations on content and operation.

**NSSI Web Portal:**  
The NSSI web portal ([www.NorthSlope.org/](http://www.NorthSlope.org/)) is the main NSSI website and the centralized location to coordinate all NSSI endeavors. The portal contains all NSSI documents including charters, NSSI member and advisory organization information, meeting documents, reports to congress, business and operating plans, and specific information for the NSSI Oversight Group (OG) and Science Technical Advisory Panel (STAP).

**NSSI Project Tracking System:**  
The NSSI Project Tracking System (PTS) (<http://catalog.NorthSlope.org/>) makes information readily available about ongoing activities by various entities on the North Slope and its off-shore environments. The PTS provides information on who, what, where, and when of activities. The database began with a spreadsheet of 571 ongoing projects, with the goal of periodically updating information on new project starts. In 2009, the PTS became operational and is now populated with some 1,200 project records representing the work of over 100 public and private institutions and over 800 individuals. These projects are searchable by subject, by agency or entity, or by principal investigator. In the future the PTS will include terrestrial geographic project locations, sorted project information, printing capabilities, and links to project websites.

**Tundra Lake Studies Web Portal:**  
Through a partnership between NSSI, the Michigan Tech Research Institute (MTRI), the University of Michigan, Marine Hydrodynamics Laboratories, and the U.S. Bureau of Land Management, 67 tundra lakes on the North Slope have been surveyed over a 3-year period using advanced autonomous robot buoy systems. A web portal (<http://tundralakestudies.nssi.org/>) has been developed to store and provide access to the water quality and bathymetry data from these deployments. Data are available as summary statistics, maps, and GIS data downloads.

[www.NorthSlope.org](http://www.NorthSlope.org)

NSSI Poster. (NSSI)



Seal skin Boat frame near the Chukchi Sea. (NSSI)

### **National Security Presidential Directive (NSPD-66) and Homeland Security Presidential Directive (HSPD-25), Relationship to the North Slope Science Initiative**

On Jan. 9, 2009, the President issued two directives related to the U.S. Arctic. While these directives do not specifically relate to the administration and operation of the NSSI, they do contain components that help set direction related to the NSSI. Section III (A)(2) states the policy of the U.S. is to “Protect the Arctic environment and conserve its biological resources”; Section III (A)(3) states the United States will “ensure that natural resource management and economic development in the region are environmentally sustainable”; and Section III (A)(6) states the U.S. will “enhance scientific monitoring and research into local, regional, and global environmental issues.”

The Directives further state that the U.S. will actively promote access to arctic research, establish effective arctic observing networks, work with the Interagency Arctic Research Policy Committee and U.S. Arctic Research Commission, and strengthen partnerships with academic and research institutions. The NSSI, through its Science Technical Advisory Panel and the Oversight Group and assistance from its Senior Staff Committee, are addressing or coordinating many of the Directives that are now U.S. policy as a member of the pan-Arctic community.

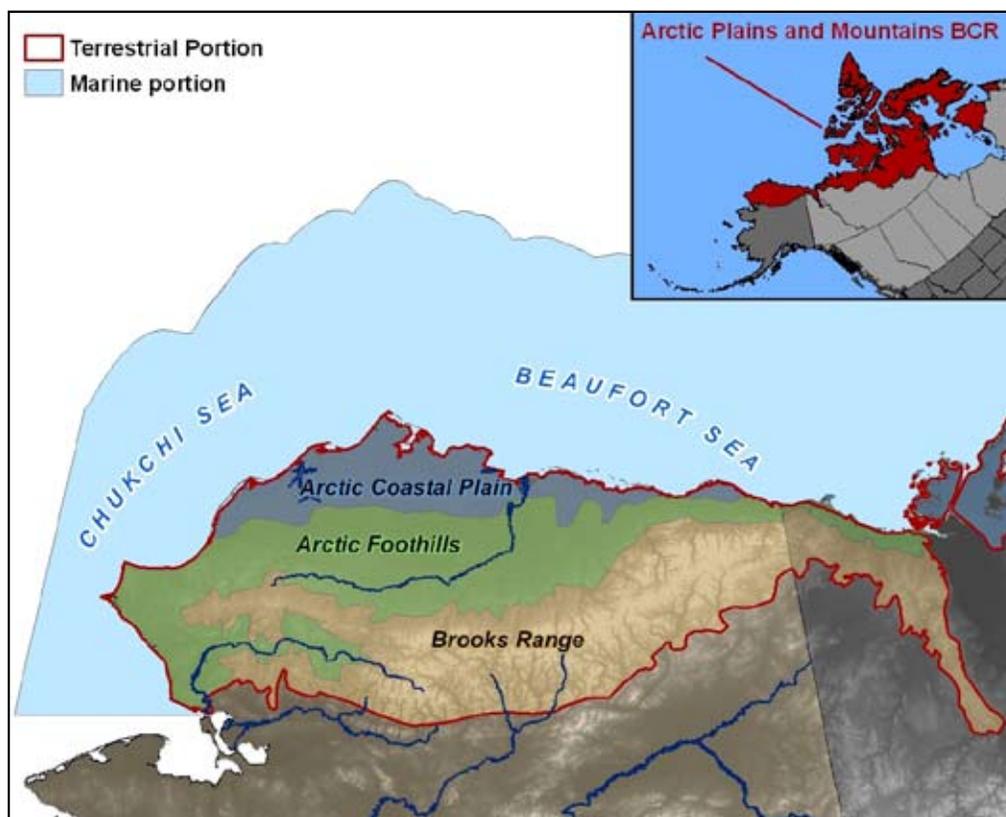
implement an integrated strategy for climate change response by the DOI. The DOI is working at the landscape, regional, and national scales by establishing *DOI Climate Science Centers (CSCs)* and *Landscape Conservation Cooperatives (LCCs)*. It is defining and implementing a vision that integrates DOI science and management expertise with that of our partners, and provides information and best management practices to support strategic adaptation and mitigation efforts on public and private lands across the U.S. and internationally. This vision supports individual bureau missions, and creates synergies with other DOI agencies and partners to implement integrated climate change science, adaptation, and mitigation strategies across broad landscapes. The DOI bureaus will pool resources to support and leverage the joint work of CSCs and LCCs. Project-level funding, implementation, regulatory, management, and policy decisions will continue to be the responsibility of each bureau and partner, in accordance with their mission-related responsibilities.

In addition, under the U.S. Department of Commerce, the National Oceanic and Atmospheric Administration (NOAA) has begun a Regional Climate Service in Alaska and developed an Arctic Vision and Strategy. NOAA envisions an Arctic that bases conservation, management, and resource use decisions and actions on sound science, and that supports healthy, productive and resilient communities and ecosystems. The agency seeks a future where we can better understand and predict the global implications of Arctic change.

### **NSSI, Arctic LCC, Alaska CSC and NOAA’s Arctic Vision—Putting the Power of Collaboration to Work**

The DOI chose Alaska’s North Slope as one of eight places nationwide to initiate a LCC. This is due to the rapid warming of the region and the solid

foundation of federal and state land and resource management agencies in Alaska. These agencies are working together to develop the scientific capacity for addressing climate change and other stressors to arctic resources. The NSSI has created a partnership structure for identifying science needs and for sharing information in the Arctic. The combination of the NSSI Emerging Issues document with the pilot Arctic LCC's WildREACH report forms an excellent foundational inventory of research and management issues facing the Arctic. This inventory can serve as a framework to prioritize science needs for the North Slope, while providing an opportunity for the Arctic LCC to focus and develop consensus on a set of conservation goals for the Arctic. Alaska is also very fortunate to be the first place nationwide to host a DOI Climate Science Center that, in conjunction with the University of Alaska Fairbanks, will work to fill climate science needs for conservation decisions in Alaska. The combined and integrated resources of NSSI, the Arctic LCC, Alaska CSC and NOAA's Climate Service are a good start toward meeting and understanding the complexity of issues in the Arctic.



Arctic Landscape Conservation Cooperative Map. (USFWS)

## National Resource Council Reports

Much of the early background for the NSSI had its roots in the first report by the National Research Council. In 2003, the National Academies, in response to a request from Congress, prepared the *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope*. This report reviews information on oil and gas activities. It assesses both known and possible cumulative impacts of those activities, including impacts on the physical, biotic, human and marine environments from past and present development.

There are several findings and recommendations in this report, including:

- ◆ **Climate Change:** Additional research and modeling is required to understand impacts to the North Slope region and the Arctic.
- ◆ **Need for Comprehensive Planning:** A comprehensive plan is needed to guide the process and ensure decisions match the overall goals for the region, in all phases of development. The multiple agencies making decisions on North Slope industrial activities make them on a case-by-case basis without this type of plan.
- ◆ **Ecosystem Research:** It is imperative to increase ecosystem-level research and focus on ecological processes.
- ◆ **Offshore Oil Spills:** Any potential for a large offshore oil spill in the Arctic requires additional research on spill effects, marine life protection, and cleanup activities effectiveness, especially in broken sea ice.
- ◆ **Human Communities:** Traditional and local knowledge can greatly benefit researchers. Research is needed to examine the benefits and threats from industrial activities and climate change to the way of life of North Slope communities.

In 2009, the National Research Council released a second report, *Informing decisions in a changing climate: Panel on strategies and methods for climate-related decision support*. This report reaffirmed the organizational structure and benefits of the NSSI by outlining a cooperative, stakeholder-based, deliberative approach with which decision makers can utilize. The NSSI was originally established to follow the six principles of the report, long before the report was released. These guiding principles are:

- ◆ Begin with the users' needs.
- ◆ Give priority to products over process.
- ◆ Link to producers and users of information.
- ◆ Build connections across disciplines and organizations.
- ◆ Seek institutional stability.
- ◆ Design processes for learning.

The world is recognizing the unparalleled challenges and opportunities of a changing climate, and with this recognition is a growing need for better information and ways to support resource decisions. The NSSI, with its broad legislative mandate and representation, is an initiative with both partnered research and service. Through the NSSI, the membership believes it can increase collaboration and coordination with its member agencies, industry, academia, non-governmental organizations, the public and the greater pan-Arctic community. This will lead to better informed management for making decisions in the future.

## Organizational Structure and Administration of the North Slope Science Initiative

### *Why is the North Slope Science Initiative Unique in its Organization?*

The NSSI is unique because of its membership and mission. Its members include the senior leaders of those agencies, governments and organizations with management responsibilities for the resources on the North Slope and its offshore environments. Also unique to the NSSI is an advisory group of principals who are either science- or resource-based.

<b>U.S. Department of the Interior</b>	
Bureau of Land Management (designated administrative agency)	State Director
Bureau of Ocean Energy Management, Regulation and Enforcement <sup>1</sup>	Regional Director
National Park Service	Regional Director
U.S. Fish and Wildlife Service	Regional Director
<b>U.S. Department of Commerce</b>	
National Marine Fisheries Service	Regional Administrator
<b>State of Alaska</b>	
Department of Fish and Game	Commissioner
Department of Natural Resources	Commissioner
<b>Local Government / Resource Manager</b>	
Arctic Slope Regional Corporation	President
North Slope Borough	Mayor
<b>Advisory to the NSSI</b>	
NOAA Climate Service	Regional Director
National Weather Service	Regional Director
U.S. Arctic Research Commission	Chair
U.S. Department of Energy	Director, NETL
U.S. Geological Survey	Regional Executive

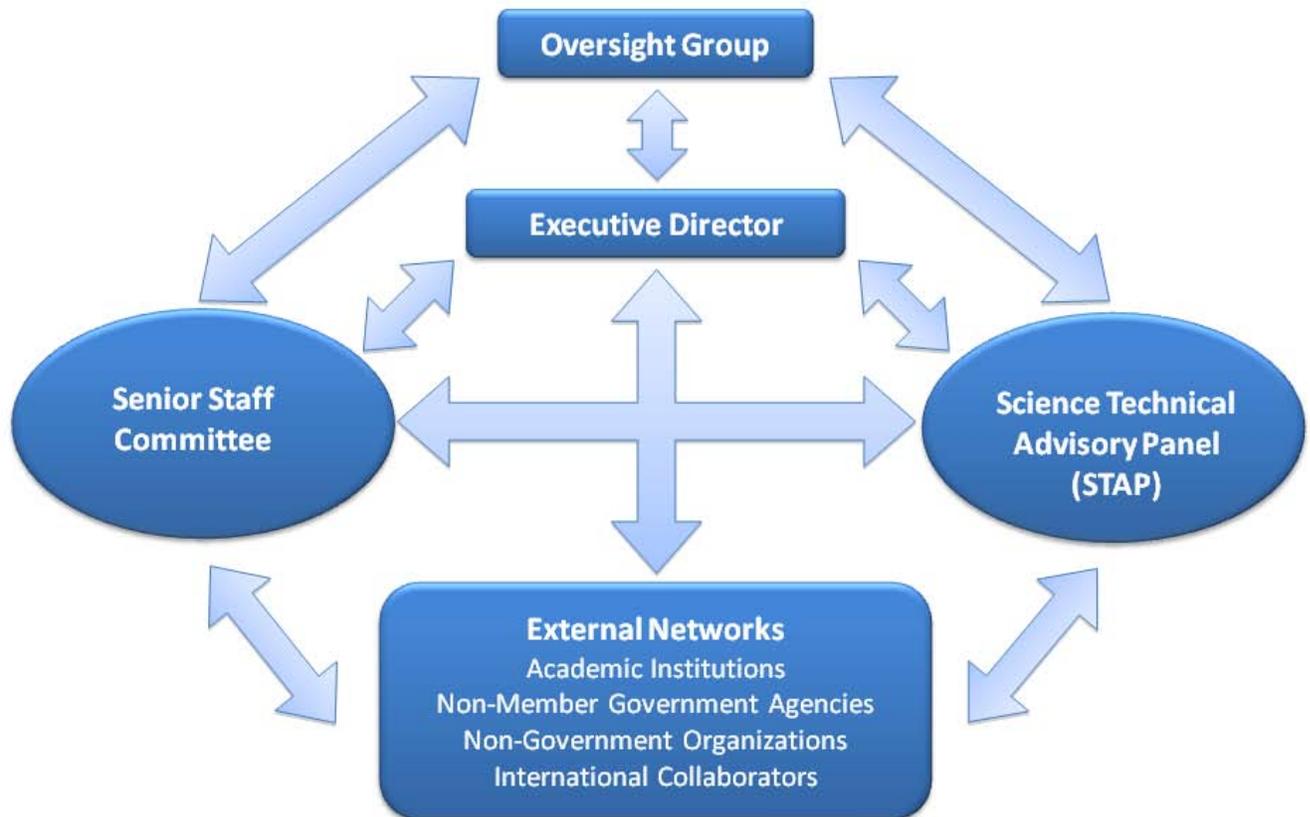
<sup>1</sup> On June 18, 2010, the Minerals Management Service was renamed the Bureau of Ocean Energy, Regulation, and Enforcement.

Consistent with its mission and vision, the NSSI is a highly interactive organization, drawing advice from a variety of disciplines, expertise, and knowledge. The NSSI's functional structure is designed to assist federal, state and local governments, academia, industry and the public in making strategic, informed decisions based on short- and long-term ecosystem management needs. This structure, with the assistance of a small core of NSSI staff and its Science Technical Advisory Panel, provides independent

expert review and advice; facilitates energetic liaison among member programs and their resources; provides effective coordination and communication; and, develops a common infrastructure for data management, proposals, publications and information processing.

Functionally, the NSSI's organizational structure includes an Oversight Group, Executive Director and staff, Science Technical Advisory Panel, and Senior Staff Committee. The four components of NSSI are highly interactive and bring a breadth and variety of expertise and knowledge to the organization.

### North Slope Science Initiative Implementing Legislation



The NSSI is an organization that provides for highly effective interaction between government leadership, the senior staff specialists of member entities, the multidisciplinary Science Technical Advisory Panel, and outside networks to identify management needs and provide recommendations to address those needs to leadership. The NSSI organization is not intended to supplant individual agency science or management programs, but to validate many of the science directions already being addressed by some individual NSSI member agency, and help in the sharing of human and monetary capital to address needs beyond an individual agency capability. The entire organization is bounded by the collective needs of its membership while still providing individual agency science programs the opportunity to share in addressing those collective needs, or by offering an expanded network of expertise. (NSSI)

## Oversight Group

The Oversight Group (OG) is the senior-level management from NSSI member and advisory agencies, as described in its charter (Appendix 1 and at <http://www.northslope.org>). The Oversight Group provides management direction to the other three components of the NSSI; oversees the quality and quantity of scientific information available for aquatic, terrestrial and marine environments on the North Slope; and makes this information available to decision-makers, governmental agencies, industry and the public. The Chair of the Oversight Group rotates annually between federal and non-federal membership.

## Executive Director

The Executive Director provides managerial guidance and executive oversight on day-to-day activities of the NSSI; advice and consultation to governmental agencies, scientific and academic institutions, and other interested parties to further the Congressional objectives of the NSSI; and, coordinates and develops integration of science-based activities for the North Slope region. Responsibilities include formulating annual operating and strategic plans, program administration, budget planning, task tracking, staff assignments, contract and agreement oversight, and travel according to mission requirements. The Executive Director provides support to the Oversight Group and is the Federal Advisory Committee Act (FACA) designated federal officer for the Science Technical Advisory Panel. The Executive Director reports to the Chair of the Oversight Group. The NSSI has identified a need for additional staff including a deputy and a technical specialist to increase organizational capacity. All NSSI staff and the Chair of the Science Technical Advisory Panel report to the Executive Director.

## Science Technical Advisory Panel

The Science Technical Advisory Panel (STAP) is a legislatively mandated FACA advisory group consisting of not more than 15 scientists and technical experts from diverse professions and interests, including the oil and gas industry, subsistence users, Alaska Native entities, conservation organizations, wildlife management organizations, academia, and other areas as determined by the Secretary of the Interior. Panel members are selected from (but not limited to) the following disciplines: expertise in North Slope traditional and local knowledge, landscape ecology, petroleum engineering, civil engineering, geology,



Science Technical Advisory Panel and staff focus on emerging issues in Deadhorse. (NSSI)

botany, hydrology, limnology, ecology, wildlife biology, biometrics, sociology, cultural anthropology, economics, ornithology, oceanography, fisheries biology and climatology (Appendix 2). STAP duties are solely advisory to the Oversight Group and NSSI's Executive Director, as described in the STAP charter (Appendix 3 and at <http://www.northslope.org>).

### Senior Staff Committee

The Senior Staff Committee (SSC) members are representatives from member agencies with experience in North Slope management and science. Committee members are the primary liaisons between the NSSI organization and their individual Oversight Group member. Senior Staff Committee members are responsible for informing their Oversight Group member about NSSI activities, providing summaries of their agency's research activities to the NSSI, and providing recommendations on projects or proposals.

### Funding of the North Slope Science Initiative



Arctic sea ice pressure ridges. (Hajo Eicken, UAF)

Section 348(f) of the Energy Policy Act of 2005 authorized the appropriation of funds necessary for the Secretary of the Interior to carry out the functions of the NSSI. In the fiscal year 2007 \$2 million was allocated as base funding for the NSSI. For fiscal years 2008 through 2010, the base funding was \$1 million, plus an additional \$125,000 from outside the federal allocation. Allocated funds are made available through the BLM's budget process.

