Science, Natural Resources, and Subsistence in Alaska's Arctic Lands and Waters

A Continuing Dialogue on Working Together to Understand our Changing Arctic

March 29-31, 2011
Barrow, Alaska

Lisanne Aerts, Bill Streever, and John Payne

Mayor Itta's Speech

I've been thinking about your dedication of this week's workshop to our elders. And that got me thinking about the role of elders in general as protectors of the Arctic environment. In some ways, they fulfill the same role as you scientists do. Their knowledge comes from repeated observations over a long period of time. These daily or weekly or annual observations amount to a database of knowledge that they carry in their heads. It is a record of Nature's behavior—its consistency and its changes over time.

Think of it in terms of my father, whose name was Esauganna Pualu in our language, and in English it was Noah. He was born in a camp on the eastern side of Teshekpuk Lake. He grew up in a family that followed the migrations of marine mammals and land-based animals of all kinds...

Read more in Appendix B

Credits

Workshop Co-Chairs

Wendy Loya, Robert Suydam, and Bill Streever, all members of the NSSI Science Technical Advisory Panel, co-chaired the workshop.

Workshop and Report Coordination

Various members of the NSSI Oversight Group, Senior Staff, and Science Technical Advisory Panel, together with the North Slope Borough and OASIS Environmental, Inc., coordinated workshop planning and implementation (in no specific order): Todd Sformo, Robert Suydam, Dave Yokel, Tim Viavant, Gary Schultz, Dee Williams, Brian Person, Ben Greene, Robyn Angliss, John Kelley, Doug Kane, Sue Moore, Gary Kofinas, Al Ott, Caryn Rea, Bob Shuchman, Matthew Sturm, Scott Pegau, Wendy Loya, Dan Reed, Jerry Brown, Lisanne Aerts, Greg Balogh, Liza Jenkins, Philip Martin, Tatyana Venegas Swanson, Bill Streever, John Payne, Amy Holman, Brent Sheets, Douglas Vincent-Lang, Geoff Haskett, John Goll, Jon Kurland, Karla Kolash, LaVerne Smith, Leslie Holland-Bartels, Richard Glenn, Robert Winfree, Sue Masica, David Fauske, Jason Bergerson, Ed Fogels, and Cheryl Rosa.

Workshop Speakers and Panel Facilitators

Workshop sessions were facilitated by Amy Holman, Wendy Loya, Robyn Angliss, Robert Suydam, Dan Reed, and Scott Pegau. Speakers and panelists included Mayor Edward Itta, Karla Kolash, John Payne, Craig George, C. Eugene Brower, Gordon Brower, Hajo Eicken, Richard Prentki, Carl Uchytil, Jana Harcharek, Torre Jorgenson, Dave Yokel, James Nageak, Lincoln Parrett, Taqulik Hepa, Brian Person, Brian Lawhead, Fenton Rexford, Henry Huntington, Robert Suydam, John Kelley, Jacob Adams, Rossman Peetook, Glenn Sheehan, Richard Glenn, Gary Kofinas, and Greg Balogh.

Workshop Sponsors

The North Slope Science Initiative (NSSI), the North Slope Borough (NSB), Alaska Slope Regional Corporation, BP, and ConocoPhillips provided funding to support the workshop.

Report Reviewers

Wendy Loya, Caryn Rea, Todd Sformo, Glenn Sheehan, Bob Shuchman, Jess Grunblatt, Tatyana Venegas-Swanson, and Jerry Brown reviewed this report and provided valuable comments.

Summary

It took many months of collaboration for the North Slope Science Initiative, including its Science Technical Advisory Panel and Senior Staff Committee, to organize this workshop. Logistical issues of holding such a gathering on the North Slope seemed overwhelming at times. Finding lodging, an appropriate venue, food services, and transportation for over 130 participants at a workshop in Barrow presented real challenges. Identifying speakers, panelists, and participants best suited to the workshop's objectives also proved challenging. The workshop would not have been possible without the help of the many people who participated in planning and organization. We want to sincerely thank everyone who contributed to making this an event to remember.

The workshop was dedicated to two North Slope elders, Arnold Brower, Senior (1922-2008) and Warren Matumeak (1927-2010). Both elders were highly respected on the North Slope and served by appointment of the Secretary of the Interior to the North Slope Science Initiatives' Science Technical Advisory Panel. Their knowledge of the North Slope, based on both personal experience and traditional information passed between generations of Inupiat hunters, has been a tremendous asset to the North Slope Science Initiative and influenced the direction of this workshop.

The workshop brought together North Slope community members, scientists, regulators, and resource managers in a way that facilitated discussion of environmental and development changes on the North Slope and its offshore environments. Of the more than 130 workshop participants, there were about an equal number of local residents, scientists, and resource managers or regulators.

The workshop was built around two key questions, with the first question divided into four broad topics:

1. How can scientists contribute to detecting, documenting, and understanding environmental changes that are relevant to local people, regulators, and resource managers? The primary sessions were designed around four broad topics:
    - Changes in sea ice and oceans
    - Changes in vegetation and landscapes
    - Importance of terrestrial subsistence resources to residents of the North Slope and how the availability of these resources may be changing
    - Importance of marine subsistence resources to residents of the North Slope and how the availability of these resources may be changing
2. How can the science community more effectively involve local people, regulators, and resource managers in helping generate relevant hypotheses for scientific research, participating in field studies and helping to understand results?

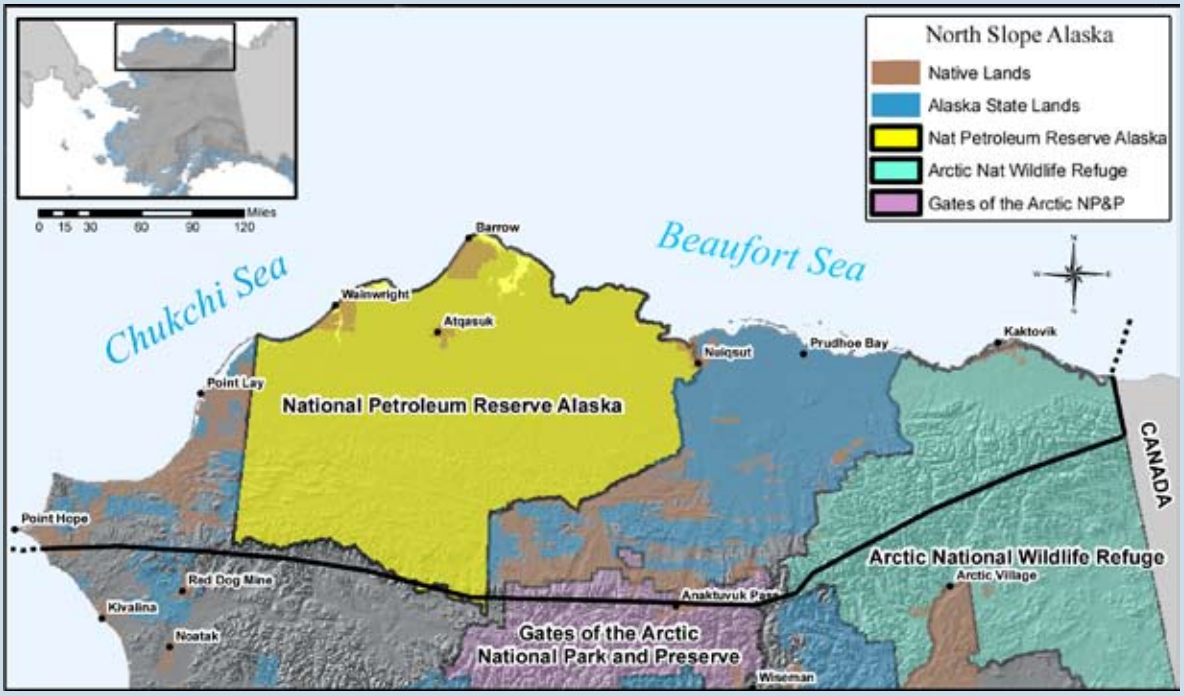
These questions were addressed through a combination of formal presentations, panel discussions, and a facilitated dialogue with all participants. By their nature, these questions did not lead to definitive answers, but instead promoted an ongoing dialogue. Aspects of this dialogue were translated into suggested or potential action items.