While individual member agencies have research programs that address many of their mandated science needs, the NSSI's coordination and collaboration efforts fill information gaps no single member agency can accomplish as well on their own. Since its creation, the NSSI has made significant progress on early NSSI priorities, including data systems, project tracking and coordination, establishing the first comprehensive land cover data base across the North Slope, and perhaps most importantly, interagency coordination and information sharing (see "**2010 Progress and Accomplishments**"). In addition to these early directions, the NSSI is identifying science and information needs for the future and published the first *North Slope 13-Emerging Issues Summaries* in 2010 (see "**Future Directions and Emerging Issues**"). This work is long-term and requires continued financial and organizational support.



Mark Clark (Natural Resources Conservation Service) and Keith Boggs (Alaska Natural Heritage Program) research soils and vegetation associations at Toolik River in support of the NSSI land cover mapping effort. (NSSI)

## 2010 Progress and Accomplishments

The NSSI has made considerable progress and accomplishments to date to analyze the science needs of Alaska's North Slope and to meet emerging issues and challenges (see **Future Direction and Emerging Issues**). The NSSI has a public website (<http://www.northslope.org>), a data management and information system, and a U.S. Arctic Project Tracking System. The organization has collaborated and networked with many regional, national, and international entities; developed and tested protocols for a North Slope-wide digital land cover map for land use and vegetation associations; and focused on efficient technologies to collect water quality parameters. The NSSI accomplished much of this through partnering, collaborations, and initiating priorities based on its existing resources, with plans to address or expand the research and monitoring projects as funding permits.

In its first years, the NSSI used information from its Senior Staff Committee, Science Technical Advisory Panel and the Oversight Group members, as well as feedback from early workshops, to develop preliminary direction for the NSSI.

These directions include:

- ✓ A public NSSI website;
- ✓ A database of ongoing North Slope projects;

- ✓ A data management and information sharing system for North Slope science;
- ✓ A cost share between the U.S. Fish and Wildlife Service, the U.S. Geological Survey and the NSSI to address and monitor hydrologic processes on the North Slope;
- ✓ A cost share project between the NSSI, U.S. Fish and Wildlife Service, the Alaska Natural Heritage Program, Natural Resources Conservation Service, the national LandFire program and Ducks Unlimited, Inc. to coordinate a consistent and accurate vegetation baseline for the entire North Slope;
- ✓ Deployment of a highly accurate water quality and bathymetry system to reduce logistical and laboratory costs made possible by a cost share between the NSSI, University of Michigan and Michigan Tech Research Institute;
- ✓ A partnership with U.S. Geological Survey, the State of Alaska, and others that updated and created higher resolution digital information layers for evaluating and planning future activities;
- ✓ Coordination between academic institutions, National Science Foundation, U.S. Arctic Research Commission, Interagency Arctic Research Policy Committee, non-governmental organizations, industry, and the greater pan-Arctic community to share information, address management issues, and collaborate on common issues; and
- ✓ Closer working relationship with other initiatives, including the U.S. Department of the Interior Arctic LCC and CSC; National Oceanic and Atmospheric Administration's Climate and Weather Services; non-governmental initiatives such as the Alaska Oceans Observing Systems, North Pacific Research Board; and others within the greater pan-Arctic community.

To continue what it has begun, help its members and partners meet the challenges of climate change and resource management on the North Slope, and prepare for the area's future, the NSSI must strategically manage and expend its funding. For example, to help improve hydrological information on the North Slope, the NSSI partnered with the U.S. Geological Survey and the U.S. Fish and Wildlife Service to deploy traditional hydrologic gauging stations in two strategic locations within the Arctic National Wildlife Refuge. Funding levels have limited the breadth of coverage for the project, and our ability to understand broad hydrological processes and has hampered the pursuit of alternative cost-effective technologies. The NSSI must continue to aggressively explore means to expand collaboration if the needs of the resource managers are to be met.

## North Slope Science Initiative Website (<http://www.northslope.org>)

NSSI developed its website as an “.ORG” site to reflect the diverse membership of the NSSI and to provide greater flexibility in both content and operation. The site operates through an Assistance Agreement with Michigan Technological University. It links to information sites throughout the world that are actively involved in Arctic issues and research. The site has internet map server (IMS) capabilities with a number of physical and biological data layers and continues to receive considerable traffic (over 35,000 visits/month average). In 2009 and 2010, the website was extensively updated and improved. As its public interface, the NSSI will continue to update its site on an on-going basis. (Obj. 7)

**NORTH SLOPE SCIENCE INITIATIVE ALASKA**

LOG IN  
OUR PARTNERS  
NSSI CATALOG

USGS

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**Michigan Tech**  
Research Institute

You are in North Slope Science Initiative > Introduction

Welcome to the North Slope Science Initiative (NSSI). The NSSI is an intergovernmental effort to increase collaboration at the local, state, and federal levels to address the research, inventory, and monitoring needs as they relate to development activities on the North Slope of Alaska.

**Featured Content**

Emerging Issues Summaries  
March 2010 NSSI Newsletter  
NSSI 2009 Report to Congress  
NSSI Tundra Lake Studies Website  
Proceedings: United States and Canada Northern Oil and Gas Research Forum '08 (English)  
NSSI Data Products and NSSI Project Tracking System

**Scope, Mission and Vision of the NSSI**

The North Slope Science Initiative (NSSI) was developed by federal, state and local governments with trust responsibilities for land and ocean management, to facilitate and improve collection and dissemination of ecosystem information pertaining to the Alaskan North Slope region, including coastal and offshore regions.

The mission of the NSSI is to improve scientific and regulatory understanding of terrestrial, aquatic and marine ecosystems for consideration in the context of resource development activities and climate change.

The vision of the NSSI is to identify those data and information needs management agencies and governments will need in the future to develop management scenarios using the best information and mitigation to conserve the environments of the North Slope. The NSSI adopts a strategic framework to provide resource managers with the data and analyses they need to help evaluate multiple simultaneous goals and objectives related to each agency's mission on the North Slope. The NSSI uses and complements the information produced under other North Slope science programs, both internal and external. The NSSI also facilitates information sharing among agencies, non-governmental organizations, industry, academia, international programs and members of the public to increase communication and reduce redundancy among science programs.

*This website is operated by MTRI through an Assistance Agreement administered by the Bureau of Land Management, as the administrative agency of the North Slope Science Initiative, and by a Memorandum of Understanding with the membership of the North Slope Science Initiative.*

Screen shot, NSSI Website. (Michigan Tech Research Institute)

## Geographic Information Network of Alaska, NSSI Data System (GINA)

Another high priority for the NSSI is to establish a central resource for information products that support research and management decision making on the North Slope. The University of Alaska's Geographic Information Network of Alaska (GINA) worked closely with the NSSI Senior Staff Committee (SSC) and the NSSI Science Technical Advisory Panel (STAP) to develop this capacity through a web based information exchange called the NSSI Catalog. The NSSI Catalog integrates a wide variety of information products from repositories such as GINA, the Arctic Observing Network Cooperative Arctic Data and Information Service (AON CADIS), Alaska Marine Information System (AMIS), and agencies and non-governmental organizations. This effort is well on its way to becoming the "one-stop shop" the NSSI had envisioned to be. The NSSI Catalog is accessible through the NSSI website (<http://www.northslope.org>) or directly at <http://catalog.northslope.org>.

Title	Source	Type	Published
Alaska Place Names (USOS) Tag: GIS shapefile	ADNR	Data	2010/05/17 11:15:41 AM
Alaska Populated Places Tag: GIS shapefile	ADNR	Data	2010/05/17 11:15:54 AM
Anadromous Salmon - Alaska - Arctic - 2010 Tag: GIS shapefile	ADFG	Data	2010/05/10 04:59:55 PM
Arctic Cyclone Track Data Set, 1966-1993 Tag: Data Table	NCAR EOL	Data	2010/07/07 09:52:46 AM
Arctic EASE-Grid Freeze and Thaw Depth, 1901 - 2002 Tag: GIS raster	NSIDC	Data	2010/07/07 09:26:52 PM
Arctic Global Radiation (AQR) Data Set Tag: Data Table	NCAR EOL	Data	2010/07/07 09:52:53 AM
Arctic Marine Shipping Assessment 2009 Report Tag: Marine Activity, Report Product, STAP	ARCTIC	Data	2010/05/19 11:55:10 AM
Arctic Marine Synthesis Atlas of the Chukchi and Beaufort Seas Tag: Map Product	AUDUBON	Data	2010/05/14 06:01:49 PM
Arctic System Science (ARCS) Program Tag: Data Table, Report Product	NCAR EOL	Data	2010/07/07 03:25:18 PM
Arctic Translators in the Land-Atmosphere System-ATLAS project description Tag: Data Table	NCAR EOL	Data	2010/07/07 09:53:06 AM
ArcticRIMS: A Regional Integrated Hydrological Monitoring System for Pan Arctic Land M Tag: Data Portal, Data Table	UNH	Data	2010/05/27 03:41:15 PM
Assessing the difference Normalized Burn Ratio's ability to map burn severity in the boreal Tag: Report Product, STAP, Site	NPS	Data	2010/05/28 11:24:31 AM
BLM Alaska - Spatial Data Management System WMS Tag: GIS WMS	BLM	Data	2010/05/10 05:05:00 PM
BPXA Rehabilitation Sites - 2006 and 2008 Summaries Tag: Report Product	BPXA	Data	2010/05/10 03:39:04 PM
BPXA Rehabilitation Sites - Abandoned Airstrips Tag: Report Product	BPXA	Data	2010/05/09 05:30:51 PM

Screen shot, NSSI Data Projects. (NSSI/GINA)

Over the past year, GINA has been completing site and data enhancements based on input from NSSI's SSC and STAP. GINA has identified more than 230 potential GIS data layers as important to ecosystem analysis, however, many of these are not publically available. GINA is working with data providers to make these products generally available. The NSSI Catalog participates in the U.S. Geological Survey's Geospatial One Stop through GINA by providing metadata records of NSSI data holdings. As a node within the Americaview consortium, GINA also provides NSSI Catalog users with access to extensive archives of imagery and topographic data.

The NSSI Catalog's portal provides more than 112 information products, and the number of available products is constantly growing. To help ensure that the Catalog is always up-to-date, the NSSI has tasked a STAP standing subcommittee on GIS/Remote Sensing to provide recommendations on content and operation. The key to better data discovery is to develop partnerships with other data providers in Alaska and the greater pan-Arctic community to enhance data accessibility and interoperability. GINA fits this mold as the center for data at the University of Alaska Fairbanks (America's Arctic University) and its connectivity with the greater pan-Arctic community. (Obj. 1-8)

## Project Tracking System (PTS)

The Project Tracking System (PTS) provides information describing the “who, what, when, and where” of on-going scientific research within the North Slope terrestrial and offshore environments. The compiled annual Information from NSSI participants is available through the NSSI Catalog as a web-based searchable database (<http://catalog.northslope.org>).

Title	Source	Type	Status
ACOUS: Acoustic Tomography of the Arctic Ocean Basin Tag: E109	ARMap	Project	Complete
ADVANCE Fellow Award: Continuing and Enhancing a Career in Arctic Ecology Research Tag: Biology, communities, Education, E113, Outreach, vegetation	ARMap	Project	Complete
ANWR-AQUADASE Tag: E106, fish, habitat, lake, quality, spring, water	USFWS	Project	Ongoing
ASDP Caribou Monitoring Program Tag: E101	CPAI	Project	Ongoing
ASDP Water Quality 2009 Tag: E106	CPAI	Project	Ongoing
Abundance and distribution of pre-migratory shorebirds staging on the coast of Arctic NWR Tag: E109, shorebirds, staging	USFWS	Project	Ongoing
Abundance, distribution, population structure, reproductive success, and survival of muskox Tag: demography, E112, muskox	USFWS	Project	Ongoing
Acoustic & Marine Mammal Monitoring Tag: acoustic, bowhead, gasar, E108, monitoring, seal, whale	BPXA	Project	Complete
Acoustic Aircraft Detection over Polar Snow Tag: Cryosphis, E113	ARMap	Project	Complete
Acoustic Professional Services Tag: E108	CPAI	Project	Ongoing
Active Layer Thickness Monitoring Tag: E110, landscape, monitoring, permafrost	BPXA	Project	Ongoing
Active Layer Thickness and Moisture Content of Arctic Tundra From SVAT Models and Au Tag: Cryosphis, E110	ARMap	Project	Complete
Active layer depth monitoring Tag: E110, ice, impacts, monitoring, permafrost, road	ADNR	Project	Ongoing
Activity Area Analysis in Western Alaska: Combining Soil Chemistry and Ethnoarchaeology Tag: E112, Human, Sciences, Social	ARMap	Project	Ongoing
Adaptive long-term fasting in land- and ice-bound polar bears: coping with ice loss in the A Tag: Biology, E108	ARMap	Project	Ongoing

Screen shot, NSSI project database. (NSSI/GINA)

The PTS became operational in 2009 and received a substantial overhaul in 2010 based on user input. The PTS has roughly 1,200 records representing scientific projects of more than 100 public and private institutions and over 800 individuals who are actively investigating Arctic issues. These projects are searchable and project locations (where available) viewable online. Initially, GINA worked closely with the National Science Foundation (NSF) to develop an automated project-tracking record transfer

that would leverage the existing automated project tracking capabilities at NSF. GINA is continuing to work on automated project-tracking record exchanges with a wide variety of NSSI participants through the Data Integration Working Group. These capabilities help to facilitate reporting and improve the timeliness of project-tracking data. (Obj. 4, 5, and 7)

## Hydrologic Gauging Stations

A solid understanding of the current and future hydrology of the North Slope is a high priority for the NSSI. Water availability may be a limiting factor for energy development and for species survival. It may also be a factor of climate change that could see a significant alteration in the future.

National Security Presidential Directive-66 and Homeland Security Presidential Directive-25, specifically require the U.S. to identify opportunities for international cooperation on North Slope hydrology and other issues [Section III (G)(4)(h)]. Initially, the NSSI worked to establish a network of traditional hydrologic gauging stations across the North Slope. While several agencies individually planned or implemented some of these stations at key locations, they were unable to maintain many of these stations due to funding fluctuations. This ‘hit or miss’ approach can leave the responsible agencies without the information necessary for permitting bridges, facilities and infrastructure; or the information needed to define the instream flow or wintering habitat needs of aquatic species.

The USGS is the lead federal agency generating hydrologic information for the Nation. Deploying, operating and maintaining a network of hydrologic stations on the North Slope of Alaska is four- to five times more costly than similar stations in the lower-48 states. As a matter of practice, in the lower-48 states access to most gauging stations is by a road system. Equally important, those stations can be maintained year-round, even in winter months. On the North Slope, it takes helicopters or fixed-wing aircraft to install and maintain traditional hydrologic gauging stations. In winter, operators must remove and store the stations to avoid irreparable ice and snow damage to the equipment. This is in addition to the challenges of defining riverine flow during “break-up” (see images below of summer flow and break-up).



Measuring water flow on the Tamayariak River, June 2009. (USGS)

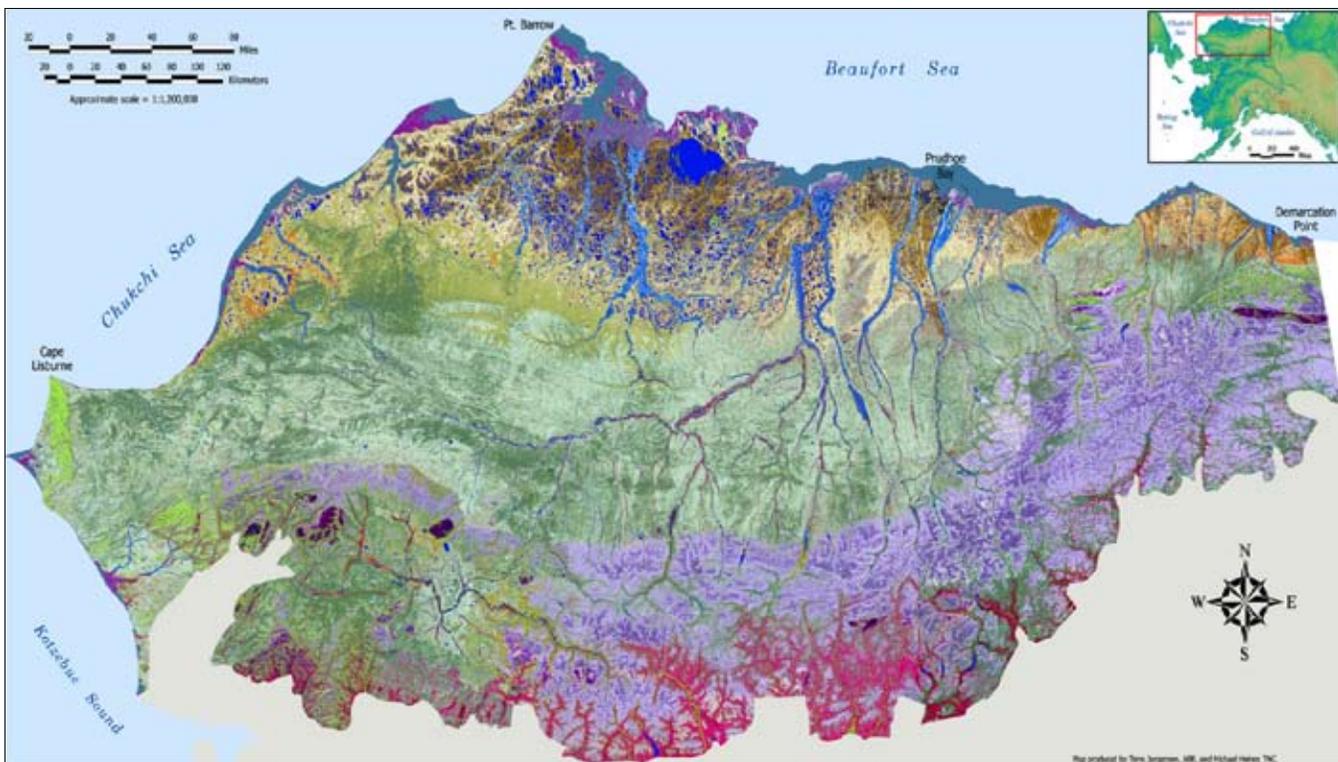


Installing Canning River gauges, Feb 2010. (USGS)

Although the USGS funds several hydrologic gauges on the North Slope, it does not have the funding to fully cover the need. In 2010, the NSSI cooperatively operated two gauging stations in the Arctic National Wildlife refuge (ANWR) on the Canning and Tamayariak Rivers by continuing its partnership with the USGS and getting additional funding from the USFWS Arctic Landscape Conservation Cooperative. These two gauges were the first stream gauges in ANWR and the furthest northeast gauges in Alaska. It also became the first hydrological data collection in this area since the early 1970s. Maintenance costs for each of the stations may be as high as \$80,000/year per station, making expansion and maintenance a funding challenge. Through an interagency cost share agreement with the USGS and USFWS, the NSSI is continuing to support deployed gauges in the near term. In addition, the NSSI has tasked its Science Technical Advisory Panel to investigate alternate technologies to gather hydrologic information of sufficient quality to comply with engineering requirements. (Obj. 1-8)

## Digital Land Use/Land Cover and Change Detection

The NSSI is working to bring North Slope land cover maps into the digital age. Approximately 55 different land cover products have been completed across the North Slope. Many of these products support a localized research project; some are regional in scope using field data for validation; and others are computer-generated maps with no field validation. While all of these products have a common element, they do not actually use a standardized protocol to combine all of these efforts into a single, highly accurate map. Portions of the North Slope have also changed dramatically since most of these efforts began. As such, no common, up-to-date land cover protocol or database exists across the North Slope.



Land coverage map of North Slope. (Torre Jorgenson, ABR, Inc. and Michael Henier)

The NSSI knows a consistent and accurate land cover database is needed to provide a strong baseline for any geographic information system (GIS). Dependable land cover information is critical to interpret landscape integrity, availability of current and future wildlife habitat, and even to help parameterize habitat-based models of carbon sequestration. However, because of the cost and potential redundancy in producing such a quality land cover mapping system for the North Slope, the Science Technical Advisory Panel (STAP) through public workshops recommended working with the National Landfire Program (<http://www.landfire.gov>). Landfire products primarily assess fire potential, and as such are not robust enough by themselves to use for future assessments of change on the North Slope. The STAP determined that greater field validation, particularly of wetland complexes, can help NSSI increase the confidence level of the Landfire product. In 2008, the NSSI began a partnership with Landfire and independently developed protocols and a proof of the concept field validation component. This summer and next, NSSI and Landfire are using these protocols for a greater, North Slope-wide field data collection. The result of combining NSSI and Landfire capacities will be a far better product for the North Slope with a revised land cover map due in late 2011. (Obj. 1-7)

## Workshops

Another significant contribution of NSSI is the convening of independent, or partnered workshops and forums to address the status of knowledge and information needs for North Slope issues that cross administrative and political boundaries. In 2010, the NSSI was a sponsor and co-sponsor of two workshops. In addition, the NSSI is planning a comprehensive “status of our knowledge” workshop with the goal of bringing agencies, academia, industry and nongovernmental organizations together. The focus will be on further understanding the environments, threats, and directions that are on-going or anticipated on the North Slope and its the offshore environments. The STAP and Oversight Group are planning this important workshop for the spring of 2011. The NSSI is planning the second Canada and United States Oil and Gas Research Forum for November 2010. The NSSI Oversight Group also frequently hosts guest presenters at its meetings as another option for internal and external cross-jurisdictional information sharing. (Obj. 1-7)

### *The State of the Arctic Conference:*

On Mar. 16-19, 2010, the NSSI participated in *At the Forefront of Global Change* in Miami, Florida. The conference reviewed the understanding of the arctic system in a time of rapid environmental change. The conference provided an open international forum to discuss future research directions aimed toward a better understanding of the arctic system and its trajectory. Topics ranged from a basic understanding of the Arctic and system-wide change, to developing response strategies to adapt and mitigate change. The conference also provided resource management and service

### **Major State of the Arctic Conference Themes**

1. Advances in understanding Arctic systems – The basic functioning of the Arctic system, including all of its human dimensions.
2. Arctic change – Rapid, system-scale changes and the capability to project future states of the arctic system under various scenarios.
3. Linkages to the Earth system – Linkages and feedbacks between the Arctic system and the Earth system.
4. Translating research into solutions – Informed solutions to the problems caused by environmental change.

agencies with an opportunity to link the most recent science findings to their objectives and priorities. The sessions included human dimensions and social science research to ensure a balanced portfolio in conference talks and discussions.

As a milestone event conceived and developed by the Study of Environmental Arctic Change (SEARCH) and the Arctic System Science (ARCSS) Program communities, the National Science Foundation's Division of Arctic Sciences provided major funding and the NSSI sponsored several young Arctic scientists' attendance from the University of Alaska Fairbanks.



Investigating a thermokarst (melting permafrost) feature at Toolik River. (Doug Kane, UAF)

### *International Polar Year (IPY) Polar Science Conference, Oslo, Norway:*

With support from the U.S. Arctic Research Commission, the NSSI participated in this important international program in June 2010 that brought over 2,300 polar scientists to Oslo, Norway. This was the largest ever gathering of polar scientists. The scientists provided current information and addressed a number of important topics, including:

- ◆ Linkages between polar regions and global systems
- ◆ Past, present and future changes in polar regions
- ◆ Polar ecosystems and biodiversity
- ◆ Human dimensions of change: health, society and resources
- ◆ New frontiers, data practices and directions in polar research
- ◆ Polar science education, outreach and communication



NSSI Executive Director John Payne speaking at the well attended International Polar Year Polar Science Conference in June 2010 held in Oslo, Norway. (NSSI)

The NSSI gave two management-oriented presentations at the conference. Both presentations, one on the organizational structure of the NSSI and the other a summary of the emerging issues, were well received by the participants.



Canada/U.S. Oil and Gas Research Forum. (NSSI)

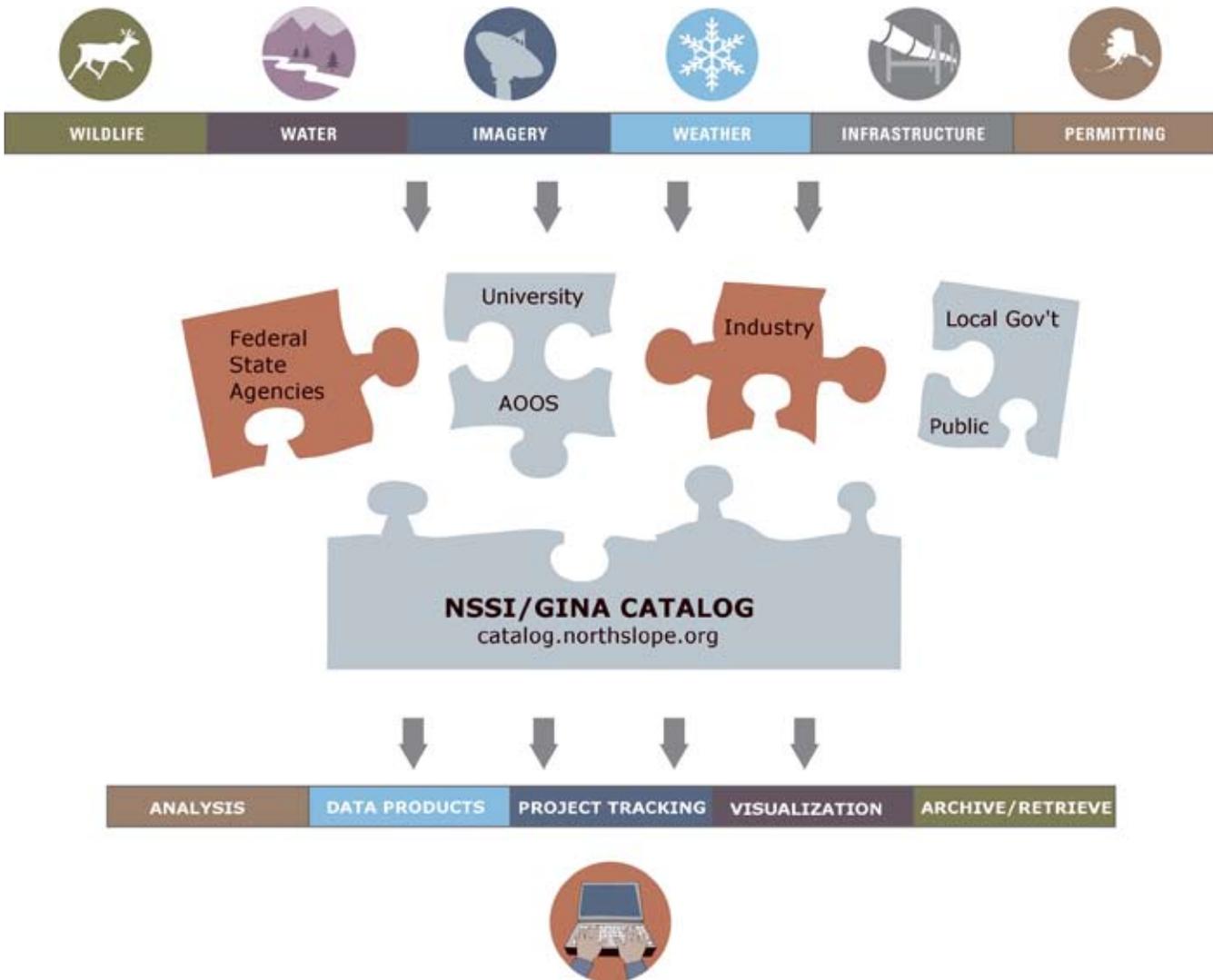
*Canada and United States, Northern Oil and Gas Research Forum:* On November 30 through December 2, 2010, the second Canada and United States Northern Oil and Gas Research Forum, *Current Status and Future Directions for the Chukchi Sea, Beaufort Sea, North Slope and Mackenzie Delta* is planned for Calgary, Alberta, Canada. The NSSI is assisting in the planning for the Forum. Canada and the U.S. share a history of oil and gas exploration and development in the Beaufort Sea and adjoining coastal areas. Currently, both countries are considering proposals for the transmission of natural gas resources

to southern markets, as well as ongoing exploration and development of oil and gas resources. Both countries have also undertaken significant research in support of the environmental assessment and regulatory processes associated with oil and gas development. This research is important as it enables governments and industry to fulfil their responsibilities to the public by ensuring that oil and gas development is undertaken in a manner that minimizes environmental and social impacts and supports economic development. This NSSI co-sponsored joint forum will provide an opportunity for the United States and Canadian scientists, industry and regulators to share information about research programs and to discuss future directions for northern oil and gas exploration and development. The forum provided an important communication tool for regulators, industry and communities to become better informed about existing research, how information is used in decision-making, and to discuss future opportunities for international collaboration.



Unloading gear for ice studies on the Beaufort Sea (Dr. Pablo Clemente-Colon, NSIDC)

**Data Integration:** The NSSI with the advice of the Science Technical Advisory Panel, has made significant progress in the discovery and dissemination of a variety of data and information services since its initial data management and integration workshop in the fall of 2007, and a follow-up workshop in January 2010. For decision makers, commonality in data and the translation into visual information is often its most useful form. These workshops help facilitate links between GINA and other databases, enhance data sharing partnerships and protocols, and improve data integration and visualization. The second important part of data integration is to know what types of research or other information gathering activities are happening on the North Slope and its adjacent marine environments. The project-tracking system helps by facilitating communication and coordination between entities interested in studies in the Arctic.



Using NSSI/GINA to improve data integration and visualization. (NSSI/GINA)

## Emerging Issues, Highlights and Future Directions

The NSSI made major progress in 2010, releasing the first 13-emerging issues for the North Slope and offshore waters. These issues are outlined below, with a detailed version at <http://www.northslope.org>. The results were the work of the NSSI and its Science Technical Advisory Panel (STAP), with the continued assistance of its Senior Staff Committee (SSC) and the full engagement of the Oversight Group (OG). This deliberative process involved:

1. Individual NSSI OG members developed targeted lists of potential emerging issues on the North Slope and in its offshore waters;
2. The NSSI SSC clarified specific management concerns associated with these issues;
3. The NSSI matched the issues with the concerns;
4. The NSSI STAP identified scientific approaches necessary to credibly address each issue.

At each step, the three groups (executives, staff, and scientists) reviewed and shared the draft products and reshaped them as necessary to ensure that the final products were both credible and served management needs.

Based on these deliberations, the STAP developed a series of summary papers. Each summary includes a brief discussion of the status of the relevant science and information needs; sets forth some preliminary findings on the management concerns; and provides a shortlist of STAP recommendations for potential the next steps for the NSSI and its member agencies and partners to begin to address the science behind these critical and shared needs. To some extent, those steps are already happening through other forums like the Alaska Climate Change Executive Roundtable, Alaska Governor's Subcabinet on Climate Change, the U.S. Department of the Interior's Arctic Landscape Conservation Cooperatives (LCC) and Climate Science Centers (CSC), and the Interagency Arctic Research Policy Committee. These forums have expressed an interest in building upon the NSSI products as they build their own science programs.



Waves cut deep into the coastline of the North Slope. (USGS)

The initial OG listing included 18 general issues of emerging concern, plus three specific animal groups of shared interest. The STAP combined two of the general issues (hydrology and lake drying) for further consideration, and addressed 13 total emerging issues through a deliberative process. The STAP is now engaged in assessments of the remaining five issues due late 2010. These additional issues include Arctic fish and fisheries, social and economic structures, resident health, restoration and reclamation, and black carbon.



Cotton grass, Barrow, Alaska. (Ben and Deb Green)

When completed, this compilation of management concerns and their related science recommendations will provide federal, state, and local resource managers for the North Slope and its offshore waters with a ground-truthed set of science priorities. The plan is for these advisory documents to assist the NSSI, its member agencies, and partners well into the future when making critical decisions on resource allocations and addressing the challenges of the North Slope. For instance, where identified science needs contribute to a shared understanding of the impacts of development activities and environmental change and support multi-agency missions, these areas will become candidates for further collaboration. Where identified information needs align closely with a single agency, that agency may use the STAP emerging issues recommendations in their own deliberations on meeting the needs. Where results call for more focused analyses or highlight the need for greater input, they will become opportunities for the NSSI to facilitate targeted workshops or promote greater coordination and cooperation. The extent to which NSSI can achieve this vision will depend on the level and stability of NSSI funding.

Here are the highlights of the *13-Emerging Issues for the North Slope* and offshore waters (the full report is at <http://www.northslope.org>):

## *1. Weather and Climate*

Weather data collection on the North Slope is currently ad hoc at best. There is a critical need for a systematic approach to collect, store, manage, and disseminate data and to maintain equipment for accurate assessment and prediction of weather and climate patterns. Agencies and other entities responsible for or in need of weather data need to work together to inventory existing weather stations, undertake a gap analysis, and invest in an improved, well-coordinated, and centrally managed system. The pressing need for improved weather data collection and management cannot be overemphasized. The current state of weather data collection on the North Slope is troubling and needs to be immediately rectified.



Ivishak River, Arctic National Wildlife Refuge at sunset. (USFWS)

## 2. Increasing Marine Activity

There is an immediate need to identify the likely range of human activities (e.g., oil and gas development, fishing, and tourism) in the coastal and offshore waters of the North Slope over the next 20 years. The Arctic Council's *Arctic Marine Shipping Assessment Report, 2009*, the National Research Council's assessment of cumulative effects from oil and gas development, and various NEPA documents offer reasonable starting points for the prediction of future scenarios. Once we understand plausible scenarios, it will be important to model potential environmental effects in a manner that is relevant to decision makers, but also recognizes uncertainties inherent in development trajectories.

There is a need for Arctic-specific baseline information on current conditions (such as community composition, noise levels, water quality, invasive species), risk assessment (e.g., for oil spills, shipping accidents, bird strikes), and other issues, and for this information to be accessible to the public (such as GINA). Consideration of cumulative impacts will be important, and those impacts will need effective short- and long-term monitoring of human activities and the physical and biological environments. Appropriate comparisons over time will require development of standardized methods.



Researching Changing Sea Ice Conditions. (Hajo Eicken, UAF)



Canadian Coast Guard helicopter approaching USCG icebreaker Healy. (Dr. Pablo Clemente-Colon, NSIDC)

## 3. Changing Sea Ice Conditions

The extent, type, and concentration of sea ice information are available daily from the National Ice Center for the North Slope's adjacent ocean areas. These observations come from a suite of satellite data that, depending on cloud cover, varies from 200 m to 25 km in spatial resolution, and it is desirable to improve that resolution. Historical ice data collected from satellites for the North Slope date back to 1979 and are available through the National Snow and Ice Data Center, the National Oceanographic Data Center, and the Canadian Ice Service Center. During the open water season, a combination of satellite observations and NOAA buoys provide daily winds, waves, and ice observations for the open ocean;

however, there are no long historical records of these observations, as in the case of sea ice. There is an acute need for high quality, user-friendly access to sea ice and ocean changes data and model projections that are specific to local conditions. Both historic remotely sensed and local traditional ecological knowledge can be useful in assessing ice conditions. It is also essential to understand the effects of oil spills in sea ice during freeze-up and spring melts. We recommend a series of actions, beginning with a synthesis workshop on sea ice conditions.

#### 4. Permafrost

Existing data and current techniques to measure permafrost are not yet sufficient to address most management concerns. Active layer depth, subsidence, and their relation to threshold conditions in the active layer-permafrost system may be of more immediate importance to land managers than broad permafrost conditions. All relevant data needs to be centralized in an accessible location. Combining ground observations with remote sensing techniques may hold some promise. For example, combining Synthetic Aperture Radar (SAR) with active layer monitoring results may lead to an improved understanding of permafrost dynamics relevant to land managers.

#### 5. Coastal and Riverine Erosion

To the extent that the rates of North Slope coastal erosion have been measured, the rates are among the highest in the world and are increasing. Coastal and riverine erosion will likely continue to increase because of rises in sea level, more intense storms, decreases in amounts of shorefast ice and near-shore pack ice, and increases in active ice layer depth. To estimate future North Slope erosion rates will require an accurate coastline and river corridor map and a program to remap selected targeted regions of the coastline every three to five years. Accurate risk assessment (e.g., for loss of cultural sites, contaminant release, damage to infrastructure, and similar risks) will depend on the development of a robust erosion model used in combination with accurate mapping of existing resources at-risk.



**A block of permafrost on a beach shows the signs of coastal erosion at a quick pace. (Ken Dunton, University of Texas)**

## 6. Hydrology and Lake Drying

The short- and long-term hydrological and meteorological information networks in the Arctic are critical to the management of the North Slope, given ongoing industrial development and environmental change in the region. This information need applies to all waters—from rivers and streams, to lakes, ponds, and wetlands. Remote sensing technologies are useful for understanding and monitoring hydrology. These technologies have yet to mature, but warrant further research and development.

The current status and trends of hydrological processes on the North Slope are poorly understood. Predicting expected changes due to climate change is extremely difficult and, given the current paucity of information on status and trends, will likely be difficult to document.



Arctic Coastal Plain. (USGS)

## 7. Coastal Salinization

Coastal salinization will change plant and animal species composition and may reduce water available for ice road construction. We know little about this phenomenon on the North Slope and current data are inadequate to assess coastal salinization trends fully. With additional field measurements, it may be possible to model future coastal salinization. We need to research the salinity tolerances of local plant species, site-specific conditions for trapping water and salt from melting ice, and the use of snow trapping to mitigate salt content of meltwater. Although coastal salinization has not yet affected large areas of the North Slope, it occurs in areas where native communities, subsistence fishing and hunting activities, and the oil industry are concentrated.

## 8. Contaminants

To develop effective contaminants management strategies, it is critical to have accurate data on the release and distribution of contaminants into the arctic environment. Most significant is the transport of contaminants into the atmosphere, although oceans, rivers, sea ice, and migratory fauna are additional transporters of contaminants to the Arctic. It will be imperative to continue to monitor contaminant levels in the Arctic to understand the extent of contaminant exposure for people and the environment on the North Slope and its offshore waters. Although some research identifying biological responses to contaminants in the Arctic was completed, significant dose-response data for arctic animals are too limited to draw clear conclusions without more data. There will be ongoing opportunities to monitor contaminants in the tissues of fishes, seabirds, and marine mammals through co-management councils.