Summary (Continued)

In addition to presentations, panel discussions, and facilitated dialogue, more than 50 science posters shared information on specific research projects or initiatives, covering a wide breadth of science activities on the North Slope. At the end of the workshop, the majority of the posters were provided to the Barrow Arctic Science Consortium (BASC) for local school students, scientists, and others who may not have attended the workshop.

This report is divided into four sections: Part I: Environmental changes and concerns for Arctic Alaska; Part II: Working together; Part III: Action items; and Part IV: Lessons learned from the workshop. Parts I and II rely heavily on tables that attempt to summarize workshop discussions. These tables reflect the diversity of viewpoints presented at the workshop, and may not convey an entirely consistent and coherent message. They include scientific findings, traditional knowledge from North Slope residents, and other information, provide insights that may be useful to the North Slope Science Initiative and similar organizations in the future. Part III highlights a few action items that appeared repeatedly or were otherwise emphasized and that could be addressed by NSSI or another organization. Part IV offers insights that might be useful during the planning of future workshops.

Figure 1: *North Slope Land Status. (Information on this map should be used for graphic display only). Provided by BLM.*



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Introduction

This three-day workshop brought together North Slope community members, scientists, regulators, and resource managers to advance ongoing discussions about issues of common interest and concern, and to share information about North Slope environmental science. The intent of this workshop was to provide a forum for information sharing and identification of issues of common interest and concern, with more detailed discussions to be addressed in follow-up workshops where applicable. Plenary talks and panel presentations by local people, scientists, and government representatives set the context for key workshop issues. Facilitated discussions allowed participants to share their experiences and work together to identify opportunities and constraints impacting research. Local excursions helped promote information sharing and informal dialogue, fostering relationships between residents, scientists, regulators, and resource managers.

These facilitated discussions allowed over 130 workshop participants to share their experiences and to identify opportunities and constraints impacting research and collaboration. In addition to the opportunity for participants to interact with panel members, the workshop offered more than 50 science posters, sharing information on specific research projects and initiatives, demonstrating the quantity and breadth of research on the North Slope. This report summarizes workshop discussions and, where possible, translates these discussions into recommendations or action items.

Workshop Objectives

The workshop was built around two key questions relevant to all participants:

1. How can scientists contribute to detecting, documenting, and understanding environmental changes that are relevant to local people, regulators, and resource managers? The primary sessions were designed around four broad topics:
    - Changes in sea ice and oceans
    - Changes in vegetation and landscapes
    - Importance of terrestrial subsistence resources to residents of the North Slope and how the availability of these resources may be changing
    - Importance of marine subsistence resources to residents of the North Slope and how the availability of these resources may be changing
2. How can the science community more effectively involve local people, regulators, and resource managers in helping generate relevant hypotheses for scientific research, participating in field studies and helping to understand results?

Report Structure

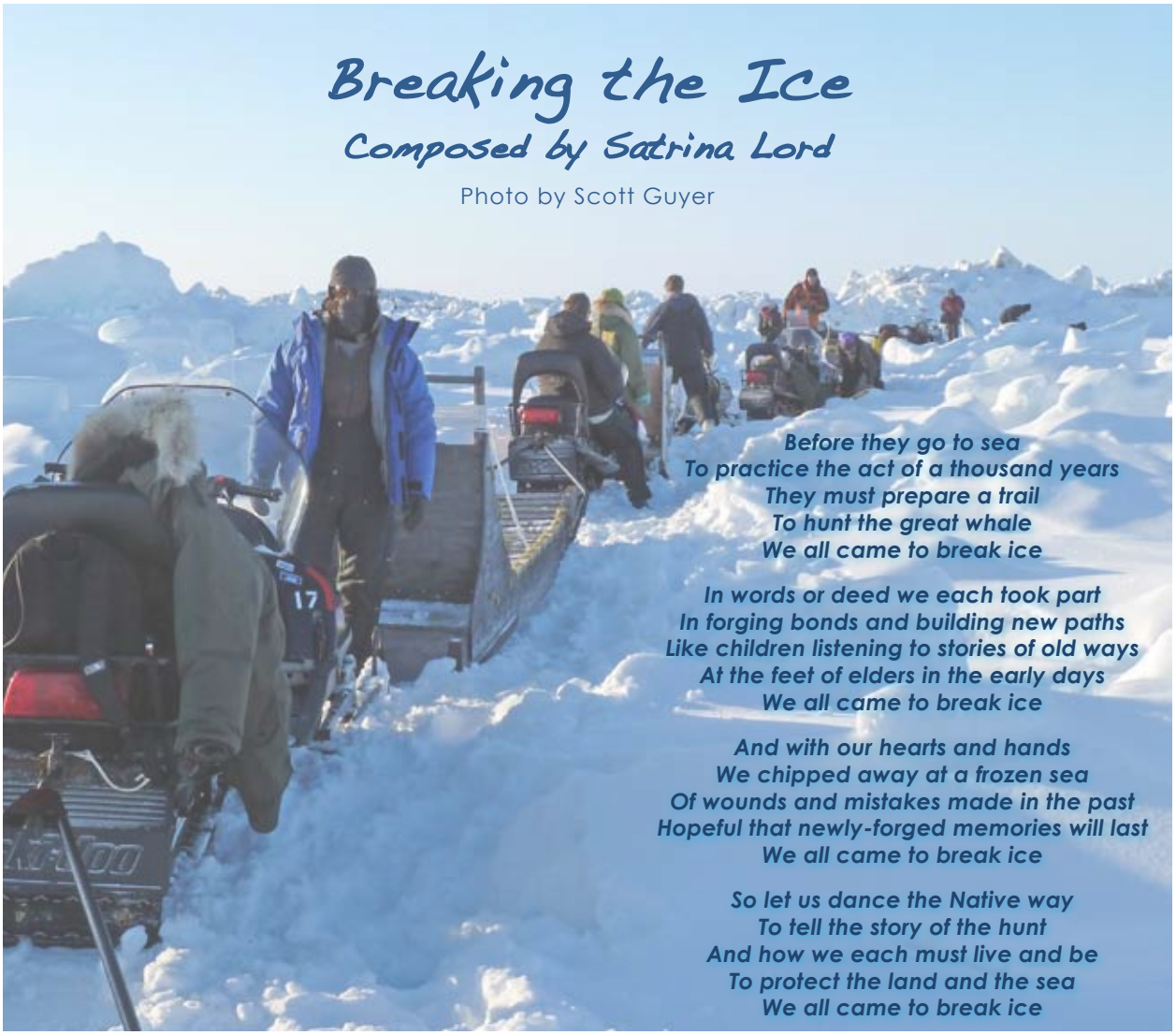
This report is presented in four parts plus appendices. Part I summarizes key changes and concerns identified by plenary speakers, panel members, and workshop participants related to Question 1. Part II focuses on Question 2, addressing ways in which local people, regulators, and resource managers can work more effectively with scientists. Part III highlights a few action items that appeared repeatedly or were otherwise emphasized and that could be addressed by NSSI or another organization. Part IV offers insights that might be useful during the planning of future workshops. Appendices to this report include the workshop agenda, banquet speech delivered by Mayor Itta, and a list of workshop participants.