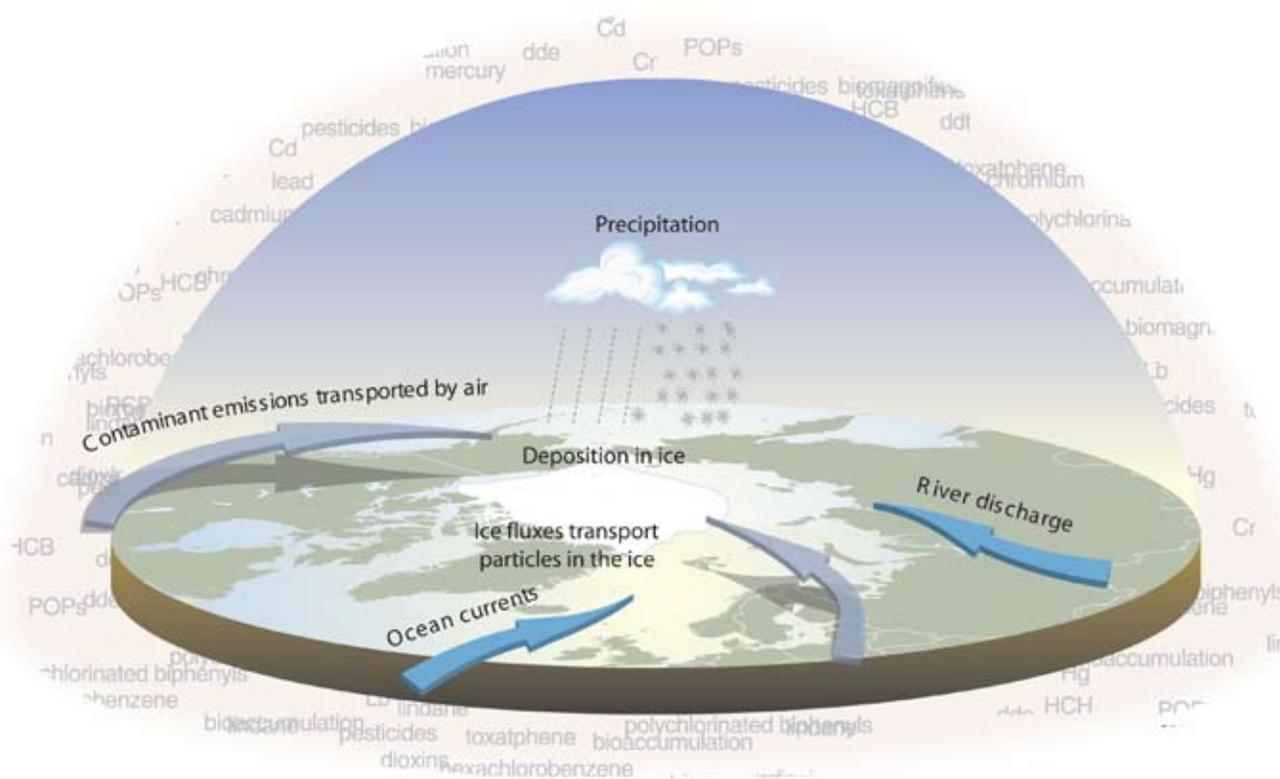


Illustration of the many contaminant pathways into Arctic environments. (AMAP 202. ACIA. 2040)

## 9. Fire Regime

Despite the large and highly publicized Anaktuvuk River tundra fire in 2007, we cannot yet answer the basic question: “Is fire regime changing on the North Slope; and if so, how?” The Emerging Issues Summaries for “Vegetation Change” and “Weather and Climate” identify the basic data requirements to support modeling to address this question. The Alaska Wildland Fire Coordinating Group and its member agencies can address urgent fire-related management questions on an annual, seasonal, or as-needed basis. This includes questions about human safety, village protection planning, fire season communications, coal deposits protection, energy development infrastructure protection, and potential changes in fire management plans.



Anaktuvuk River fire of 2007. (BLM)



**Sampling vegetation on the North Slope. (ADNR)**

## 10. Vegetation Change

Not only are the implications and ramifications of changing North Slope vegetation widespread and complex, but they are interwoven with other management concerns (e.g., migratory birds, fire regime, and caribou). Although there are maps for much of the North Slope's vegetation in one form or another, technical issues related to scale, accuracy, density of field checking, and continuity of coverage limit their application. This is why it is imperative to complete an accurate, single, North Slope-wide land cover map (such as the current effort by NSSI) to provide a basis for starting a slope-wide vegetation

change detection program. At this time, no formal vegetation change detection plan is in place for the North Slope. We recommend moving beyond the vegetation inventory stage as soon as possible and beginning formal programs to delineate vegetation change in this area. This action will, at worst, show the shortcomings of the data and methodology, and at best, provide change trajectories we need for the North Slope.

Long-term (multi-decadal) monitoring sites may provide the highest level of detail for detecting vegetation change. We do not know the number or types of long-term sites present on the North Slope. For these sites, we recommend an inventory, compilation of the standard sizes and methodologies, and development of recommendations to establish additional sites. A mechanistic model of vegetation response to climate change and disturbances could be useful for predicting future rates of change. It would be helpful to the STAP, after NSSI has formulated a slope-wide plan for vegetation change detection and monitoring, to see a more focused and reduced list of pressing management questions. This would provide a basis for the STAP to convene experts to produce a "vegetation-change ramification" model.

## 11. Species of Interest: Migratory Birds

We do not fully understand habitat use and selection, migratory corridors, and wintering areas for migratory birds on the North Slope. We need a more complete understanding of migratory bird use of Arctic habitats, including offshore habitats, in order to identify appropriate mitigation measures in areas of oil and gas development, to predict more accurately the potential impacts of climate change, and to improve land management decisions on these habitats. The lack of data on rare species (existing species in low numbers) is a major concern, given their significant influence on management decisions. Understanding population status and trends is also critically important. Inter-annual and seasonal data are necessary to describe the natural range and variation in population dynamics parameters for target species.

An oil spill into Arctic waters could be devastating to migratory birds, particularly if it occurs during a key life cycle event (e.g., molting). A spill occurring in the Outer Continental Shelf (OCS) during a period of broken ice would be problematic in that the oil could be concentrated at the water surface in open leads, directly impacting resting birds. As these leads close or shift, oil could be forced down into the water column, thus impacting the bird's prey or the ability of these birds to successfully forage. An onshore spill into a waterbody could also affect birds in key life cycles. Understanding and gathering data on habitat use and selection, migratory corridors, wintering areas, effects of oil and gas development, climate change, rare species, population status and trends, and impacts in areas farther south and cumulatively will be important for making management decisions on the North Slope.



**Long-tailed Ducks during break-up.** (NSSI)

## *12. Species of Interest: Caribou*

Many of the concerns raised for this issue dealt with perceived differences in the management of the four herds that calve on the North Slope. While there are valid scientific issues of consistency for comparing data, these are primarily management concerns that we can address by initiating and/or participating in the collaborative management planning processes for the four North Slope herds, to the extent that this is not already happening.

We support a meeting or mini-conference to identify and prioritize caribou data needs, and to identify current data. This meeting could recommend parameters for cooperative annual data collection planning and the data structure necessary to design a data-sharing network. The earlier work of the NPR-A Research and Monitoring Team (e.g., monitoring strategy, caribou model, and subsistence access model) may serve as a useful starting point to identify some of the core data needs and planning work. Directed research projects following the proposed meeting and support from the NSSI and its partners will address some management concerns.

## *13. Species of Interest: Marine Mammals and Their Prey*

There is a need for better information on marine mammal species abundance, seasonal distribution, seasonal movements, and human-animal interactions to support management decisions. Information on species abundance in the Arctic is often unavailable or out of date (>8 yrs old). Often, information on seasonal distribution and movements is not at the spatial scales or in the areas where managers need to make decisions. The spatial scale at which distribution and movements are important will depend on the specific management question.

At this time, there continues to be a need for more systematic monitoring of the subsistence harvest of marine mammals and their prey. There is some harvest monitoring of bowhead and beluga whales, polar bears, ice seals, walrus, and fish. There is also USFWS systematic monitoring of polar bear and walrus harvest. We need to enhance and conduct monitoring for many species in a systematic manner to allow

managers to understand existing marine mammal harvest practices and their changes.

It may also be necessary to focus data collection on listed endangered or threatened species under the Endangered Species Act, species listed as depleted under the Marine Mammals Protection Act, or species harvested for subsistence. When assessing historical information on animal and fish distribution, incorporating Traditional Ecological Knowledge should be a priority and will be critical to understanding changes in the subsistence harvest. We need modeling to focus and integrate studies, develop hypotheses, and predict likely future states.



Male walrus hauled out on land. (Bill Hickey, USFWS)

## Coordination and Cooperation

One of the primary goals of the local, state, and federal partners in forming the North Slope Science Initiative is to improve their awareness and collective understanding of each others' missions, management concerns, and science needs for the region. This purpose solidified under enabling legislation that emphasized coordination of ongoing and future inventory, monitoring and research activities, and cooperation among NSSI parties and the broader scientific community. The structure and organization of the NSSI and its leadership is to enable and promote communications needed to accomplish this goal.

### *External Communication*

The mission and administrative structure of NSSI requires a viable network of external contacts with academia, non-governmental entities, industry and other science organizations. These contacts bring together potential partners, add a broader knowledge of North Slope endeavors, and assure scientific excellence in NSSI products. The NSSI accomplishes its networking in three ways: (1) through internal communications with member agencies to gain knowledge into projects or programs occurring or planned for the North Slope; (2) through Science Technical Advisory Panel expertise; and, (3) through academia, workshops, seminars, and interaction with the National Science Foundation Office of Polar Programs, and other external networks having knowledge of Arctic and pan-Arctic environments (Appendix 4). (Obj. 1-8)

### *Collaboration with Arctic Research and Policy*

The Arctic Research and Policy Act of 1984, Public Law 98-373, July 31, 1984; amended as Public Law 101-609, Nov. 16, 1990 (ARPA), provides for a comprehensive national policy dealing with national research needs and objectives in the Arctic. On Jan. 9, 2009, this law was followed by two Presidential Directives (NSPD-66 and HSPD-25, previously referenced) that brought dated U.S. Arctic policy to

the forefront of security and climate change. The ARPA established the Arctic Research Commission (ARC) and an Interagency Arctic Research Policy Committee (IARPC) to help implement the Act. The NSSI is a formal member of the IARPC as an independent organization. NSSI membership and participation in IARPC programs is important and mutually beneficial to both entities because of their difference in reach, but similarity in mission. The mission of IARPC:

- ◆ Helps set priorities for future Arctic research;
- ◆ Works with the Arctic Research Commission to develop and establish an integrated national Arctic research policy to guide federal agencies in developing and implementing their research programs in the Arctic;
- ◆ Consults with the Arctic Research Commission on matters related to Arctic research policy, programs and funding support;
- ◆ Develops a five-year plan to implement national policy, and updates the plan biennially;
- ◆ Coordinates preparation of multi-agency budget documents for Arctic research;
- ◆ Facilitates cooperation between the federal Government and state and local governments in Arctic Research;
- ◆ Coordinates and promotes cooperative Arctic scientific research programs with other nations;
- ◆ Promotes federal interagency coordination of Arctic research activities, including logistical planning and data sharing; and



**Sovereign Prince Albert II of Monaco speaks to gathered scientists in Oslo during the June 2010 Polar Science Conference. (NSSI)**

### **Royalty in the Arctic**

The Sovereign Prince Albert II of Monaco addresses polar scientists in Oslo, Norway. In addressing the Oslo International Polar Year scientists, Prince Albert II said that “...*the International Polar Year has proven that mankind is becoming more aware of the global threats presented by a warming planet. These threats concern us all, and we should bring together good will from all over the planet to increase the understanding of northern environmental issues and examine the possibility of creating opportunities for early career polar scientists.*”

Prince Albert II has been a major supporter of Antarctic research and will continue the support for programs at the bottom of the world, but he announced a new foundation and partnership with the University of the Arctic dedicated to the protection of the environment and the promotion of sustainable development on a global scale. The new foundation, Prince Albert II of Monaco Foundation, will help a network of universities, colleges and other organizations committed to higher education and research in the north. The foundation embraces 130 institutions in total.

- ◆ Submits a biennial report to the Congress through the President containing a statement of the activities and accomplishments of the IARPC since its last report.

Having principle investigator status in the development of the Arctic Observing Network and the larger Sustained Arctic Observing Network furthers the goals of the NSSI. It also expands the NSSI's networking capabilities and future partnership opportunities for arctic activities outside its organization. There is strategic value to the NSSI in developing information sharing tools for the long-term sustainability of Arctic data. To this end, the NSSI has positioned itself as key player and significant contributor in the design and development of both the U.S. and the international observing systems. (Obj. 1,3,4,5,6,7)

### *NSSI Internal Communication*

The substantial benefit of the organizational structure of the NSSI is that both the Oversight Group and their Senior Staff Committee regularly communicate and coordinate with each other on new and ongoing projects. Even prior to the formation of the NSSI, the various member organizations had each been supporting a range of inventory, monitoring and research activities. That level of ongoing activity continues. The Oversight Group meets a minimum of four times a year. The Senior Staff Committee meets a minimum of six times a year. At these meetings, they discuss North Slope agency-specific issues and the use of science for better decision making. In addition to the regular meetings, there is an annual meeting of the Senior Staff Committee to introduce new agency initiatives and report on the progress of on-going projects.

These meetings provide an opportunity for each member organization to understand what others are planning. They can identify and benefit from the efficiencies afforded through collaboration and coordination in both gaining knowledge and sharing resources (monetary and human capital). The 2010 accomplishments detailed in the previous section all benefited from NSSI-assisted coordination. These forums also help to identify future information needs and promote discussion of emerging management questions (see Future Directions section below). (Obj. 1-7)

### *NSSI Member Agency Cooperative Science on the North Slope*

The NSSI has provided a forum for its members to build on their own agency's study or research programs. Each year, senior staff from the member agencies gather to present their individual agency projects planned for the upcoming fiscal year. This forum provides a basis for additional cooperation or collaboration focused on the work each agency is planning within their mandates. Below are descriptions of some of the coordinated science efforts of each NSSI agency that has an operational component on the North Slope:



***Bureau of Land Management (BLM):*** The BLM's Arctic Field Office manages the National Petroleum Reserve-Alaska (NPR-A) on the western North Slope. The BLM's mission in the NPR-A is to contribute to the nation's domestic production of oil and gas resources, while protecting the surface resources and their traditional uses by the local Native communities. The NPR-A is large, 9.3 million ha (22.1 million acres)

and remote, making studies of surface resources both expensive and logistically difficult. The BLM enhances its efforts to gain information about the NPR-A's surface resources and their use by cooperating with many other entities, thereby increasing the available knowledge, expertise and finances for research and monitoring. In 2010, the BLM's partners include the North Slope Borough (NSB), the Alaska Department of Fish and Game (ADFG), the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) (formerly the Minerals Management Service), the U.S. Fish and Wildlife Service (USFWS), the U.S. Geological Survey (USGS), the Alaska Natural Heritage Program, the University of Alaska Fairbanks (UAF), University of Idaho, and ConocoPhillips Alaska, Inc.

This year's cooperative projects are diverse and include:

- ◆ studies of caribou, an important subsistence resource;
- ◆ threatened (Endangered Species Act or ESA) spectacled eiders, Steller's eiders and polar bears;
- ◆ yellow-billed loons (ESA candidate species); and,
- ◆ several fish species important to the Native subsistence culture.

Additional biological studies investigate the distribution of rare plant species; the impacts to tundra vegetation of oil and gas exploration activities conducted during winter; and a long-term study of tundra recovery from an unusually severe wildfire. A hydrological study is gathering multi-year data on stream flow of several rivers and recharge of lakes following winter water withdrawal by the oil/gas industry. A paleoecological study is addressing the effects of climate warming on the landscape, fauna and ecology of the North Slope over the last 15,000 years.



*(Left)* shows Eric Miller, BLM-AFS fire ecologist, inspecting large ice lense at head of debris flow. *(Right)* shows same flow and other smaller ones from the air; ice lense visible at top of flow. All of the orange is moss that moved in quickly post-fire. (BLM)

Caribou and fish studies will improve the BLM's, NSB's and State of Alaska's ability to manage development of the oil and gas infrastructure to minimize effects on caribou range use and movements and fish movements through streams and lakes. Similarly, studies of protected or proposed listings of species under the ESA will help the BLM and USFWS to permit oil and gas activities and other land uses without further jeopardy to those species. Information on rare plants will allow the BLM to avoid management decisions that could lead to the need for protection of those plants under the ESA. Monitoring the effects of winter exploration on common species of tundra vegetation helps the BLM, State of Alaska and oil industry make potential technological improvements and mitigation efforts for off-road activities. Hydrological data will make it possible to engineer adequate stream-crossing infrastructure and gravel pads for oil field development (e.g. culverts, bridges and drilling pads), and protect both the infrastructure and fisheries habitat. By determining how lakes recover after water withdrawal will protect important wintering habitat for fish. The study of past climate change will inform all management agencies and the oil industry about situations that might develop during future climate change. In summary, oil and gas exploration and development may affect many valuable surface (biological and physical) resources, but with sufficient knowledge, the managing agencies and the oil industry can minimize those impacts.

As the administrative agency for the NSSI, the BLM provides support through funding, contracting, agreements, procurement, and office space. The BLM participates in identifying management needs through interactions with its Oversight Group, Senior Staff Committee, and Science Technical Advisory Panel.

***Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE):*** The BOEMRE manages and regulates oil, gas, and renewable energy projects on the nation's Outer Continental Shelf. The Beaufort and Chukchi Sea planning areas off the North Slope cover about 73 million acres, but leases currently are on only about five percent of this area. The BOEMRE Alaska Environmental Studies Program currently manages and funds more than 50 ongoing study projects across the disciplines of physical oceanography, biology, endangered species, and social sciences.

In the Beaufort Sea, the BOEMRE continues to fund research to monitor ocean circulation, sedimentation, ice dynamics, whale migration, fish distribution, and potential effects on social systems and subsistence activities across the Beaufort Sea and around Northstar and Liberty oil fields operations. In the Chukchi Sea, the BOEMRE is funding a new suite of studies to research and monitor marine mammals, fish, birds, benthic fauna and sedimentation, ice dynamics and oceanographic conditions, offshore subsistence hunting, and community resilience through sharing networks.



**Crew navigates through icy filled waters as part of the Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA) Project, Beaufort Sea. (BOEMRE)**

The BOEMRE's 2009 Alaska research budget exceeded \$12 million. Well over half of its current projects were in partnership with other federal, state, and local government or science-oriented institutions, such as the National Oceanographic Partnership Program, the USGS Biological Resources Division, the National Marine Mammal Laboratory of the Alaska Fisheries Science Center, the University of Alaska-Fairbanks Coastal Marine Institute, Alaska Department of Fish and Game, and the North Slope Borough Department of Wildlife. A list of BOEMRE's FY 2010 new and ongoing projects is at [http://alaska.boemre.gov/ess/ongoing\\_studies/ongoing\\_studies/Ongoing%20Studies.pdf](http://alaska.boemre.gov/ess/ongoing_studies/ongoing_studies/Ongoing%20Studies.pdf). You can find more detail in their Annual Studies Plan at <http://alaska.boemre.gov/ess/essp/SP.HTM>.