A Word about the Summary Tables in this Report

The interactive workshop format provided an unusual opportunity for both panelists and participants to offer conclusions, present issues or concerns, offer solutions or recommendations to address those issues or concerns, and tell all attendees about their personal observations of changes on the North Slope and in its offshore environment. The tables presented in this report should be thought of as workshop notes, and as such they will reflect the diversity of viewpoints presented at the workshop and may not convey an entirely consistent and coherent message. Nevertheless, these summary tables provide insights that may be useful to the North Slope Science Initiative and other organizations in the future. They include scientific findings, traditional knowledge from North Slope residents, and other information.

Workshop Dedication and Tribute

This workshop was dedicated to two North Slope elders: Arnold Brower, Senior (1922 – 2008), and Warren Matumeak (1927 – 2010). (See back cover)



PART 1: Environmental Changes and Concerns for Arctic Alaska

Panel members and workshop participants were asked to share experiences, observations, science, and concerns related to the four topics that comprised Question 1:

> **How can scientists contribute to detecting, documenting, and understanding environmental changes that are relevant to local people, regulators, and resource managers? The primary sessions were designed around four broad topics:**
>
> - **Changes in sea ice and oceans**
> - **Changes in vegetation and landscapes**
> - **Importance of terrestrial subsistence resources to residents of the North Slope and how the availability of these resources may be changing**
> - **Importance of marine subsistence resources to residents of the North Slope and how the availability of these resources may be changing**

Panel members presented their views on the current situation, along with suggestions that might improve coordination and cooperation, ultimately advancing knowledge and addressing concerns related to each of these four topics. Some points were brought up repeatedly and identified by all participants as key findings. Short narrative summaries and tables were developed for each of the four broad topics, i.e., changes in sea ice and oceans, changes in vegetation and landscape, terrestrial subsistence resources, and marine subsistence resources.

Panel 1: Sea Ice and Oceans

Facilitator: Amy Holman

Panel: Hajo Eicken (scientist), Gordon Brower (local resident), Richard Prentki and Carl Uchytil (government representatives).

Photo by NSSI.

The Bering, Chukchi, and Beaufort Seas, as well as the greater Arctic Ocean sea-ice, are important supporters and providers of life to the indigenous people whose subsistence, culture, and lifestyle depend on natural resources. For those who live in the Arctic regions and depend on the harvest of natural resources, climate change has had, and continues to have, serious consequences for their personal safety and sustainable food supply. While the scientific community studies climate change and tries to determine whether the observed changes are part of a long-term global warming trend, many of the indigenous peoples of the Arctic are already feeling some of the impacts of a changing climate. It is important to understand that from the perspective of many indigenous peoples who live in the Arctic region, even small changes in the climate or environment can have dramatic impacts on their lives. Their livelihoods are directly dependent upon and tied to natural resources and the healthy functioning of Arctic ecosystems.

Figure 2: *Sea ice near Barrow in the Chukchi Sea, March 2011. Photo by BLM/Scott Guyer.*

According to a recently released report by the Arctic Council's Arctic Monitoring and Assessment Program, Arctic sea ice decline has been more extensive during the past ten years than in the previous 20 years. New observations reveal that average sea ice thickness and overall sea ice cover are decreasing. This means historically inaccessible areas of the Arctic are becoming more accessible to shipping passage and potentially opening new areas for oil and gas exploration and development. In contrast, for local residents using the ice as a platform for travel and hunting, the sea ice decline makes access more challenging.

To adapt to rapid sea ice changes, local hunters need to rely increasingly on scientific information in addition to their own knowledge. The abbreviated time window for ice-based hunting activities also affects social life. Shorter hunting periods reduce the bonding time between family members and limit opportunities for transmission of traditional knowledge.

There is uncertainty about how climate change, proposed offshore oil and gas development, and potential future commercial tourism, shipping, and fishing will cumulatively impact the Arctic ecosystem and the availability of subsistence resources. Potential cumulative effects of these activities must be addressed. Rapid changes in sea ice regime make it difficult for managers to predict how proposed activities will likely be affected. For example, current oil spill trajectory modeling relies heavily on information from the past. With the rapidly changing conditions, the reliability of models is now more uncertain.

All of this means local residents, scientists, and resource managers must work together to collaboratively share scientific and observational knowledge that will improve the collective understanding of changing conditions and promote adaptation to these changing conditions. Table 1 outlines points discussed during the workshop that could open doors to a broader understanding of sea ice and ocean change.

Table 1. Key issues and recommendations from the workshop's "Changes in sea ice and oceans" session. This table summarizes session notes, and its content reflects the diversity of viewpoints presented at the workshop. Some of the "Possible Solutions or Recommendations" that applied to more than one "Key Statement" are repeated in the table.