The NSSI and other research partners are broadly disseminating technical reports and research data that are applicable to programs of other NSSI members and relate to the Emerging Issues. These are available at <http://alaska.boemre.gov/ref/AKPUBS.HTM>. Recent examples include the *Annual Assessment of Subsistence Bowhead Whaling Near Cross Island, 2001-2007*, and *Recommended Physical Oceanographic Studies in the Alaska Beaufort Sea*. An ongoing project that is generating interest in data distribution by NSSI agencies is the *Beaufort /Chukchi Seas Mesoscale Meteorology Modeling Study* that will integrate thirty years of weather data across the North Slope into a viable Weather Research and Forecasting model and climatological analysis. The BOEMRE continues publishing social science reports of wide use among NSSI agencies. The BOEMRE has also published *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow*, which follows a 2009 synthesis of thirty years of socioeconomic effects research.

Two excellent examples of the BOEMRE's broad coordination efforts include whale foraging ecology and environmental monitoring projects are:

- ◆ **Bowhead Whales:** The BOEMRE is funding a multi-disciplinary effort in arctic research through a \$7 million study, "*Bowhead Feeding Variability in the Western Alaska Beaufort Sea*." This study combines targeted oceanographic sampling with biological sampling and satellite tracking of individual whales, involving Alaska Native whalers and traditional knowledge, to expand understanding of whale behavior and to improve predictions about where and when aggregations of feeding whales are likely to occur.
- ◆ **Nuiqsut Oil Operations Effects Monitoring:** The BOEMRE is also funding an important social science project facilitated through coordination within the NSSI, "*Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut*." This study will benefit from a steering committee of representatives from the BOEMRE, BLM, USFWS, and ADFG. The study involves cumulative impact research across federal and state oil development projects, both onshore and offshore.

Through NSSI coordination, the BLM joined with the BOEMRE, USGS, and USFWS in a FY 2009 multi-lateral polar bear project, which encompasses the oil and gas prospects of NPR-A.

Collaboration continues on FY 2010 research projects. At least five of new or extended the BOEMRE projects involve Interagency Agreements with various departments of NOAA. Several more new projects are anticipated through collaboration with the Coastal Marine Institute at UAF.



**National Park Service (NPS):** Some of the highlights of NPS coordination and collaboration projects in northern Alaska include:

- ◆ **Moose movement in Alaska Game Management Unit 24 (includes Gates of the Arctic National Park):** This multi-year project is to capture and track moose to investigate seasonal moose movement. Gathered data will help managers make informed decisions on sport and subsistence hunting seasons and regulations. Project partners include the ADFG, BLM, and USFWS.
- ◆ **Western Arctic Caribou Herd (WACH) Range Conditions:** The WACH is Alaska's largest caribou herd and is heavily harvested for both subsistence and sports hunting. The WACH summers on the North Slope, but there are also management concerns on its critical winter range. This WACH winter range study has three objectives: (1) quantify the amount of wildfire that is present on the landscape over the past 55 years; (2) determine factors that correlate with caribou distribution; and, (3) model the effects of different climate scenarios on the quantity and quality of available WACH winter range. The data will help managers determine when to take actions affecting management of the herd, fire suppression strategies, and seasonal migration changes due to changing conditions. Partners include the ADFG, BLM, and USFWS.
- ◆ **Western Arctic Caribou Herd (WACH) Working Group Support:** A Challenge Cost-Share Agreement is in place to support the WACH Working Group annual meeting, publication of the 2009 edition of Caribou Trails, and aircraft charter for participants with the Onion Portage project. Partners include the ADFG, BLM, USFWS, and Northwest Arctic Borough School District.
- ◆ **Snowshoe Hare Ecology Project and Contaminant Analysis:** This traditional knowledge project has been on-going for several years. Partners include residents of Wiseman and UAF-IAB.



Caribou herd on North Slope. (BLM)

Additional NPS proposed collaborative projects include:

- ◆ **Chandler Lake Clean-Up:** This proposed clean-up effort will remove more than 100 55-gallon fuel drums and nearly 1,000 five-gallon fuel cans. Partners will include the Arctic Slope Regional Corporation, Nunamiut Corporation, Village of Anaktuvuk Pass, and a DoD contractor.
- ◆ **Tundra Fire Climate Modeling:** This project will quantify the links between climate and fire within key tundra vegetation types and apply statistical models to link climate and burned tundra area to the future. Partners include the BLM, University of Alaska Fairbanks, and Montana State University. The proposed study will also benefit from an ongoing project in partnership with the BLM that is looking at paleo tundra fire regime (lake coring).



**U.S. Fish and Wildlife Service (USFWS):** The U.S. Fish and Wildlife Service mission is to work with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people, and is cooperative in nature. In 2009, on Alaska's North Slope, the USFWS began collaborating with other federal (BLM, USGS, MMS (now BOEMRE), NPS, and the USDA), State of Alaska (ADFG), and local governments (North Slope Borough, Native Village of Barrow, Native Village of Kaktovik), non-governmental organizations (BP, ConocoPhillips, ABR, Wildlife Conservation

Society, Manomet) and universities (Univ. of Alaska Fairbanks, Univ. of Wyoming, Univ. of Texas) to conserve trust resources on the North Slope.

- ◆ **ANWR:** In the northeast corner of Alaska is the Arctic National Wildlife Refuge (ANWR). The USFWS will work with cooperators to: (1) document distribution and abundance of pre-migratory shorebirds staging in coastal areas; (2) investigate breeding ecology, abundance, distribution, and habitat associations of Smith's Longspurs; (3) study the abundance, distribution, population structure, reproduction success, and survival of muskoxen in northeastern Alaska; (4) continue data collection on the Porcupine caribou herd; and, (5) conduct climate change research, including permafrost, vegetation, weather, and coastal erosion studies. Off-ANWR studies include a long-term shorebird phenology study across the North Slope.

- ◆ **Endangered or Threatened Species:**

Most other USFWS studies with cooperators on the North Slope concern species listed as threatened under the Endangered Species Act (ESA) or as a candidate species for the listing. The USFWS is working very closely with multiple partners to conserve Steller's eiders (threatened under the ESA). Activities range from the biological (breeding pair surveys,



Yellow-billed loon. (USFWS)

nest surveys) to the social (myriad outreach activities with Native partners). The USFWS is working collaboratively with the BLM, USGS, and NSSI to determine the parameters that make lakes suitable for yellow-billed loon (candidate species) nesting (hydrological characteristics, prey species, disturbance). The USFWS is also working with collaborators (USGS, ADFG, universities) to determine polar bear survival, distribution, and migration.

The USFWS continues to work with a variety of partners to identify areas of common interest and to promote collaboration to improve the quality of information available to support management decisions. As climate change continues to impact northern latitudes disproportionately, the USFWS and other managers will increasingly depend upon collaborative partnerships with specialists from other disciplines to conserve trust resources for future generations.



**National Marine Fisheries Service (NMFS):** The National Oceanic and Atmospheric Administration (NOAA) Fisheries Alaska Region and Alaska Fisheries Science Center (AFSC) are responsible for the management and research of living marine resources in the coastal oceans off Alaska. The majority of the AFSC research occurs in the Bering Sea and Gulf of Alaska, and recently research activity is increasing north of the Arctic Circle. The NMFS Arctic studies depend on collaboration as a key component, as resources for Arctic research on living marine resources have been historically scarce and there is critical expertise in many different agencies, organizations, and universities.

Until recently, the AFSC supported only a modest level of Arctic research. Projects include:

- ◆ **Bowhead Whale Population Dynamics:** The National Marine Mammal Laboratory (NMML) participates in assessments of bowhead whale population dynamics and stock structure in cooperation with the North Slope Borough.



**Bowhead Whales.** (Julie Mocklin, NOAA)

- ◆ **Climate Change:** The Bering-Aleutian Salmon International Survey (BASIS) has been studying the effects of climate change on oceanography and fish communities for many years, and recently extended the survey's efforts to the Chukchi Sea. BASIS collaborators include the University of Alaska Fairbanks, North Pacific Anadromous Fish Commission, Woods Hole Oceanographic Institution, Russian-American Long-Term Census of the Arctic (RUSALCA), USFWS, and the Evergreen State College.
- ◆ **Seals:** Several collaborative studies of the four species of ice-associated seals have begun in recent years. The AFSC did initial surveys with the Army Corps of Engineers to help understand local population densities in areas of proposed development near Red Dog Mine. Alaska Native Ice Seal Committee members participated on the field team for recent ice seal surveys from both USCG icebreakers and NOAA ships. In fiscal year 2010, the AFSC initiated a new effort to assess the range-wide abundance of ice-associated seals.
- ◆ **Seal Survey Tool:** The NMML evaluated the use of an unmanned aircraft system in surveying for ice seals in the Bering Sea. This NMFS project was with the University of Alaska-Fairbanks and with additional support from the Navy.
- ◆ **Nearshore Schooling Fish:** The AFSC Alaska Region has collaborated on inventories of nearshore schooling fish in shallow Arctic marine waters with the Army Corps of Engineers and the North Slope Borough.

Since 2006, the AFSC's Arctic research program increased dramatically with funding support from the BOEMRE (formerly MMS) for a variety of collaborative studies on marine mammals and fish in the Chukchi and Beaufort Seas. Some of the key collaborative projects between NMFS and the BOEMRE are in the BOEMRE Alaska Environmental Studies Program section of this report.

The NMFS believes that the vital importance of collaborations will increase in the future, and many of the most important research questions cross international boundaries (e.g. population estimates of ice-associated seals) or are interdisciplinary (e.g., effects of climate change on animal distribution). To respond will require expertise in areas such as climate, weather, and physical oceanography that are not NMFS' strengths. The NMFS/AFSC anticipates that its past productive collaborations with local, state and federal agencies, NGOs, Alaska Native organizations and universities will be an important component of most of our future research in the Arctic.



**Alaska Department of Natural Resources (ADNR):** ADNR manages state-owned lands on the North Slope. These lands are between the Canning and Colville Rivers, and the tidelands across the Slope within three miles of the coast. This covers almost nine million acres of uplands and two million acres of tidelands. ADNR's mission is to develop, conserve, and enhance natural resources for present and future Alaskans. On the North Slope, this mostly involves managing lands for oil and gas development, while minimizing impacts on other resources and users. Information on fish, wildlife, subsistence uses, geology, and other resources are important when preparing oil and gas lease sales. ADNR uses weather and climate data

when making day-to-day decisions on managing access to remote exploration areas.

This year, the ADNR Division of Geological and Geophysical Surveys will continue its petroleum-related geological studies on Alaska's North Slope. ADNR is coordinating and collaborating this work with the ADNR Division of Oil and Gas, UAF, and the USGS. This research will focus on economically significant strata and topics relevant to oil and gas exploration in the Brooks Range Foothills and east-central North Slope of Alaska.



Winter snow sampling. (ADNR)

The ADNR Division of Mining, Land, and Water is coordinating with the Alaska Department of Transportation and Public Facilities and UAF in the collection of hydrologic and meteorological data needed for road engineering design. This data is also useful for determining when off-road travel will not impact tundra resources. In the past, this work focused on the eastern Brooks Range foothills. This year, the area will include the Brooks Range foothills lying west of the Dalton Highway.



*Alaska Department of Fish and Game (ADFG):* ADFG has responsibility to assure the sustainability of all fish and wildlife on all lands and waters in Alaska, including all lands of the North Slope. The State of Alaska's management authority over all fish and wildlife is diminished only by specific acts of Congress, such as the Marine Mammal Protection Act. Under Alaska law, subsistence use of fish and wildlife by Alaska residents is a priority over other consumptive uses on all lands except where subsistence use is not allowed. Under the Alaska National Interest Lands

Conservation Act, federal agencies are responsible for assuring that subsistence uses by federally qualified rural residents on federal public lands are granted a priority over other consumptive uses of fish and wildlife. In exercising that responsibility, federal lands may be closed to harvests by non-federally qualified subsistence users. The State of Alaska and the Federal Subsistence Board (USFWS, NPS, BLM, BIA, and USFS) maintain a Memorandum of Understanding to coordinate management of subsistence use on federal lands. The ADFG also coordinates with federal agencies and international organizations that share responsibilities for marine mammals and migratory waterfowl.

The primary focus of the ADFG research and management on the North Slope are species subject to subsistence harvests (caribou, moose, bear, wolf, musk ox, walrus, seals, whales, whitefish, Dolly Varden, lake trout, and salmon) and subsistence uses of these species.



Caribou form an important part of the subsistence diet of North Slope residents. (Brian Person, NSB)

The ADFG is working on a number of cooperative projects that relate to energy development, primarily through the linkage of the effects on subsistence users and uses, including:

- ◆ resident fish studies (abundance and harvest monitoring) with various agencies;
- ◆ assessments of climate impacts on salmon distribution along the North Slope streams with various partners;
- ◆ caribou studies (abundance, health indices, and harvest assessment) with the BLM and NSB;
- ◆ musk ox studies (abundance, distribution, and calving success) with USFWS;
- ◆ moose and caribou (abundance, browse, and health indices) with the NPS;
- ◆ whale studies (TEK) with the NSB, the Alaska Eskimo Whaling Commission, several village Whaling Captain's Associations, and NMFS;
- ◆ walrus studies (TEK) with the USGS, NSB, and USFWS;
- ◆ polar bear (human-bear interaction, movement, abundance, and research methods) with the USGS and USFWS;
- ◆ grizzly bear (movement and research methods) with BP Exploration and ConocoPhillips; and,
- ◆ studies of subsistence sharing networks and use of fish, caribou, and furbearers with the NSB, BLM, NPS, and BOEMRE.



**North Slope Borough (NSB):** The NSB is the municipality that serves the arctic coastal region and manages and permits land use through Title 19 of the NSB Code of Ordinances and the NSB Coastal Management Program. The Borough strives to balance the economic needs of its eight North Slope communities with the traditional subsistence practices of the Iñupiat who depend on these lands for their spiritual, cultural and nutritional needs. The NSB Department of Planning and Community Services and Department of Wildlife Management play an active role in documenting the traditional land and wildlife practices of the region's residents.

For more than 20 years, the NSB has actively monitored and studied the ecology of wildlife species that are of particular importance to subsistence users. NSB research and monitoring activities have been largely supported through grants and collaborative relationships with numerous federal and state agencies, non-governmental organizations, and universities. These include the BOEMRE, NOAA, NMFS, BLM and USFWS; the Alaska Department of Commerce, Community, and Economic Development and Alaska Department of Fish and Game (ADFG); the oil and gas industry; the Alaska Eskimo Whaling Commission; and other non-governmental organizations. Much of the research the NSB conducts has focused on building collaborative relationships with its partners, and NSSI represents the most extensive of these collaborations. The Borough's research has also incorporated a local perspective that improves the quality of data collected and its interpretation.

In particular, the NSB has served as a community-based group of subsistence users and scientists who live on the North Slope and facilitate relationships between NSB residents, land use and wildlife managers, and developers.

It is important to note that NSB residents have acquired a sophisticated understanding of fish, wildlife and marine mammals through generations of dependence on these species for survival. As a result, the Borough's primary responsibility is to address the concerns and interests of NSB residents through a coupling of western and traditional knowledge. To address local concerns over industrial development, changes in climate, and land use practices, NSB has built several long-term monitoring programs focusing on the bowhead whale, caribou, subsistence practices, waterfowl species, fisheries, and the health assessment of subsistence resources. The NSB could not have accomplished or developed these programs without collaboration and input from local NSB residents, numerous agencies, and universities.



**Whale hunt at Barrow.** (Gordon Brower, NSB)

- ◆ **Bowhead Whales:** One of the core NSB-supported projects is the ongoing study of bowhead whale population dynamics, the hunt, life history characteristics and behavior. Information derived from this program has withstood the scrutiny of the international community for the past 25+ years and has allowed the continued sustainable harvest of the bowhead. Despite this knowledge base, numerous important questions remain unanswered and it is the NSB's goal to gain a more complete understanding of this important resource, thus ensuring its protection and availability as a resource to the Iñupiat.
- ◆ **Beluga Whale:** The Borough has sought to understand better the distribution, life history and ecology of the beluga whale through satellite monitoring and health assessment programs. Much of this work was under the guidance of the Beluga Whale

Commission, with the cooperation of subsistence hunters, and collaboration with ADFG and various universities.

- ◆ **Subsistence Use:** The NSB has monitored the subsistence practices and use of all resources in each community on the North Slope since the early 1990's. Through interviews, NSB has documented the use of plants, birds, fish, and terrestrial and marine mammals. This work was through collaborative relationships with the BLM, USFWS, and ADFG and has served to document a baseline of community needs and land use practices.
- ◆ **Teshekpuk Caribou Herd Monitoring:** Together with the ADFG and BLM, the Borough developed a Teshekpuk caribou herd satellite-monitoring program to document and monitor herd distribution and land use. Before beginning this program in 1990, western scientists did not know the seasonal distribution of the Teshekpuk herd, nor its importance to North Slope communities. This project provides a better understanding of barren ground caribou's life history. In addition, the NSB has responded to large winter die-offs of the Western Arctic Caribou Herd and helped to monitor the land use and distribution of the Central Arctic Caribou Herd.
- ◆ **Migratory Birds:** The NSB has monitored the distribution and abundance of nesting and brood rearing Pacific black brant and lesser snow geese along the coast of the North Slope since the 1990s. This program has documented the exponential growth of lesser snow goose colonies and has begun to understand wintering distribution and use of this population by sport and subsistence hunters. The NSB has also begun to monitor breeding and brood rearing habitat of this species, and has studied the breeding ecology of Steller's and king eiders on the North Slope for the past decade. Under the guidance of the local Fish and Game Management Committee, the NSB sought and gained approval to ban all lead shot use for hunting on the North Slope.
- ◆ **Subsistence Fish:** Fish are a vitally important resource to subsistence on the North Slope. Among species used for subsistence are broad whitefish, burbot, arctic grayling, dolly varden, rainbow smelt and arctic cisco. With cooperation from local fishers, and in combination with the studies of our partners, the NSB now has a better understanding of fisheries that are important to subsistence on the North Slope. This work has included documenting the movements and distribution of key fish species using satellite telemetry technologies, inventory of fish in lake and river systems used by subsistence fishers, and measuring water quality, deposition composition and productivity to describe important fish habitats. As a result, the NSB has identified important spawning and over-wintering areas, as well as areas important to subsistence fishing.



**Arctic Slope Regional Corporation (ASRC):** ASRC is an Alaska Native-owned regional corporation representing more than nine thousand Iñupiat Eskimos of Alaska's North Slope. ASRC shareholders own surface and subsurface title to more than five million acres of North Slope lands. ASRC lands are in areas with known resources or are exceedingly prospective areas for oil, gas, coal, and base metal sulfides. ASRC is committed to

developing these resources and bringing them to market, in a way that respects Iñupiat subsistence values and ensures proper care of the environment, habitat and wildlife of the North Slope. The mission of ASRC includes actively managing its lands and resources in order to enhance Iñupiat cultural and economic freedoms through:

- ◆ **Preserving Iñupiat Culture and Traditions:** ASRC is committed to preserving the Iñupiat culture and traditions that strengthen both our shareholders and ASRC. By adhering to the traditional values of protecting the land, its environment, and the Iñupiat culture, ASRC has successfully adapted and prospered in an ever changing economic climate.
- ◆ **Representing Arctic Slope Communities:** ASRC represents eight villages on Alaska's North Slope: Point Hope, Point Lay, Wainwright, Atkasuk, Barrow, Nuiqsut, Kaktovik and Anaktuvuk Pass. ASRC land is abundant with natural resources. This natural resource-based corporation employs 6,000 people, has a growing shareholder population of 9,000, and has title to approximately five million acres of land. A founding principle of ASRC is respect for the Iñupiat heritage.
- ◆ **Professional Fields:** The family of companies of ASRC extends into the professional fields of engineering, financial management, oil and gas support services, petroleum refining and distribution, civil construction and communications.
- ◆ **Fostering Relationships:** ASRC recognizes the importance we place on stewardship of our lands for the benefit of our shareholders; development of our human and financial resources; and fostering of our relationships with North Slope villages. These objectives build on the accomplishments of our first quarter century and set the stage for future growth, profitability and other achievements.