Key Statement from Panel or Participant	Possible Solutions or Recommendations
The most obvious changes in sea ice conditions observed over the past years by scientists and local residents are a reduction in sea ice extent, season, thickness, and age.	Build an ice observatory driven by user demands and science interests. Get guidance from ice users on what needs to be observed, and use hardware and advanced tools to bring different perspectives to the table.
Over the past 10 years, the extent of summer sea ice in the Arctic oceans has reduced by about one-fifth. Winter sea ice cover remained largely the same, while the ice season has become much shorter due to earlier melt and later freeze-up.	Observation, no solutions or recommendations were discussed.
Sea ice thickness has dramatically decreased for both summer and winter ice, and the presence of multi-year ice has become sparser.	Observation, no solutions or recommendations were discussed.
Due to changes in thickness, area, and presence of sea and freshwater ice, the time window and locations available for hunting activities are shifting.	Rapidly changing environmental conditions increase the importance of cooperation and continuing dialogue between subsistence users, researchers, and managers. Implement a community-based monitoring approach to provide opportunities for local residents to input their observations. Note that a cooperative sea-ice observing network between Iñupiaq, Yupik, and UAF sea-ice experts has been developed and has been used for several years.
Changing sea ice means the ice platforms used for hauling out large whales are increasingly more difficult to find.	Observation, no solutions or recommendations were discussed.
There is currently little coordination of science between researchers, possibly leading to unwanted duplication of effort.	Develop and maintain a "project tracking" system that is accessible to everyone, including local communities. Note that a tracking system is currently in place through NSSI, but it may not be well known within the scientific and local communities.
Develop a monitoring plan that allows local residents to provide early input to sampling design and to assist in the interpretation of results. Include aspects of monitoring that are important to local residents.	Implement a community-based monitoring approach to provide opportunities for local residents to input their observations. Note that a cooperative sea ice observing network between Iñupiaq, Yupik, and UAF sea ice experts has been developed and has been used for several years. Collaborate with agencies, industry, and scientists to better monitor resource decisions.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
Coordination between academic researchers, resource managers, industry, and local residents is important to minimize potential conflicts when researchers or resource managers visit villages or subsistence hunting grounds. This is especially important when public meetings are scheduled in villages.	Develop a community calendar that would allow visitors to the North Slope to coordinate meetings and site visits in a manner that minimizes potential conflicts.
Just collecting information is not enough; the local people need to be informed of the results.	Develop a community calendar that would allow visitors to the North Slope to coordinate meetings to bring better local representation into meetings describing research results. Science results should be communicated in plain language to stakeholder groups, including local communities, managers, and regulators. Make it easier for researchers to return to the communities and report results in person to local residents, schools, and concerned groups. Consider appointing a science officer based in Barrow tasked with facilitating communication between local people, scientists, and managers. This appointment could be managed jointly through the NSSI, SeaGrant, the University of Alaska's extension service, and the North Slope Borough.
Too many researchers could be disturbing animal life that local residents depend upon.	Develop a community calendar that would allow North Slope researchers to more effectively coordinate their research activities in a manner that minimizes potential impacts on animals. Consider implementing real time tracking of research projects across the North Slope.
The NSSI is not well understood on the North Slope.	The NSSI should improve outreach efforts on the North Slope to explain the organization's mission and their initiatives to improve the coordination of science on the North Slope.
Meeting "overload" is an issue for North Slope communities in that it reduces participation by local residents and often disrupts hunting and other village activities.	To help prevent information overload, the science and regulatory communities need to work together to provide up-to-date information to the communities. Develop a community calendar that would allow visitors to the North Slope to coordinate meetings to bring better local representation.
Rapid changes in ice conditions increase importance of local resident involvement in research and management discussions so that the pace of change in traditional knowledge can keep pace with changing ice conditions.	School children are the best avenue for transmitting knowledge from elders to the new generations and the NSSI should consider helping facilitate such exchange. Encourage scientists to engage in two-way information sharing with school children and elders.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
Development seems to occur in patches so it is difficult to predict how this will impact the North Slope ecosystem in 20-50 years.	Undertake scenario mapping to better understand the future of the North Slope. Use the principles of risk assessment in the decision-making process to help identify future scientific needs and make better management decisions. Comprehensive maps that include subsistence camps and subsistence areas should be created, regularly updated, and made available to managers and researchers. Engage the private sector.
Studies are not currently focused so the resulting science can have immediate and effective applicability for managers, local residents, and others.	Scientists should strive for direct involvement with North Slope communities by designing studies that employ local people and developing long-term relationships with residents to build trust. Scientists should focus on issues relevant to managers, local residents, and others. A network of experts (community of practice) should be built around key issues; this network should consist of users and scientists who share a passion for sea ice. An effort should be made to better interface between different cultures.

Panel 2: Vegetation and Landscape

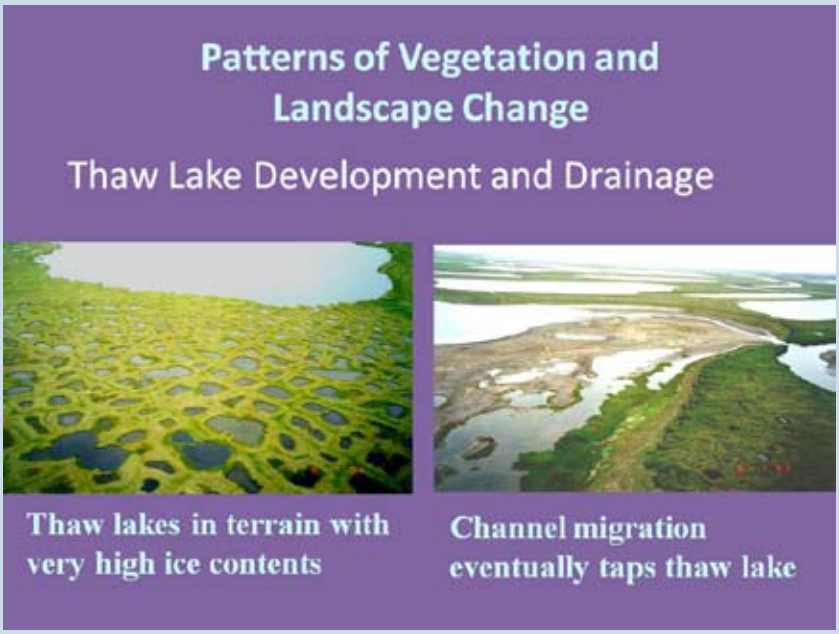
Facilitator: Dan Reed

Panel: Torre Jorgenson (scientist), Jana Harcharek (local resident), and Dave Yokel (government representative).

Photo by NSSI.

Landscape and vegetation features are assessed through ecological classification, mapping, field observations, historical landscape change and paleo-ecological analyses, remote sensing, and modeling. Currently, ground-based ecological classification maps exist for much of the North Slope and can be useful. For example, the Circumpolar Arctic Vegetation Map (CAVM) developed by the Arctic Council working group, Conservation of Arctic Flora and Fauna, shows that Alaskan tundra supports more tussock habitat than most other parts of the Arctic. However, currently available maps are generally of a spatial and temporal scale not useful for determining meaningful trends in vegetation change across the North Slope.

Figure 3: *Day 1 presentation by Torre Jorgenson (Alaska Ecoscience) covered vegetation change across the North Slope. Studies are being conducted to determine if natural changes are occurring with increasing frequency.*



Like other places in the Arctic, vegetation changes have been observed in northern Alaska over the past several years. These changes may be driven by various factors, such as increased air temperatures, hydrologic changes, permafrost degradation, lake drainage, floodplain dynamics, plant migration, fire, coastal erosion, flooding, and human development. Table 2 outlines points discussed during the workshop that could open doors to a broader understanding of landscape and vegetation change.