ASRC is involved with a number of North Slope resource development activities, and has a variety of subsidiary companies that are active in North Slope resource development and other sectors. The ASRC is a member of the NSSI and supports the science goals and objectives of the initiative to help utilize the collective scientific knowledge to better understand, mitigate and adapt to development activities and climate change.



(Left) Wainwright residents celebrate the whale festival with a traditional blanket toss. (Right) The whole community gathers to honor the successful captain and crew. Each family receives whale meat from the catch. (NSSI)



**U.S. Geological Survey (USGS):** In 2010, USGS continues to conduct a broad range of collaborative research in cooperation with other federal (BLM, BOEMRE, USFWS, NPS and the NSSI), State of Alaska (ADFG, ADNDR), local government (NSB), Native corporations (ASRC), and universities (Univ. Of Alaska Fairbanks; Univ. of Alaska Anchorage) that address energy, mineral, water resources, geographic analysis, and biological assessments. You can find a more comprehensive view of USGS activities on the North Slope through its USGS Alaska portal at <http://alaska.usgs.gov/portal/>.

Some USGS research activities include:



Monitoring polar bear on the North Slope. (Mike Lockhart, USGS)

- ◆ **Polar Bear Research:** In FY 2010, the USGS initiated a research project to understand the distribution, land use, and demographics of polar bears on the northern Alaska coast during the summer ice minimum season. Primary funding for this research came from the USGS and the BOEMRE, with the BLM funding glue-on and ear tag satellite radio tags. The data collection phase began in 2009 with the capture of 16 polar bears on coastal lands along the Beaufort Sea.
- ◆ **Species and Habitat Modeling:** The USGS is continuing ongoing research on sea ice, polar bears, and walrus to understand variability in population size, distribution, habitat use, and demography; as well as the effects of climate change and diminishing sea ice on these species. USGS research



Polar Bear 32255. (Mike Lockhart, USGS)

is increasingly emphasizing the development of new modeling approaches to forecast future status of sea ice habitat, and polar bear and Pacific walrus populations. USGS scientific findings help the USFWS, BOEMRE, and BLM with their management responsibilities for the North Slope and its offshore waters.

- ◆ **Permafrost and Climate-Monitoring Network:** The USGS is a participant in the Global Terrestrial Network for Permafrost (GTN-P) and the Global Climate Observing System (GCOS) two sub-networks on the North Slope. This involves: 1) a network of 15 automated surface stations; and 2) a 20-element deep borehole array. The surface stations continuously monitor changes in permafrost active-layer and a number of other climate parameters such as permafrost temperature, soil moisture, snow depth, air temperature, wind speed and direction, up- and down-welling shortwave radiation, albedo, and cloudiness. Cooperators: BLM and USFWS.
- ◆ **North Slope Shoreline Change Project:** The USGS is engaged in three separate and independent studies examining historical shoreline change along segments of the North Slope's coast on the Arctic Ocean. All three studies have documented extremely high rates of shoreline retreat. The studies will make use of new acquisitions of lidar and near coastal bathymetry data to document past and ongoing change, and to build prediction models for future erosion rates based on beach geomorphology and ocean wave and current intensity. Cooperators: BLM, NOAA, and USFWS.
- ◆ **Movements and Distribution of Yellow-billed Loons:** In Alaska, breeding Yellow-billed Loon habitat is on the North Slope coastal tundra areas north of the Brooks Range. Their highest densities occur just west of Teshekpuk Lake, along the Ikpikpuk River drainage in the National Petroleum Reserve - Alaska (NPR-A), and in the Colville River Delta. The USGS is conducting studies that will: (1) develop tools such as predictive models, decision support, and expert systems for science-based management of populations and habitats; and (2) evaluate the status of at-risk plant and animal species and provide scientific guidance for their conservation and management. Satellite telemetry is documenting Yellow-billed loon use of coastal marine habitats, migration pathways, and wintering areas. Cooperators: USFWS and BLM.



**U.S. Department of Energy (USDOE):** Since 2001, the U. S. Department of Energy's Arctic Energy Office (AEO), managed by the National Energy Technology Laboratory, has been conducting research. Its research activities are broad and generally involve: (1) the development of technical solutions and economic analysis of potential fossil energy recovery activities; (2) alternative environmental practices associated with tundra access in support of oil exploration; and (3) facilitating communications with key stakeholders. The AEO has collaborated its work with the

University of Alaska, the energy industry and state agencies. The AEO is an active advisory member of the NSSI Oversight Group. The AEO's current North Slope projects emphasize heavy oil

recovery and development of methane hydrate resources, and use of water resources to build North Slope ice roads. Some example projects include:

- ◆ **North Slope Water Resources Planning and Management:** Ice roads and ice pads provide a cost-effective means of oil and gas exploration on Alaska's North Slope with minimal impact to the sensitive underlying tundra. Key components involve information systems technology, Arctic hydrology and climatology, water resources management, and decision support through modeling. Partners include the University of Alaska Fairbanks, Texas A & M University, and PBS&J Consulting.
- ◆ **Using Artificial Barriers (Snow Fences) to Augment Fresh Water Supply:** Current Arctic energy production is situated in a "Polar Desert." Total annual precipitation averages a mere 6- to 10-inches annually. Water is a precious resource on the North Slope, as it is only available for 12 weeks, has high operation costs, and is difficult to store and distribute in Arctic conditions. The project will work to optimize retention of source water and to discover means of retaining the existing supply for facility use and building ice roads and ice pads. Partners include the University of Alaska Fairbanks, Colorado State University, and the Cold Regions Research and Engineering Laboratory.
- ◆ **Producing Light Oil from a Frozen Reservoir:** The Umiat oil field contains light oil in a shallow, frozen reservoir and may be typical of an abundant supply across the arctic permafrost. Most prior work researching how to produce in these strata of rock/ice/light oil system at low pressures has focused upon techniques for heavy oil in unconsolidated and unfrozen sands, or on gas hydrates. The goal is to develop a robust reservoir model to test possible production methods for Umiat and similar frozen reservoirs that do not use steam or a liquid that will freeze.



Trans-Alaska Pipeline (Doug Kane, UAF)

- ◆ **Use of Polymers to Recover Viscous Oil from Unconventional Reservoirs:** Alaska's North Slope contains a very large unconventional oil resource—over 35 billion barrels of heavy and viscous oil. Production has been limited to pools in the core area that flow with thermal or miscible gas injection/water-alternating-gas. This project will re-examine the use of polymers and, where appropriate, redefine reservoir types to apply polymer flooding. Researchers will also test new visco-elastic polymers and improved polymer injection techniques.
- ◆ **Fluid and Rock Property Controls On Production and Seismic Monitoring Alaska Heavy Oils:** The heterogeneity of the system is a prime factor limiting the efficiency of heavy oil recovery. Variability includes the heavy oil with varying resin and asphaltene contents and the rock matrices' with different porosities, permeability,

connectivity, and mineral content. This study will use seismic data to characterize the reservoir fluid and rock properties in way that a geophysical monitoring program can potentially enhance heavy oil recovery.

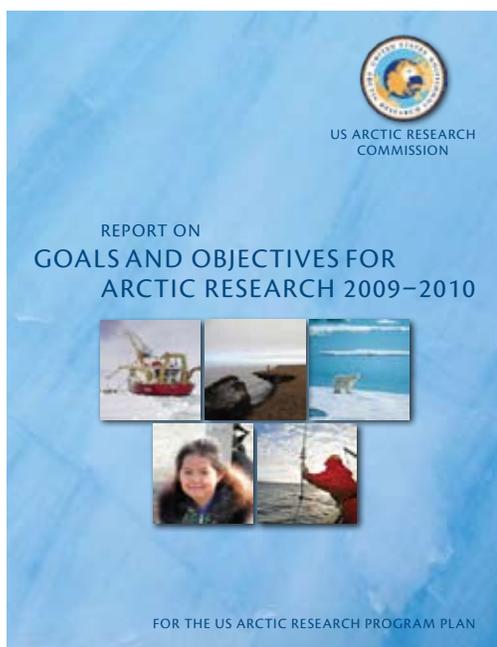
- ◆ **Gas Hydrates Production Trials:** (1) Laboratory experiments conducted by ConocoPhillips and the University of Bergen have demonstrated the effectiveness of exchanging carbon dioxide for methane in the hydrate structure, without the release of free water. The exchange technology could prove to be a critical tool for unlocking the methane hydrate resource potential in a manner that minimizes adverse environmental impacts such as water production and subsidence while simultaneously providing a synergistic opportunity to sequester carbon dioxide. Researchers are currently designing a field test for the North Slope. (2) Previous research efforts funded by the DOE, supported the hypothesis that methane hydrates exist within the Barrow gas fields. Based on detailed reservoir modeling and other favorable conditions, we believe these accumulations may be interacting with the free gas reservoirs and providing pressure support through dissociation of the hydrates. A program is starting for continual reservoir surveillance and monitoring to prove the commercial potential of producing methane hydrate through depressurization dissociation from the gas zone underlying the hydrates.
- ◆ **Alaska North Slope Oil and Gas: A Promising Future or an Area in Decline?:** In 2007, the DOE National Energy Technology Lab's Arctic Energy Office published a report with this title using 2005 data. It published updated data in an April 2009 addendum. With today's estimates of economically recoverable reserves of about 50 billion barrels of oil and 137 TCF of natural gas, researchers made a detailed assessment and analysis of North Slope oil and gas resources and the interrelated technical, economic, and environmental factors controlling future development of those resources. The scope includes known onshore and offshore fields (both developed and undeveloped) as well as prospective development areas such as the NPR-A and various offshore areas. The report is at [http://www.netl.doe.gov/technologies/oil-gas/publications/AEO/ANS\\_Potential.pdf](http://www.netl.doe.gov/technologies/oil-gas/publications/AEO/ANS_Potential.pdf).



**U.S. Arctic Research Commission (USARC):** The USARC continues to promote their five priority research themes reported in their 2009-10 goals and objectives report. (See <http://www.arctic.gov>)

- ◆ Environmental change of the Arctic and Bering Seas
- ◆ Arctic human health
- ◆ Civil infrastructure
- ◆ Natural resource assessment and earth science
- ◆ Indigenous languages, cultures, and identities

The Interagency Arctic Research and Policy Committee (IARPC) have adopted these themes, originally developed in 2007-08. The USARC has recently achieved specific actions towards these



#### USARC Goals Report. (USARC)

waters in Anchorage, AK. The meeting involved representatives of the federal Interagency Coordinating Committee on Oil Pollution Research chaired by the U.S. Coast Guard. In May, the USARC published the *U.S. Arctic Research Commission Recommends Steps to Expand U.S. Funding for Arctic/Subarctic Oil Spill Research* white paper. A copy of this paper at [http://www.arctic.gov/publications/usarc\\_oilspill\\_5-26-10.pdf](http://www.arctic.gov/publications/usarc_oilspill_5-26-10.pdf) and the USARC's first 2004 publication on oil spills in ice-covered waters at [http://www.arctic.gov/publications/oil\\_in\\_ice.pdf](http://www.arctic.gov/publications/oil_in_ice.pdf).

The USARC has been involved in other congressional activities. For example, Commissioner Warren Zapol testified on “Youth Suicide in the Arctic” before the Senate Committee on Indian Affairs on March 25, 2010, and Executive Director John Farrell testified on “Charting the Unknown: America’s Arctic Seafloor” before the House Subcommittee on Insular Affairs, Oceans and Wildlife Committee on Natural Resources on May 6, 2010. Also in Washington, representatives from the Commission continued to work with those from other agencies to implement national Arctic policy (NSPF66/HSPD25). In 2009, President Obama created an Arctic Region Interagency Policy Committee (IPC) co-chaired by the White House National Security Council and by the Council of Environmental Quality. The Arctic Region IPC met several times in 2010 and is making progress on implementing policy and aligning with other initiatives (such as ocean policy).

The USARC is also working with the U.S. Department of Homeland Security to co-sponsor and participate in two workshops. The first, *U.S. Coast Guard American Indian/Alaska Native Consultation and Cultural Communication Course* was Aug. 10-13, 2010, in Juneau, AK. The second, *U.S. Coast Guard Challenges in the Arctic: How Research Can Address Them*, will be in Fairbanks, AK, Sept. 21-23, 2010.

goals. For example, representatives from the Commission partnered with the Fogarty International Center, National Institutes of Health, to publish *Behavioral and Mental Health Research in the Arctic: Strategy Setting Meeting Proceedings* about arctic health in the *International Journal of Circumpolar Health* (see: [http://www.arctic.gov/publications/CHS%20\(5\)%20netti.pdf](http://www.arctic.gov/publications/CHS%20(5)%20netti.pdf)).

The USARC also hosted a *Arctic civil infrastructure* workshop with the Army Corps of Engineers’ Cold Regions Research and Engineering Lab, the University of Alaska Fairbanks, and the Denali Commission, on April 21-23, 2010 in Fairbanks, AK. You can find the presentations and results from that workshop at <https://sites.google.com/a/alaska.edu/arctic-civil-infrastructure-workshop/>.

The USARC has long been a proponent of greater research on the topic of oil spills in ice-covered waters. On March 4, 2010, the USARC held a public meeting on oil spills in ice-covered

### Arctic Boundary as defined by the Arctic Research and Policy Act (ARPA)

All United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain<sup>1</sup>



Acknowledgement: Funding for this map was provided by the National Science Foundation through the Arctic Research Mapping Application (armap.org) and Contract #0520837 to CH2M HILL for the Interagency Arctic Research Policy Committee (IARPC).  
Map author: Allison Gayford, Nuna Technologies. May 27, 2009.

1. The Aleutian chain boundary is demarcated by the 'Contiguous zone' limit of 24-nautical miles.

#### Map of the Arctic region. (USARC)

On Sept. 22, 2010, the USARC is coordinating with several other federal agencies to co-sponsor and participate in *U.S. Scientific Access to the Russian Arctic*, a one-day mini-workshop with the National Academies Polar Research Board.

USARC staff continues to support efforts to implement the recommendations in the *Arctic Marine Shipping Assessment* report approved by the Arctic Council Ministerial meeting in Tromso, Norway, on April 29, 2009. Various federal agencies and legislation introduced by members of the Alaskan delegation are implementing the recommendations from this report. The report is at [http://www.arctic.gov/publications/AMSA\\_2009\\_Report\\_2nd\\_print.pdf](http://www.arctic.gov/publications/AMSA_2009_Report_2nd_print.pdf).

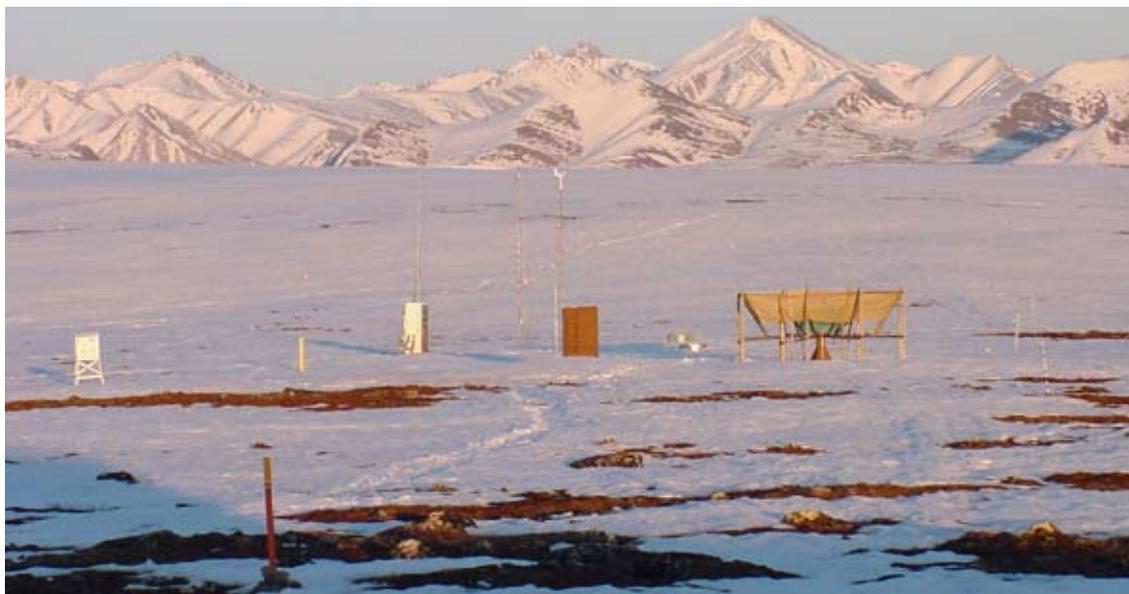
Commissioner Virgil (Buck) Sharpton has been designated "Acting Chair," by President Obama. On June 25, 2010, he appointed Ms. Mary Ciuniq Pete, of Bethel, AK, to the USARC. Ms. Pete is a long-time Alaska Native leader and a subsistence expert.

USARC remains an active advisor to the NSSI and is actively involved in working toward its goals and objectives. One such example was through a week-long series of meetings in Washington, DC, on behalf of the NSSI with representatives from the executive and congressional branches of government. The USARC is also helping NSSI plan a major Arctic conference in 2011.



*National Weather Service (NWS):* The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service Alaska Region provides weather, hydrologic, climate forecasts, and volcanic ash and tsunami warnings for Alaska and its surrounding waters. Strategic priorities for the NOAA include establishing a National Climate Service; supporting comprehensive marine spatial planning; ensuring the sustainability of marine fisheries; strengthening arctic science and stewardship; and sustaining satellite-based earth observation.

As a component of its focus on arctic strengthening, NOAA NWS and the NOAA Climate Program are continuing the deployment of the U.S. Climate Reference Network (USCRN) within Alaska. The USCRN's primary goal is to provide future long-term observations of temperature and precipitation and join them to historical observations for the detection and characterization of present and future climate change. The NOAA will use data from the USCRN for operational climate monitoring activities and for placing current climate anomalies into a historical perspective. The USCRN will also provide the U.S. with a reference network that meets the requirements of the Global Climate Observing System. There are four USCRN sites within Alaska (Barrow, Sitka, Fairbanks and St. Paul). Over the next five years, NOAA expects to deploy 29 additional sites throughout Alaska, including five sites on the North Slope. NOAA NWS and the National Environmental Satellite and Data Information Service (NESDIS) are also establishing a satellite product proving ground, collaborating with the University of Alaska Fairbanks, to test and evaluate remote sensing algorithms for weather, water and climate applications.



Meteorological station on North Slope. (Doug Kane, UAF)

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For additional information on the North Slope of Alaska, or the membership organizations of the North Slope Science Initiative, please visit these websites:

**Federal:**

Bureau of Land Management, Alaska	<a href="http://www.blm.gov/ak">http://www.blm.gov/ak</a>
Bureau of Ocean Energy Management, Regulation and Enforcement, Alaska OCS Region	<a href="http://alaska.boemre.gov">http://alaska.boemre.gov</a>
National Park Service, Alaska Region	<a href="http://www.nps.gov/alaska">http://www.nps.gov/alaska</a>
National Marine Fisheries Service, Alaska Region	<a href="http://fakr.noaa.gov">http://fakr.noaa.gov</a>
National Weather Service, Alaska Region	<a href="http://www.arh.noaa.gov">http://www.arh.noaa.gov</a>
U.S. Arctic Research Commission	<a href="http://www.arctic.gov">http://www.arctic.gov</a>
U.S. Department of Energy	<a href="http://www.energy.gov/alaska.htm">http://www.energy.gov/alaska.htm</a>
U.S. Fish and Wildlife Service, Region 7	<a href="http://alaska.fws.gov">http://alaska.fws.gov</a>
U.S. Geological Survey, Alaska Science Center	<a href="http://alaska.usgs.gov">http://alaska.usgs.gov</a>

**North Slope:**

North Slope Borough	<a href="http://www.north-slope.org">http://www.north-slope.org</a>
Arctic Slope Regional Corporation	<a href="http://www.asrc.com">http://www.asrc.com</a>

**State of Alaska:**

Alaska Department of Commerce, Community & Economic Development	<a href="http://www.commerce.state.ak.us">http://www.commerce.state.ak.us</a>
Alaska Department of Environmental Conservation	<a href="http://dec.state.gov">http://dec.state.gov</a>
Alaska Department of Fish and Game	<a href="http://www.adfg.state.ak.us">http://www.adfg.state.ak.us</a>
Alaska Department of Natural Resources	<a href="http://dnr.state.gov">http://dnr.state.gov</a>
Alaska Department of Transportation & Public Facilities	<a href="http://www.dot.state.ak.us/">http://www.dot.state.ak.us/</a>
University of Alaska Fairbanks-Arctic Research	<a href="http://www.uaf.edu/uaf/research">http://www.uaf.edu/uaf/research</a>

# Appendix I: Oversight Group Charter

## North Slope Science Initiative

Department of the Interior (Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Geological Survey, Minerals Management Service, and National Park Service), Department of Commerce (NOAA National Marine Fisheries Service and National Weather Service), Department of Energy (National Energy and Technology Laboratory), State of Alaska (Department of Fish and Game and Department of Natural Resources), Arctic Slope Regional Corporation, North Slope Borough and U.S. Arctic Research Commission

## Charter

### *North Slope Science Oversight Group*

1. **Official Designation:** North Slope Science Initiative, North Slope Science Oversight Group (hereafter the Oversight Group).
2. **Background & Need:** Alaska's North Slope provides important terrestrial, marine and estuarine habitat for thousands of migratory birds, caribou and other terrestrial mammals, marine mammals, and fish, and is culturally important to many Alaskan Natives and their communities. Its petroleum resources are vital to the Nation and it currently provides about 11% of annual domestic oil production. When production of the large reserves of natural gas and coal in the region becomes economically feasible, the strategic and economic importance of the North Slope's hydrocarbon energy resources will be even greater. Past oil and gas activities have impacted habitats but those impacts have been difficult to measure. It is essential that state, federal and North Slope Borough and Arctic Slope Regional Corporation natural resource agencies collectively develop and implement cooperative North Slope-wide inventory, monitoring and research programs to provide the scientific information necessary to address development impacts, and to differentiate these impacts from those caused by natural processes.
3. **Mission and Vision:** The North Slope Science Initiative is the effort of federal, state and local governments having responsibilities for land and ocean management, to facilitate and improve collection and dissemination of ecosystem information pertaining to the Alaskan North Slope region, including coastal and offshore regions. The *mission* of the NSSI is to improve scientific and regulatory understanding of terrestrial, aquatic and marine ecosystems for consideration in the context of resource development activities and climate change. The *vision* of the NSSI is to identify those data and information needs that management agencies will need in the future to develop management scenarios using the best information and mitigation to preserve the environments of the North Slope. The NSSI adopts a strategic framework to provide resource managers with the data and analyses they need to help evaluate multiple simultaneous goals and objectives related to each agency's mission on the North Slope. The NSSI utilizes and complements the information produced under other North Slope science programs, both internal and external. The NSSI also facilitates information sharing among agencies, non-governmental organizations, industry, academia and members of the public to increase communication and reduce redundancy among science programs.

**4. Legislative Purpose and Objectives:** The NSSI was formally authorized in Section 348, Energy Policy Act of 2005 (Public Law 109-58). The legislative **purpose** and **objectives** are stated below:

§(a)(2) The **purpose** of the Initiative shall be to implement efforts to coordinate collection of scientific data that will provide a better understanding of the terrestrial, aquatic, and marine ecosystems of the North Slope of Alaska.

§(b) **Objectives-** To ensure that the Initiative is conducted through a comprehensive science strategy and implementation plan, the Initiative shall, at a minimum—

- (1) identify and prioritize information needs for inventory, monitoring, and research activities to address the individual and cumulative effects of past, ongoing, and anticipated development activities and environmental change on the North Slope;
- (2) develop an understanding of information needs for regulatory and land management agencies, local governments, and the public;
- (3) focus on prioritization of pressing natural resource management and ecosystem information needs, coordination, and cooperation among agencies and organizations;
- (4) coordinate ongoing and future inventory, monitoring, and research activities to minimize duplication of effort, share financial resources and expertise, and assure the collection of quality information;
- (5) identify priority needs not addressed by agency science programs in effect on the date of enactment of this Act and develop a funding strategy to meet those needs;
- (6) provide a consistent approach to high caliber science, including inventory, monitoring, and research;
- (7) maintain and improve public and agency access to—
  - (A) accumulated and ongoing research; and
  - (B) contemporary and traditional local knowledge; and
- (8) ensure through appropriate peer review that the science conducted by participating agencies and organizations is of the highest technical quality.

**5. Membership:** The Oversight Group consists of the following member agencies with voting privileges: the State Director of the Bureau of Land Management; the Regional Directors of the U.S. Fish and Wildlife Service, National Park Service, National Marine Fisheries Service, and the Minerals Management Service; the Commissioners of the Alaska Department of Natural Resources and the Alaska Department of Fish and Game; the Arctic Slope Regional Corporation President; and the Mayor of the North Slope Borough. These agencies represent the principal government agencies at the regional, state, and federal level with management responsibilities for public lands, fish, and wildlife on the North Slope. In addition, the U.S. Geological Survey, U.S. Arctic Research Commission, National Weather Service and the U.S. Department of Energy will participate on the Oversight Group as the primary advisory agencies on science issues related to the North Slope, but will not have voting privileges.

## 6. Summary of Agency Missions and Roles:

### A. Federal

1. Bureau of Land Management: collaboratively manages its Alaska lands and its uses on the North Slope to promote healthy and productive ecosystems for present and future generations, in accordance with the Federal Land Policy Management Act (FLPMA) and the Naval Petroleum Reserves Production Act of 1976 (NPRPA). The NPRPA encourages oil and gas leasing in the National Petroleum Reserve Alaska (NPR-A) while requiring protection of important surface resources and uses, including any activities related to the protection of environmental, fish and wildlife, and historical or scenic values.
2. Fish and Wildlife Service: is one of the primary natural resource management agencies on the North Slope. The mission of the Fish and Wildlife Service is to work with others to conserve, protect and enhance the fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Fish and Wildlife Service manages the 19 million acre Arctic National Wildlife Refuge in northeast Alaska, and has primary management authority for migratory birds, certain threatened and endangered species, polar bear, and Pacific walrus. The Service also cooperates with other federal and state agencies and various industries to minimize the effects of development on fish and wildlife resources. To accomplish this mission, the Service is involved in a variety of research, monitoring and management projects of the North Slope and in adjacent coastal waters of the Beaufort Sea.
3. Minerals Management Service: manages the energy and mineral resources located on the Nation's Outer Continental Shelf, collects revenue from the federal OCS and onshore Federal and Indian lands, and distributes those revenues. The MMS Offshore Minerals Management Program administers the OCS competitive leasing program and oversees exploration and production of our Nation's offshore natural gas, oil, other mineral resources and alternative energy for safety and environmental soundness. MMS is also responsible for oil spill response reviews for all platforms off the Nation's coasts. MMS funds environmental and technology studies for ocean energy and minerals. The prime laws for the MMS Offshore Program are the Outer Continental Shelf Lands Act and the Oil Pollution Act.
4. National Park Service: preserves the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.
5. Geological Survey: serves the Nation as the Department of Interior's lead science agency by providing scientific expertise responsive to important natural resources issues and natural hazards assessments. The mission of the USGS Alaska Science Center (ASC) is to provide scientific leadership and accurate, objective, and timely data, information, and research findings about the earth and its flora and fauna to Federal and State resource managers and policy makers, local government, and the public to support sound decision-making regarding natural resources, natural hazards, and ecosystems in Alaska and circumpolar regions. To meet the specific information needs of resource management agencies for the marine and terrestrial ecosystems of the North Slope of Alaska, the ASC will combine and enhance the Center's diverse science programs, capabilities, and talents with capabilities of USGS from across the nation to strengthen its scientific capacity and contribution to the resolution of the complex natural resource issues associated with change within the North Slope region.
6. NOAA/ National Marine Fisheries Service: provides stewardship of living marine resources through science-based conservation and management and the promotion of healthy ecosystems. NOAA's activities on Alaska's North Slope include consultation and coordination regarding federal water development

projects under the Fish and Wildlife Coordination Act and other laws, consultation regarding federal actions under the Endangered Species Act, and regulation of small take authorizations under the Marine Mammal Protection Act. Under this program, NOAA issues regulations or Incidental Harassment Authorizations for the unintentional take of small numbers of marine mammals. The authorizations often require monitoring and research to quantify the extent of take and to reduce harmful effects to marine mammals. NOAA also performs research concerning marine mammals under NOAA jurisdiction, including whales and seals. NOAA is especially involved with bowhead whales and whaling, including research, funding/grant work for the Alaska Eskimo Whaling Commission, and staffing for the U.S. delegation to the International Whaling Commission.

7. United States Department of Energy: seeks to protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy. To tackle our immediate need for oil and gas, the DOE continues to develop and promote technologies that can lower the costs of oil and natural gas exploration and development, maximize the efficiency and stability of America's oil and gas production and supply, and protect the environment. The Department's research activities are closely coordinated with, and synergistic to, the activities of other federal agencies including Environmental Protection Agency, and various branches of the Department of the Interior. DOE recently established the Arctic Energy Office in Fairbanks and is sponsoring numerous research efforts regarding the Alaska North Slope through that office and other DOE programs.

8. National Weather Service: The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) Alaska Region provides weather, hydrologic, climate forecasts and volcanic ash and tsunami warnings for the state of Alaska and its surrounding waters. The Region has an outstanding team of employees in three Weather Forecast Offices (WFO), 12 Weather Service Offices, the Alaska-Pacific River Forecast Center, the Alaska Aviation Weather Unit, the Anchorage Center Weather Service Unit, the West Coast and Alaska Tsunami Warning Center, the Anchorage Electronics Unit, and the Alaska Region Headquarters.

Staff members are dedicated to delivering climate, weather, and water warnings and forecasts in support of our mission to protect lives and property and enhance the economic interests of our Nation. This team of dedicated professionals, in collaboration with our critical partners such as NSSI, supports the NWS strategic plan theme of "Working Together to Save Lives."

The office with responsibility for the North Slope is WFO Fairbanks. Collocated with the International Arctic Research Center at the University of Alaska Fairbanks campus, this WFO provides all the weather and flood warnings, daily forecasts, and meteorologic and hydrologic data for the northern two-thirds of the state. The terrestrial area of responsibility of this office is the largest assigned to any National Weather Service Weather Forecast Office, encompassing some 340,000 square miles. Its area extends southward to the crest of the Alaska Range, eastward to the Alaska-Canada border, westward to the Bering Strait and northward to the Arctic Ocean including Barrow.

9. U.S. Arctic Research Commission: The United States Arctic Research Commission was established by the Arctic Research and Policy Act of 1984 (as amended, Public Law 101-609). The Commission's principal duties are (1) to establish the national policy, priorities, and goals necessary to construct a federal program plan for basic and applied scientific research with respect to the Arctic, including natural resources and materials, physical, biological and health sciences, and social and behavioral sciences; (2) to promote Arctic research, to recommend Arctic research policy, and to communicate our research and policy recommendations to the President and the Congress; (3) to work with the National Science Foundation as the lead agency responsible for implementing the Arctic research policy and to support cooperation and collaboration

throughout the Federal Government; (4) to give guidance to the Interagency Arctic Research Policy Committee (IARPC) to develop national Arctic research projects and a five-year plan to implement those projects; and (5) to interact with Arctic residents, international Arctic research programs and organizations and local institutions including regional governments in order to obtain the broadest possible view of Arctic research needs.

The Arctic Research and Policy Act was amended in 1990 to increase the number of Commissioners appointed by the President of the United States from five to seven voting members. Four members are from academic or research institutions; two members from private industry undertaking commercial activities in the Arctic; and one member from among the indigenous residents of the US Arctic. The Director of the National Science Foundation serves as an *ex officio* member.

### **B. State of Alaska:**

1. Department of Fish and Game: protects, maintains and improves the fish and game resources of the state, and manages their use and development for the maximum benefit of the people of the state, consistent with the sustained yield principle. The Alaska Department of Fish and Game has a responsibility to collect biological information necessary to evaluate land development activities, to present this information to decision makers so they can make informed decisions and to provide options for development activities that will minimize or mitigate negative impacts of development. The department also fulfills specific statutory responsibilities for protecting freshwater anadromous fish habitat under the Anadromous Fish Act and providing free passage of anadromous and resident fish in fresh waterbodies.

2. Department of Natural Resources: is the lead resource development agency for the State of Alaska. Its mission is to develop, conserve and enhance natural resources for present and future Alaskans. Several Divisions in DNR have major responsibilities regarding North Slope developments.

(a) The Division of Oil and Gas develops and manages the state's oil and gas leasing programs. The division staff identifies prospective lease areas; performs geologic, economic, environmental and social analyses, develops a five-year leasing schedule, and conducts public review of proposed sales. The division conducts competitive oil and gas lease sales and monitors collection of all funds resulting from its programs.

(b) The Division of Geological and Geophysical Surveys (DGGS) generates, analyzes and interprets data on geologic resources and natural conditions; maps and inventories mineral and energy resources on state land for use by government, private industry, scientists, educators and the public.

(c) The Division of Mining, Land & Water is the primary manager of Alaska's land holdings. Responsibilities include ensuring the state's title; preparing land-use plans and easement atlases; classifying land; leasing and permitting state land for commercial and industrial uses, and coordinating needed authorizations for major developments on the North Slope. The division allocates and manages the state's water resources on all lands in Alaska, adjudicates water rights, provides technical hydrologic support, and assures dam safety.

(d) The Division of Coastal and Oceans Management administers the Alaska Coastal Management Program which provides stewardship for Alaska's rich and diverse coastal resources to ensure a healthy and vibrant Alaskan coast that efficiently sustains long-term economic and environmental productivity. It also administers the State of Alaska's Large Project teams responsible for coordinating state agency participation on major resource development projects throughout Alaska.

(e) The Office of Project Management and Permitting administers the State of Alaska's Large Project teams responsible for coordinating state agency participation on major resource development projects throughout Alaska.

**C. Arctic Slope Regional Corporation (ASRC):** is the Alaska Native-owned regional corporation representing more than nine thousand Iñupiat Eskimos of Alaska's North Slope. The shareholders of ASRC own surface and subsurface title to more than four million acres of North Slope lands. By virtue of this title, the ASRC represents the largest private landowner on the North Slope. The ASRC ownership stems from an earlier claim of aboriginal title - covering the entire Alaskan North Slope - that was eventually settled in part by the Alaska Native Claims Settlement Act of 1971 ("ANCSA"). The mission of ASRC includes actively managing its lands and resources in order to enhance Iñupiat cultural and economic freedoms. ASRC is involved with a number of North Slope resource development activities, and has a variety of subsidiary companies that are active in North Slope resource development and other sectors.

**D. North Slope Borough:** Responsibilities include planning, zoning and permitting; coastal management; wildlife research with a focus on subsistence; and support for the traditional culture of the North Slope. The Borough's planning and zoning authority through its Home Rule Charter mandates active land use management across federal, state, Native and municipal lands. The Borough has a coastal management plan and participates in ACMP consistency reviews, stressing the health, safety and cultural welfare of NSB residents and compliance with environmental policies of local concern. The Borough monitors and conducts scientific research on marine and wildlife resources to ensure healthy population levels and to sustain a continued subsistence harvest for its residents. All of the Borough's planning and research activities are conducted in part to guarantee strong local input into subsistence resource management, with special emphasis on the blending of contemporary and traditional local knowledge as a mechanism to sustain the resources and the local indigenous culture.

## 7. **Officers and Organization:**

**A. Chair and Vice Chair:** The Oversight Group shall designate a chair and vice chair. The chair shall alternate annually between federal and non-federal voting members and serve from June 1 through May 31 of each year. The chair may participate in discussion and debate at the meetings and may vote on all questions before the Oversight Group. The vice chair shall assume the responsibilities of the chair in the event of the chair's absence. The vice chair shall be the chair elect for the annual rotation.

**B. Designees:** Oversight Group members may appoint designees to act on their behalf in their absence.

**C. Advisory Groups:** The Oversight Group may recommend to the Secretary of the Interior the establishment of formal advisory groups, such as the North Slope Science Technical Advisory Panel, as appropriate. Charters for any advisory group must be reviewed and approved by the Oversight Group and forwarded to the Secretary of the Interior following the guidance provided by the Federal Advisory Committee Act.

**D. Staffing and Budget:** Staffing and budget will be provided through the Bureau of Land Management as the designated administrative agency. Budgets will be prepared by the Executive Director and support staff and be reviewed and approved annually by the Oversight Group. An Executive Director will report programmatically to the Chair and Vice Chair of the Oversight Group. Support staff will report to the Executive Director.

**E. Committees:** The Oversight Group may establish other ad hoc and standing committees as deemed necessary, and will specify the purpose and duration of each committee. Any ad hoc committees established would automatically expire upon completion of their committee assignment. The Oversight Group will establish a standing staff level committee composed of one member from each representative Oversight Group member agency or organization. Staff committee members will advise their respective Oversight Group members on issues prior to each Oversight Group meeting, and will provide assistance to the Executive Director of NSSI as appropriate.

## **8. Oversight Group Meetings & Procedures:**

**A. Notice of Meetings:** Reserved

**B. Conduct of Meetings:** Oversight Group meetings will be open to the public and will be generally conducted according to *Roberts Rules of Order*. The Oversight Group shall provide a reasonable opportunity for public comment.

**C. Voting Procedures:** A quorum of Oversight Group members, or their designees, shall be convened prior to any voting (a quorum shall consist of at least three federal members and two non-federal members). All decisions shall be made by the voting members by consensus. Oversight Group members may participate by telephone or teleconference. The U.S. Geological Survey and Department of Energy will not have voting privileges. The use of a proxy by voting members is not permitted.