Table 2. Key issues and recommendations from the workshop's "Changes in vegetation and landscape" session. This table summarizes session notes, and its content reflects the diversity of viewpoints presented at the workshop. Some of the "Possible Solutions or Recommendations" that applied to more than one "Key Statement" are repeated in the table.

Key Statement from Panel or Participant	Possible Solutions or Recommendations
Vegetation is changing, possibly due to more favorable growing conditions on the North Slope.	Long-term studies are needed to determine vegetation trends. Completion of NSSI land cover project will help provide a landscape-level base for the current vegetation and provide the same base for future landscape change (although the scale and resolution will not be adequate to address all research questions and conservation concerns). Monitoring programs are needed to understand and recognize trends in landscape and vegetation change and to predict future changes. The information needs to feed into management decisions in order to maintain suitable wildlife habitat and to understand and minimize impact from industrial activities. A need for community-based monitoring exists because it facilitates communication of results and the continuation of dialogue between scientists and local residents.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
Some plant species on the North Slope are very sensitive to ground disturbance.	Minimizing ground disturbing activities such as tundra travel could help maintain sensitive plant species, while an increase in on-the-ground surveys could help detect and document the presence of sensitive plant species.
Increasing evaporation could increase lake drying.	Completion of NSSI land cover project will help provide a landscape-level base for the current vegetation and provide the same base for future landscape change (although the scale and resolution will not be adequate to address all research questions and conservation concerns).
North Slope residents are aware that the use of snow machines and all-terrain vehicles as transport to and from their subsistence sites damages the tundra.	Open discussions about this issue and share ideas about ways to minimize the footprint of snow machines and all-terrain vehicles.
Invasive or non-native plant species could become more common on the North Slope due to more favorable growing conditions.	Develop a monitoring program to survey for non-Native species. Completion of NSSI land cover project will help provide a landscape-level base for the current vegetation and provide the same base for future landscape change (although the scale and resolution will not be adequate to address all research questions and conservation concerns). Monitoring programs are needed to understand and recognize trends in landscape and vegetation change and to predict future changes. The information has to feed into management decisions in order to maintain suitable habitat for wildlife, and to understand and minimize impact from industrial activities. A need for community-based monitoring exists because it facilitates communication of results and the continuation of dialogue between scientists and local residents.
Increased coastal erosion caused by a shorter ice-covered season could lead to a loss of land available for both humans and animals.	Completion of NSSI land cover project will help provide a landscape-level base for the current vegetation and provide the same base for future landscape change (although the scale and resolution will not be adequate to address all research questions and conservation concerns). Monitoring programs are needed to understand and recognize trends in landscape and vegetation change and to predict future changes. The information has to feed into management decisions in order to maintain suitable habitat for wildlife, and to understand and minimize impact from industrial activities. A need for community-based monitoring exists because it facilitates communication of results and the continuation of dialogue between scientists and local residents.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
Seeing more changes in vegetation caused by salt water intrusion.	Long-term studies are needed to determine vegetation trends. Completion of NSSI land cover project will help provide a landscape-level base for the current vegetation and provide the same base for future landscape change (although the scale and resolution will not be adequate to address all research questions and conservation concerns). Monitoring programs are needed to understand and recognize trends in landscape and vegetation change and to predict future changes. The information has to feed into management decisions in order to maintain suitable habitat for wildlife, and to understand and minimize impact from industrial activities. A need for community-based monitoring exists because it facilitates communication of results and the continuation of dialogue between scientists and local residents.
Vegetation changes could become more frequent due to the increase of wildfire in the tundra.	Long-term studies are needed to determine vegetation trends. Completion of NSSI land cover project will help provide a landscape-level base for the current vegetation and provide the same base for future landscape change (although the scale and resolution will not be adequate to address all research questions and conservation concerns). Monitoring programs are needed to understand and recognize trends in landscape and vegetation change and to predict future changes. The information has to feed into management decisions in order to maintain suitable habitat for wildlife, and to understand and minimize impact from industrial activities. A need for community-based monitoring exists because it facilitates communication of results and the continuation of dialogue between scientists and local residents.

Panel 3: Terrestrial Subsistence Resources

Facilitator: Wendy Loya

Panel: Brian Lawhead (scientist), Brian Person (government representative), and Taqulik Hepa (local resident).

Photo by NSSI.

Changes to Arctic ecosystems directly affect supplies of water and fish; the availability of traditional food sources; and grazing animals. For the residents of the North Slope, caribou for food and other traditional uses is one of the most important terrestrial resources. Four caribou herds utilize the North Slope: Teshekpuk, Porcupine, Central Arctic, and Western Arctic. In general, over the past four decades all of these herds have either been increasing in numbers or have remained stable. It is anticipated that changes resulting from a warmer climate will have an impact on all of these herds as species of vegetation currently used by caribou shift. Potential decreases in desirable forage for caribou could result from changes in the drainage of wetlands, changes in fire regimes leading to a reduction in lichen cover, and increasing rain-on-snow events leading to both changes in vegetation composition and availability to grazers. Also, small changes in climate could lead to insect emergence during calving season, which could be harmful to young animals. Cumulatively, these events could lead to severe declines in caribou populations to a point at which subsistence needs may not be met. Table 3 outlines points discussed during the workshop relevant to terrestrial subsistence resources.

Table 3. Key issues and recommendations from the workshop's "Terrestrial Subsistence Resources" session. This table summarizes session notes, and its content reflects the diversity of viewpoints presented at the workshop. Some of the "Possible Solutions or Recommendations" that applied to more than one "Key Statement" are repeated in the table.

Key Statement from Panel or Participant	Possible Solutions or Recommendations
Specific monitoring tools used in caribou research (aerial surveys and radio collars) have been very successful in studying animals that cover such large areas.	Monitoring using aerial surveys and radio collars should be continued.
Reliable minimum population estimates for caribou can be obtained through photo census techniques.	Monitoring using aerial survey photo census techniques should be continued.
Small-scale distribution changes, such as deflection and diversion, and the associated impact on caribou populations, are difficult to address.	Observation, no solutions or recommendations were discussed.
Population demography data, such as birth, death, and recruitment rates, are being collected to detect and predict current and future changes in caribou population size.	Because information on age structure and body condition is lacking, difficulties in interpreting demography data should be recognized.