**D. Recusal:** Oversight Group members may recuse themselves from voting, if necessary to avoid a conflict of interest.

**E. Records:** Minutes of each Oversight Group meeting will be posted on the NSSI website (<http://www.northslope.org>). Hard copies will be available upon request.

**F. Closed Meetings (Executive Sessions):** The Oversight Group may close meetings on matters pertaining to confidential personnel issues, litigation, confidential information such as archaeological information, and other matters included under applicable State and Federal laws and Borough ordinances.

**G. Frequency and Location of Meetings:** The Oversight Group will meet a minimum of two times per year—once in Anchorage and once in Barrow.

**H. Expenses for Oversight Group:** Expenses related to travel, lodging and per diem for Oversight Group meetings shall be borne by the representatives' respective member agencies.

## **9. Availability of Funds:**

This agreement shall not be construed as a commitment by any federal agency signatory to expend funds in excess of available appropriations.

## Appendix 2: Science Technical Advisory Panel Appointees

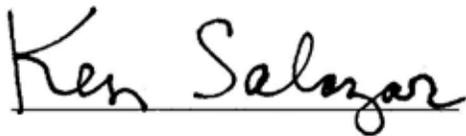
<b>2010 Appointees and Representative Scientific Expertise</b>	
Sue Moore, Ph.D.	Marine Ecology
Robert Suydam, Ph.D.	Marine Biology
Alvin Ott, Ph.D.	Habitat Biology
Gary Kofinas, Ph.D.	Social Science
W. Scott Pegau, Ph.D.	Oceanography
Wendy Loya, Ph.D.	Ecology/Biogeochemistry
Dan Reed, M.S.	Biometrics
Bill Streever, Ph.D.	Wildlife Biology/Restoration Ecology
John Kelley, Ph.D.	Oceanography/Environmental Monitoring
Caryn Rea, M.S.	Wildlife Biology
Robert Shuchman, Ph.D.	Remote Sensing
Matthew Sturm, Ph.D.	Geophysicist/Hydrology
Douglas Kane, Ph.D.	Civil Engineering
Jerry Brown, Ph.D.	Permafrost
Warren Matumeak	Traditional Ecological Knowledge

## Appendix 3: Science Technical Advisory Panel Charter

1. **Committee's Official Designation:** North Slope Science Initiative Science Technical Advisory Panel (Panel).
2. **Authority:** The Panel is a statutory advisory committee established under Section 348(d), Energy Policy Act of 2005 (PL 109-58); Section 309 of the Federal Land Policy and Management Act (FLPMA), as amended (43 U.S.C. 1739); the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1600); Section 14 of the National Forest Management Act of 1976 (16 U.S.C. 472a); and the Wilderness Act (16 U.S.C. 1131). The Panel is established in accordance with the provisions of the Federal Advisory Committee Act (FACA), as amended, 5 U.S.C. App. 2.
3. **Objectives and Scope of Activities:** The Panel will advise the North Slope Science Oversight Group through the Designated Federal Officer (DFO) on proposed inventory, monitoring, and research functions.
4. **Description of Duties:** Panel duties and responsibilities are generally as follows:
  - a. Provide advice to the Oversight Group on proposed inventory, monitoring and research functions;
  - b. Advise the Oversight Group on scientific information relevant to the Oversight Group's mission;
  - c. Review selected reports to advise the Oversight Group on their content and relevance;
  - d. Review ongoing scientific programs of North Slope Science Initiative (NSSI) member organizations on the North Slope at the request of the member organizations to promote compatibility in methodologies and compilation of data;
  - e. Advise the Oversight Group on how to ensure that scientific products generated through NSSI activities are of the highest technical quality;
  - f. Periodically review the North Slope Science Plan and provide recommendations for changes to the Oversight Group;
  - g. Provide recommendations for proposed NSSI funded inventory, monitoring and research activities to the Oversight Group;
  - h. Provide other scientific advice as requested by the Oversight Group; and
5. **Agency or Official to Whom the Panel Reports:** The Panel reports to the Secretary of the Interior through the DFO.

6. **Support:** Administrative support and funding for activities of the Panel will be provided by the Bureau of Land Management.
7. **Estimated Operating Costs and Staff Years:** The annual operating costs associated with supporting the Panel's activities are estimated to be \$45,000, including all direct and indirect expenses and .50 of Federal staff years.
8. **Designated Federal Officer:** The DFO is the Executive Director, North Slope Science Initiative who is a full-time employee appointed in accordance with Agency procedures. The DFO will approve or call all the Panel and subcommittee meetings, prepare and approve all meeting agendas, attend all Panel and subcommittee meetings, adjourn any meeting when the DFO determines adjournment to be in the public interest, and chair meetings when directed to do so by the official to whom the advisory Panel reports.
9. **Estimated Number And Frequency of Meetings:** The Panel will meet approximately two to four times annually, and at such other times as designated by the DFO.
10. **Duration:** Continuing.
11. **Termination:** The Panel's charter will expire 2 years from the date the charter is filed, unless, prior to that date, it is renewed in accordance with the provisions of Section 14(a)(2) of the FACA. The Panel will not meet or take any official action without a valid current charter.
12. **Membership and Designation:** The Panel shall consist of a representative group of not more than 15 scientists and technical experts from diverse professions and interests, including:
  - a. the oil and gas industry;
  - b. subsistence users;
  - c. Native Alaskan entities;
  - d. conservation organizations;
  - e. wildlife management organizations; and
  - f. academia
13. **Ethics Responsibilities of Members:** No Panel or subcommittee member shall participate in any specific party matter including a lease, license, permit, contract, claim, agreement, or related litigation with the Department in which the member has a direct financial interest. As provided in 43 CFR 1784.2-2, members of the Panel shall be required to disclose their direct or indirect interest in leases, licenses, permits, contracts, or claims that involve lands or resources administered by the BLM, or in any litigation related thereto.

14. **Subcommittees:** Subject to the DFO's approval, subcommittees may be formed for the purposes of compiling information or conducting research. However, such subcommittees must act only under the direction of the DFO and must report their recommendations to the Panel for consideration. Subcommittees must not provide advice or work products directly to the Agency. The Panel's Chair, with the approval of the DFO, will appoint subcommittee members. Subcommittees will meet as necessary to accomplish their assignments, subject to the approval of the DFO.
15. **Record keeping:** The Records of the Panel, formally and informally established subcommittees of the Panel, shall be handled in accordance with General Records Schedule 26, Item 2, or other approved Agency records disposition schedule. These records shall be available for public inspection and copying, subject to the Freedom of Information Act, 5 U.S.C. 552.



SECRETARY OF THE INTERIOR

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## Appendix 4: External Presentations to the Oversight Group and Science Technical Advisory Panel, Organizational Affiliation, and External Networks

### **Academic Institutions**

Buck Sharpton, University of Alaska Fairbanks, *North Slope Research*

Dan White, University of Alaska Fairbanks, Institute of Northern Engineering, *Experimental Program to Stimulate Competitive Research (EPSCoR)*

David Atkinson, University of Alaska Fairbanks, International Arctic Research Center, *Coastal Processes and Climate Change*

Doug Causy, University of Alaska Anchorage, *North Slope Research by UAA*

Hajo Eicken, University of Alaska Fairbanks, Geophysical Institute, *North By 2020 Initiative and Study of Arctic Environmental Change*

Johnson, Mark, Alaska Marine Information System

Rich Haut, Houston Advanced Research Center, *Ecosystem and Biodiversity Measurement and Assessment*

Robert Shuchman, Michigan Technological Research Institute, Michigan Technological University, *Automated Lagrangian Water Quality Assessment System (ALWAS) Measurements of North Slope Lakes*

Sergei Marchenko, University of Alaska Fairbanks, International Arctic Research Center, *Permafrost Issues in the Arctic*

Syndonia Bret-Harte, University of Alaska Fairbanks, Toolik Research Station, *Long-Term Ecological Research at Toolik Lake*

Tom Heinrichs, University of Alaska, Geographic Information Network of Alaska, *Project Tracking System/Data Catalog*

### **Industry**

Bill Streever, BP Alaska, Inc., *Environmental Studies*

Caryn Rea, ConocoPhillips Alaska, Inc., *Avian Studies in the Colville Delta and Northeastern Planning Area of NPR-A*

Caryn Rea, ConocoPhillips Alaska, Inc., *Mammal Research in the Colville River Delta and the Northeastern NPR-A*

Caryn Rea, ConocoPhillips Alaska, Inc., *Alpine Satellite Development Program: Environmental Studies Overview*

Caryn Rea, ConocoPhillips Alaska, Inc., *Integration of Traditional Knowledge and Western Science*

Diane Sanzone, BP Alaska, Inc., *Long-Term Ecological Program on Alaska's North Slope: Challenges, Progress and the Future*

Joanna Roth, ABR, Inc., *An Ecological Land Survey in the Northeastern NPR-A*

John Norman, Alaska Oil and Gas Conservation Commission, *Program Overview*

Lawrence Moulton, MJM Research, *Alpine Development Satellite Development Program: Fisheries Surveys*

Michael Baker, Jr., ConocoPhillips Alaska, Inc., *Colville River Delta Breakup Studies*

Michael Baker, Jr., ConocoPhillips Alaska, Inc., *Lake Monitoring and Recharge Studies*

Torre Jorgenson, ABR, Inc., *Geomorphology Studies in Northeastern NPR-A*

URS, Inc., Hydrologic/Hydraulic Assessment: *Fish Creek, Judy Creek and Ublutuoch River*

### **U.S. Department of Energy**

James Hamseth, Office of Fossil Energy, *Briefing on Key North Slope Projects*

### **International**

Jay Van Oostdam, Safe Environments Program, Health Canada, *Human Health Implications of Arctic Contaminants*

### **Organizations and Initiatives**

Alaska Oceans Observing System (AOOS) (<http://www.aos.org>)

Alaska Oil and Gas Association (AOGA) (<http://www.aoga.org>)

Arctic Monitoring and Assessment Programme (AMAP) (<http://www.amap.no>)

Arctic Observing Network (AON) (<http://www.nsf.gov/pubs/2008/nsf0842/index.jsp>)

Arctic Ocean Biodiversity (ArcOD) (<http://www.arcodiv.org>)

Arctic Portal (<http://www.igospartners.org>)

Arctic Research Consortium of the United States (ARCUS) (<http://www.arcus.org>)

Arctic Research Mapping Application (ARMAP) (<http://www.armac.org>)

Arctic Systems Science Program (ARCSS) (<http://www.arcus.org/arcss/>)

ArcticNet, Canadian Network of Excellence (<http://www.arcticnet.ulaval.ca>)

Barrow Arctic Science Consortium (BASC) (<http://www.arcticsscience.org>)

Barrow Area Information Database (BAID-IMS) (<http://www.baidims.org>)

Barrow Area Information Database Geospatial Data Sets (BAID) ([http://nsidc.org/data/docs/arcss/arcss400/access400\\_summary.html](http://nsidc.org/data/docs/arcss/arcss400/access400_summary.html))

Canadian Sea Ice Service (<http://www.ice.ec.gc.ca/app/WsvPageDsp.cfm?id=11872&Lang=eng>)

Circum-Arctic Environmental Observations Network (CEON) (<http://www.ceoninfo.org>)

Circumarctic Environmental Observatories Network (CEON) (<http://www.ceon.utep.edu>)

Circumpolar Active Layer Monitoring (CALM) (<http://www.udel.edu/Geography/calm>)

Conservation of Arctic Flora and Fauna (CAFF) ([http://arctic-council.org/working\\_group/caff](http://arctic-council.org/working_group/caff))

Forum of Arctic Research Operators (FARO) (<http://www.faro-arctic.org>)

Gateway to the United Nations Work on Climate Change (<http://www.un.org/climatechange/>)

Group on Earth Observations (GEO) (<http://earthobservations.org>)

Integrated Global Observing Strategy (IGOS) (<http://www.igospartners.org>)

Interagency Arctic Research Policy Committee (IARPC) (<http://www.nsf.gov/od/opp/arctic/iarpc/start.jsp>)

International Arctic Science Committee (IASC) (<http://www.arcticportal.org/iasc/>)

International Permafrost Association (IPA) (<http://ipa.arcticportal.org>)

International Polar Year (IPY) (<http://www.ipy.org>)

Marine Biological Laboratory (MBL), Woods Hole (<http://ecosystems.mbl.edu/>)

National Science Foundation, Office of Polar Programs (OPP) (<http://www.nsf.gov/dir/index.jsp?org=OPP>)

National Snow and Ice Data Center (NSIDC) ([www.nsidc.org](http://www.nsidc.org))

NOAA Arctic Science Laboratory (<http://asl.arctic.noaa.gov>)

North Pacific Research Board (NPRB) (<http://www.nprb.org>)

North Pole Environmental Observatory (<http://psc.apl.washington.edu/northpole/>)

SCANNET, Circumpolar Arctic Network of Terrestrial Field Bases (<http://www.scannet.nu>)

Study of Environmental Arctic Change (SEARCH) (<http://psc.apl.washington.edu/search/>)

Sustained Arctic Observing Network (SAON) (<http://www.arcticobserving.org>)

U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) (<http://www.crrel.usace.army.mil>)

United States Global Change Research Program (<http://www.globalchange.gov>)

Unmanned Aerial Systems (UAS) (<http://.uas.noaa.gov/testbeds/arctic/>)

## Appendix 5: Organizations and Initiatives Related to the Arctic

Alaska Center for Climate and Policy (ACCAP) (<http://www.uaf.edu/accap>)

Alaska Fisheries Science Center (NOAA, NMFS) (<http://www.afsc.noaa.gov/>)

Alaska Marine Ecosystem Forum (AMEF) ([http://www.fakr.noaa.gov/npfmc/current\\_issues/ecosystem/AMEF\\_MOU.pdf](http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/AMEF_MOU.pdf))

Alaska Oceans Observing System (AOOS) (<http://www.aos.org>)

Alaska Oil and Gas Association (AOGA) (<http://www.aoga.org>)

Alaska Sea Grant (<http://seagrant.uaf.edu>)

Arctic Council (<http://www.arctic-council.org>)

Arctic Contaminants Action Program (ACAP) ([http://arctic-council.org/working\\_group/acap](http://arctic-council.org/working_group/acap))

Arctic Monitoring and Assessment Programme (AMAP) ([http://arctic-council.org/working\\_group/amap](http://arctic-council.org/working_group/amap))

Arctic Observing Network (AON) (<http://www.nsf.gov/pubs/2008/nsf0842/index.jsp>)

Arctic Ocean Biodiversity (ArcOD) (<http://www.arcodiv.org>)

Arctic Policy Group (APG) ([http://arctic-council.org/member\\_state/united\\_states\\_of\\_america](http://arctic-council.org/member_state/united_states_of_america))

Arctic Portal (<http://www.igospartners.org/>)

Arctic Research Consortium of the United States (ARCUS) (<http://www.arcus.org>)

Arctic Research Mapping Application (ARMAP) (<http://www.armac.org>)

Arctic Systems Science Program (ARCSS) (<http://www.arcus.org/arcss/>)

ArcticNet, Canadian Network of Excellence (<http://www.arcticnet.ulaval.ca>)

Barrow Arctic Science Consortium (BASC) (<http://www.arcticscience.org>)

Barrow Area Information Database (BAID-IMS) (<http://www.baidims.org>)

Barrow Area Information Database Geospatial Data Sets (BAID) ([http://nsidc.org/data/docs/arcss/arcss400/access400\\_summary.html](http://nsidc.org/data/docs/arcss/arcss400/access400_summary.html))

Canadian Sea Ice Service (<http://www.ice.ec.gc.ca/app/WsvPageDsp.cfm?id=11872&Lang=eng>)

Circum-Polar Environmental Observatories Network (CEON) (<http://www.ceon.utep.edu>)

Circumpolar Active Layer Monitoring (CALM) (<http://www.udel.edu/Geography/calm>)

Climate Change Executive Roundtable ([http://alaska.fws.gov/climate\\_change.htm](http://alaska.fws.gov/climate_change.htm))

Conservation of Arctic Flora and Fauna (CAFF) ([http://arctic-council.org/working\\_group/caff](http://arctic-council.org/working_group/caff))

Emergency Prevention, Preparedness and Response (EPPR) ([http://arctic-council.org/working\\_group/eppr](http://arctic-council.org/working_group/eppr))

Forum of Arctic Research Operators (FARO) (<http://www.faro-arctic.org/>)

Gateway to the United Nations Work on Climate Change (<http://www.un.org/climatechange/>)

Group on Earth Observations (GEO) (<http://earthobservations.org/>)

Integrated Global Observing Strategy (IGOS) (<http://www.igospartners.org/>)

Interagency Arctic Research Policy Committee (IARPC) (<http://www.nsf.gov/od/opp/arctic/iarpc/start.jsp>)

Interagency Committee on Ocean Sciences and Resource Management Integration (ICOSRMI) (<http://ocean.ceq.gov/about/icosrmi.html>)

International Arctic Science Committee (IASC) (<http://www.arcticportal.org/iasc/>)

International Long-Term Ecological Research (ILTER) (<http://ilternet.edu>)

International Permafrost Association (IPA) (<http://ipa.arcticportal.org/>)

International Polar Year (IPY) (<http://www.ipy.org>)

Marine Biological Laboratory (MBL), Woods Hole (<http://ecosystems.mbl.edu/>)

National Science Foundation, Office of Polar Programs (OPP) (<http://www.nsf.gov/dir/index.jsp?org=OPP>)

National Security Presidential Directive/NSPD-66 and Homeland Security Presidential Directive/HSPD-25 (<http://www.fas.org/org/offdocs/nspd/nspd-66.htm>)

National Snow and Ice Data Center (NSIDC) (<http://www.nsidc.org>)

NOAA Arctic Science Laboratory (<http://asl.arctic.noaa.gov/>)

North Pacific Research Board (NPRB) ([www.nprb.org](http://www.nprb.org))

North Pole Environmental Observatory (<http://psc.apl.washington.edu/northpole/>)

Office of Polar Programs (OPP) (<http://www.nsf.gov/od/opp/about.jsp>)

Office of Science and Technology Policy (OSTP) (<http://www.ostp.gov>)

Polar Research Board (PRB) (<http://dels.nas.edu/prb>)

Prince William Sound Oil Spill Recovery Institute (OSRI) (<http://www.pws-osri.org>)

Protection of the Arctic Marine Environment (PAME) ([http://arctic-council.org/working\\_group/pame](http://arctic-council.org/working_group/pame))

SCANNET, Circumpolar Arctic Network of Terrestrial Field Bases (<http://www.scannet.nu>)

State of Alaska, Governor's Sub-Cabinet on Climate Change (<http://climatechange.alaska.gov>)

Study of Environmental Arctic Change (SEARCH) (<http://psc.apl.washington.edu/search/>)

Sustainable Development Working Group (SDWG) ([http://arctic-council.org/working\\_group/sdwc](http://arctic-council.org/working_group/sdwc))

Sustained Arctic Observing Network (SAON) (<http://www.arcticobserving.org>)

U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) (<http://www.crrel.usace.army.mil>)

United States Global Change Research Program (<http://www.globalchange.gov>)

Unmanned Aerial Systems (UAS) (<http://.uas.noaa.gov/testbeds/arctic/>)