Key Statement from Panel or Participant	Possible Solutions or Recommendations
Mechanisms behind changes in variables such as mortality are poorly understood.	Large datasets of meaningful covariates (e.g., snow data, vegetation maps) are needed to be able to determine driving mechanisms behind vital rates and other variables, such as range size.
Snow geese populations are growing fast, which leads to concerns regarding the impact of snow geese grazing on vegetation relevant to caribou.	Coordinated monitoring efforts to study caribou, other wildlife, and habitat should be continued and should incorporate such local concerns. Scientists should share their observations with local communities.
Local residents are often unaware of science or exploration activities, especially when those activities are close to their traditional hunting grounds.	Engage local residents where possible. Local hunters can help develop research hypothesis with their knowledge of the animals and environment. Organize issue specific workshops, perhaps in the North Slope communities, to combine their knowledge with the current science to better understand the changes. Consider implementing real time tracking of research projects across the North Slope.
Due to increased rainfall it is becoming more difficult to dry caribou and fish before it spoils.	Observation, no solutions or recommendations were discussed.
Thawing permafrost prevents ice cellars from functioning properly, resulting in rotting food. This will likely become a bigger problem in the future.	Observation, no solutions or recommendations were discussed.
The number of sightings of brown bears breaking into cabins is increasing. Although it is unclear exactly why this is occurring, it is believed that these bears may have grown accustomed to feeding on garbage in areas with oil and gas developments.	Observation, no solutions or recommendations were discussed.
There are a lot of aircraft, especially helicopters, that fly across the North Slope, especially during the summer months. Sometimes these aircraft disrupt caribou that the local residents need for their food.	Develop stricter flight plans for small aircraft and monitor compliance with these plans. NSSI could help with this by developing an aircraft use register on their website. Consider options such as requiring contracted helicopters and airplanes to be trackable in near real time on publically available websites.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
In some cases, caribou harvest data are not complete.	Establish collaborative support, coordinated by the North Slope Science Initiative, or another organization, of community-based monitoring of subsistence harvests (for example, the CARMA network). Collect information on health and disease, such as body condition indices and measurements, tissue samples for health and disease status, and contamination levels. Collect harvest numbers and locations (using GPS mapping) on an annual basis. A recently released report by Stephen Braund & Associates on subsistence harvests contains useful examples of maps displaying areas of various subsistence use intensity per season and per species.
Questions about caribou management plans continue to arise.	Monitor the effectiveness of management plans and implement an adaptive management approach that allows plans to change in response to population status and distribution of subsistence resources. Strive for a more user-friendly management system. Existing management systems are very complicated, making compliance difficult. For effective cooperation and species management it is important to understand the traditional values of the North Slope residents. Sometimes these values conflict with requests for help or advice. For example: • The North Slope Borough was asked to help develop guidelines for blackout dates for the migratory bird hunt. According to traditional hunting values, fixed hunting dates do not exist. Instead, observations of other wildlife or other environmental factors govern when hunts can start or stop and these are variable. • In the 1990s the North Slope Borough started a process to submit a proposal to let the first caribou herd pass undisturbed so others would follow. This proposal was rejected several times and accepted only after continued communications. (Anaktuvuk Pass)

Panel 4: Marine Subsistence Resources

Facilitator: Robyn Angliss

Panel: Fenton Rexford (local resident), Henry Huntington (scientist), and Robert Suydam (government representative).

Photo by NSSI.

Physical changes in the marine system have the capability to dramatically affect marine species. Marine mammals that depend upon sea ice, such as walrus, polar bears, and ice seals, use ice as a platform for resting, breeding, and rearing young. While sea ice is a dynamic environment, seasonal patterns are taken into account during traditional marine subsistence harvest. More recently, hunters have encountered changes in the direction and intensity of wind, sea-ice distribution, and sea-ice formation that have not been observed nor encountered in the past. Winds are reported to be stronger now compared with the recent past, and there are fewer calm days. For hunters out in small boats, even a 10- to 12-mph wind creates waves of sufficient size to swamp boats. Winds also affect the distribution of sea ice. Early season strong winds can move sea ice northward, putting the marine mammals on the retreating ice out of range of hunters. Winds can also pack sea ice so tightly against shorelines that communities expend significant time and energy blazing trails through the ice ridges to access hunting sites. These changes are not predictable, which affects both hunting opportunity and safety.

The loss of large areas of sea ice represents devastating habitat loss for some ice-adapted species. Many animals, including bowhead whales, depend on organisms that thrive near the sea ice. This food source is changing as the ice edge recedes. Even as these changes affect the marine environment, it is not always clear how they will impact current marine subsistence uses. Table 4 outlines points discussed during the workshop relevant to marine subsistence use.

Table 4. Key issues and recommendations from the workshop's "Marine Subsistence Resources" session. This table summarizes session notes, and its content reflects the diversity of viewpoints presented at the workshop. Some of the "Possible Solutions or Recommendations" that applied to more than one "Key Statement" are repeated in the table.

Key Statement from Panel or Participant	Possible Solutions or Recommendations
Increasingly, numbers of walrus are using on-shore haul outs during the summer months.	Monitoring programs are needed or should be continued to understand and recognize trends in marine mammal populations and to predict future changes.
Recent sightings of fin and humpback whales are being reported in the Arctic.	Monitoring programs are needed to understand and recognize trends in marine mammal populations and to predict future changes.
Invasive species may be increasing, and there is a need to understand how they impact native marine species.	Observation, no solutions or recommendations were discussed.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
In order to understand trends in marine populations, there is a need to continue and expand monitoring efforts.	The North Slope Borough, Department of Wildlife, has a long-term dataset tracking changes in the bowhead whale population that can serve as a model for efforts to monitor other species. A breakthrough in methodology is needed for more accurate population assessments of seals and walrus. Focused monitoring of key life history traits and health parameters is needed to better understand the mechanisms behind observations in population changes of seals and walrus (for example, growth rate, age at maturity, blubber thickness, disease, calf mortality).
Ice seals are doing well despite the decrease of sea ice, but the status of walrus is less clear.	Long-term, large scale efforts to better understand the status of walrus and other species should be initiated or continued.
There is a need for more current information, using both western science and traditional knowledge, to understand how environmental conditions, including the increase in human activities, affect the availability and accessibility of marine subsistence resources.	Monitoring programs are needed to understand and recognize trends in marine mammal populations and to predict future changes. A need for community-based monitoring exists because it facilitates communication of results and the continuation of dialogue between scientists and local residents. A breakthrough in methodology is needed for more accurate population assessments of seals and walrus.
Polar bears may be increasing their presence on land with diminishing sea ice.	Monitoring programs are needed to understand and recognize trends in marine mammal populations and to predict future changes. Agencies should continue collaboration with local governments and communities to address concerns related to increased presence of polar bears on land.
Fish communities are changing with increased frequency of species new to the Arctic, but how these are changing and what impacts they will have in the future on the availability of subsistence resources is not understood.	Monitoring programs that are in place should be continued and additional monitoring programs are needed to understand and recognize trends in fish populations and to predict future changes.
Flexibility is needed in management decisions regarding subsistence species.	A good example is the Marine Mammal Protection Act; it imposes no regulations for the subsistence harvest, and therefore hunters are allowed to adjust those hunting conditions according to what is happening in their environment.

PART II: Working Together

Facilitator: Scott Pegau

Communications Panel: Richard Glenn (local resident), Greg Balogh (government representative), and Gary Kofinas (scientist).

Photo by NSSI.

A broadly shared understanding of the environmental changes occurring in the Arctic and the scope of expected changes is important in determining what actions can be taken. On the North Slope, residents, scientists, and managers need to share their knowledge. It is important to understand how each group has acquired their knowledge and how they interpret that knowledge. Through a shared understanding of what is occurring in the Arctic, managers can better develop strategies that are responsive to the needs of residents and scientists.

Incorporating and understanding the knowledge and perspectives of North Slope residents is a starting point for working together on research and monitoring projects or developing management strategies for the future. However, it is essential that the use of observational science and knowledge by the people of the North Slope is not limited to the start of an effort. It should continue throughout the research and monitoring process, including interpretation of results. This approach has benefits to the scientists, local residents, and decision makers since it brings about a more thorough understanding of the science by all involved. Table 5 summarizes notes regarding increased local involvement with science.

Table 5. Increasing local involvement with research and monitoring. This table summarizes session notes, and its content reflects the diversity of viewpoints presented at the workshop. Some of the "Possible Solutions or Recommendations" that applied to more than one "Key Statement" are repeated in the table.

Key Statement from Panel or Participant	Possible Solutions or Recommendations
Local North Slope scientists are scarce, even though research has been conducted here for decades. Everyone needs to focus on encouraging North Slope scientists, starting with the children from elementary and middle school.	Involve school children in local field monitoring as part of their school education. Develop web-based tools that could be used by school children to enhance scientific education within the communities. This can help develop children into local scientists. Involve school children in developing questions to ask their elders and to collect information on the old ways of doing things that can help scientists and managers. This is an unobtrusive way of sharing traditional knowledge from elders and passing on this knowledge to the children.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
Local observations can contribute to scientific studies, especially during design of studies.	The concerns of local residents should be considered during study design. What issues are most relevant to communities? That is, what issues affect local communities? Also, what aspects of the environment are monitored as part of the subsistence lifestyle? Involve school children in developing questions to ask their elders and to collect information on the old ways of doing things that can help scientists and managers. This is an unobtrusive way of sharing traditional knowledge from elders and passing on this knowledge to the children. Be open and build trust. When sharing information about traditional knowledge, the local communities are often uncertain about how this information will be used. Some fear that it might be used for measures that will negatively impact them. Create a collaborative monitoring partnership that collects information, shares results, and gives input in interpreting these results.
Financial support is needed to encourage local involvement.	Assist local residents in writing grants or other ways to find money for issues that can help communities, such as funding of polar bear patrols. Consider using equipment that is locally present when conducting research close to local communities, as it increases local involvement, brings economic benefits to the communities, and keeps people informed of research. For example, use locally owned boats and nets. To the extent possible, research projects should strive to hire local people. Involve school children in local field monitoring as part of their school education.

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Key Statement from Panel or Participant	Possible Solutions or Recommendations
Local communities want to understand the results of research.	Provide feedback on results from scientific programs that potentially benefit the communities or that reduce concerns. For example, there was a proposal for implementing bubble curtains as a mitigation measure that could reduce propagation of certain frequencies of underwater sound, but no feedback on feasibility was provided. Share information through additional forms other than technical reports on websites or technical presentations. To date, most of the information is inaccessible because it is too technical in nature or too voluminous and time consuming to read. The challenge is to find a way to disseminate research information in a form that can be understood and shared with a large audience (local communities, regulators, scientists, and other interested parties). These could be done through the generation of plain language reports summarizing scientific research results on a regular basis. Additionally, sharing of individual projects through non-technical oral presentations would benefit many residents. Consider appointing a science officer based in Barrow with the objective to facilitate communication between local people, scientists, and managers. Ideally, this should be a job for someone from the North Slope. The appointment could be managed through SeaGrant or a similar organization. Share information in face-to-face meetings as much as possible. Develop a community calendar that would allow visitors to the North Slope to coordinate meetings to bring better local representation.
Better communication is needed between scientists and communities.	Develop guidelines on how researchers can work as "good neighbors" in the Arctic. Existing guidelines can be used as examples, such as Guidelines for Improved Cooperation between Arctic Researchers and Northern Communities (link on BASC website www.arcticscience.org). Consider participation/interaction with a larger public through radio phone-in or other media.

PART III: Recommended Action

The tables in Parts I and II of this report include repeated or emphasized suggestions or recommendations. From these recommendations, a few of the action items that appeared repeatedly or were otherwise emphasized could be addressed by NSSI or another organization. They are summarized and emphasized here:

- The NSSI or another organization should work with Sea Grant or others to establish a science officer position in Barrow. The science officer would help coordinate science communication on the North Slope. Ideally, a local person should fill this role. Some of the recommendations identified below could be taken on by the science officer.
- The NSSI or another organization should develop a community calendar that would allow visitors to the North Slope to coordinate meetings to bring better local representation.
- The NSSI or another organization should work closely with the Barrow Arctic Science Consortium to facilitate researchers to return to the communities and report results in person to local residents, schools, and concerned groups.
- The NSSI or another organization should create comprehensive maps that include subsistence camps and subsistence areas; these maps should be regularly updated and made available to managers and researchers.
- The NSSI or another organization should encourage researchers to develop a community-based monitoring program that facilitates input from local residents or employs local residents and that enhances communication of results between scientists and local residents.
- The NSSI or another organization should establish collaborative support of community-based monitoring of subsistence harvests (for example, the CARMA network).
- The NSSI or another organization should continue working on inter-agency communication and research coordination.
- The NSSI or another organization should develop a framework for organizing issue-specific workshops.
- The NSSI or another organization should improve outreach efforts on the North Slope to explain the organization's mission and initiatives to improve coordination of science on the North Slope.

Figure 4: *Round table discussion on setting important directions for the future. Photo by NSSI.*

PART IV: Workshop Lessons Learned

One of the recommended actions in Part III calls for more workshops. With this in mind, lessons learned from the workshop described in this report may be useful in the future. Lessons learned include both items that went well and items that could be improved upon in the future.

What went well?

- Inclusion of regular and long breaks gave participants time for small group discussions and time to re-energize.
- The total number of participants was very workable and near optimal.
- Having roughly equal representation by North Slope residents, scientists, and government managers maintained a balance and encouraged valuable exchanges of views and knowledge.
- Weekly workshop planning teleconferences kept workshop logistics and planning on track.
- Remaining reasonably flexible throughout the workshop encouraged discussions and open exchange. Last-minute inclusion of breakout groups and additional speakers added value to the workshop.
- Having enough people involved in workshop planning and organization, allowing delegation of responsibilities, was a key to the workshop's success.
- During the workshop planning process, formal (written) tracking of milestones added to the workshop's success.
- The length of the workshop — a bit less than eight hours each day (not counting field trips) for three days — was about right. Shorter workshops would be valuable, but more than three days would not be beneficial.
- The workshop was timed to avoid conflicts with other important events on the North Slope. The workshop banquet was timed to avoid a conflict with evening events at Barrow churches.
- Breakfast and lunch were provided at the workshop so that participants could participate in small group discussions during meals.
- The banquet was well planned, with excellent interaction between the scientists, managers, and local participants.

What could be done better?

- Plan for more use of small breakout groups to maximize input from participants.
- Focus on a strategy to keep speakers on time, without resorting to stop watches and a forced ending of presentations or discussions.
- Make sure there are translators or more Inupiaq speakers to more actively convey messages from discussions to and from participants who may not want to communicate in English.
- Conduct facilitator training sessions early in the planning process to help focus workshop objectives and to allow early communication of expectations to speakers and panelists.
- Send out the final agenda earlier, without specific information that might evolve as the planning process moves forward.
- The field trips should be managed so that participants are broken into small groups for a more "hands-on" experience.

Figure 5: *Workshop attendees join Native dancers at the evening banquet. Photo by NSSI.*

APPENDIX A: Workshop Agenda

Day 1: Tuesday, March 29, 2011

(Workshop co-chair Wendy Loya to facilitate Day 1)

8:30 – 9:00 Coffee and breakfast sandwiches – hosted by North Slope Borough

9:00 – 9:10 Welcome (Mayor Edward Itta)

9:10 – 9:25 NSSI overview and goals of the workshop (Karla Kolash, John Payne, Bill Streever)

9:25 – 9:40 Dedication to Warren Matumeak and Arnold Brower, Sr. (Craig George)

9:40 – 10:30 Primer on Subsistence Culture, Emphasizing the Subsistence Hunt for Bowheads (C. Eugene Brower)

10:30 – 11:00 Break

11:00 – 1:00 Sea Ice Change (facilitated by Amy Holman)

- Local speaker, scientist, and government representative to talk about which variables are important from their perspective and the degree of change that is important, as well as opportunities to understand that change
- Facilitated panel (Gordon Brower; Hajo Eicken; Richard Prentki; Carl Uchytil) discussion with input from all participants

1:00 – 2:00 Catered lunch at the Inupiat Heritage Center

2:00 – 4:00 Vegetation Change (facilitated by Dan Reed)

- Local speaker, scientist, and government representative to talk about which variables are important from their perspective and the degree of change that is important, as well as opportunities to understand that change
- Facilitated panel (Jana Harcharek; Torre Jorgenson; Dave Yokel) discussion with input from all participants

4:00 – 4:30 Summary of discussions by facilitators (Amy Holman and Dan Reed)

4:30 – 6:00 Excursions

6:00 – 9:30 Banquet at the Ipalook Elementary School multi room, with address by Mayor Itta and entertainment by Tagiugmiut Dancers
Hosted by the North Slope Borough and Arctic Slope Regional Corporation

Day 2: Wednesday, March 30, 2011

(Workshop co-chair Bill Streever to facilitate Day 2)

8:30 – 9:00 Coffee and breakfast sandwiches – hosted by North Slope Borough

9:00 – 9:10 Welcome (John Payne)

9:10 – 9:40 Primer on Subsistence Hunt for Caribou (James Nageak)

9:40 – 10:00 Caribou technical paper overview (Lincoln Parrett)

10:00 – 10:30 Break

10:30 – 12:30 Change in Terrestrial Subsistence Resources (facilitated by Wendy Loya)

- Local speaker, scientist, and government representative to talk about which variables are important from their perspective and the degree of change that is important, as well as opportunities to understand that change
- Facilitated panel (Taqulik Hepa; Brian Person; Brian Lawhead) discussion with input from all participants

12:30 – 1:30 Catered lunch at the Inupiat Heritage Center – hosted by Oil Spill Research Institute

1:30 – 2:00 Marine mammal technical paper overview (Craig George)

2:00 – 4:00 Change in Marine Subsistence Resources (facilitated by Robyn Angliss)

- Local speaker, scientist, and government representative to talk about which variables are important from their perspective and the degree of change that is important, as well as opportunities to understand that change
- Facilitated panel (Fenton Rexford; Henry Huntington; Robert Suydam) discussion with input from all participants

4:00 – 4:30 Summary of discussions by facilitators (Wendy Loya and Robyn Angliss)

4:30 – 6:00 Excursions

6:30 – onward Pizza and Posters social at Inupiat Heritage Center common area
Hosted by North Slope Science Initiative

Day 3: Thursday, March 31, 2011

(Workshop co-chair Robert Suydam to facilitate Day 3)

8:30 – 9:00 Coffee and breakfast sandwiches – hosted by North Slope Borough

9:00 – 9:10 Welcome (Karla Kolash)

9:10 – 9:40 Primer on the History of Science in Barrow and across the North Slope, Emphasizing Participation by Local People (John Kelley)

9:40 – 10:00 Presentation on Personal Reflections of Long-term North Slope Residents on Science on the North Slope (Jacob Adams; Rossman Peetook)

10:00 – 10:30 Presentation on Working with Scientists who come to Barrow from Outside: Opportunities and Constraints (Glenn Sheehan)

10:30 – 11:00 Break

11:00 – 1:00 Opportunities to Work Together: Local People, Regulators, Resource Managers, and Scientists (facilitated by Scott Pegau)

- Local speaker, scientist, and government representative to talk about ways to work together, drawing from actual experiences as well as providing thoughts on how to improve participation
- Facilitated panel (Richard Glenn; Gary Kofinas; Greg Balogh) discussion with input from all participants

1:00 – 2:00 Catered lunch at Inupiat Heritage Center – hosted by North Slope Borough

2:00 – 4:00 Recap and discussion of the workshop sessions to ensure that key points have been captured, and to suggest future efforts (facilitated by Bill Streever and others)

4:00 – 4:30 Thank you and adjourn (Mayor Itta, John Payne, Wendy Loya, Robert Suydam, and Bill Streever)

APPENDIX B: Mayor Itta's Banquet Speech

I've been thinking about your dedication of this week's workshop to our elders. And that got me thinking about the role of elders in general as protectors of the Arctic environment. In some ways, they fulfill the same role as you scientists do. Their knowledge comes from repeated observations over a long period of time. These daily or weekly or annual observations amount to a database of knowledge that they carry in their heads. It is a record of Nature's behavior—its consistency and its changes over time.

Think of it in terms of my father, whose name was *EsaugannaPualu* in our language, and in English it was Noah. He was born in a camp on the eastern side of Teshekpuk Lake. He grew up in a family that followed the migrations of marine mammals and land-based animals of all kinds. They lived and died by their ability to observe and interpret what they saw. They remembered what they had observed from year to year, and they used this knowledge to guide their decisions. They depended on the accuracy of that knowledge for their survival.

Their knowledge was tested on a daily basis, and the reward for their study was one day of survival after another. It was a high-stakes education. They lived on the edge in many respects, inhabiting a world that was both unforgiving and highly productive, and they became intimately familiar with the subtleties of ice and ocean and tundra. Their knowledge was not only in their heads; it was in their bones and their hearts and their ancestry.

I guess that's why I say that our people are not separate from our environment. We are part of it, because we have been here so long and we have such an intimate relationship with it. You cannot think of the Arctic without thinking of the Iñupiat. We belong here, just like the polar bear and the walrus and the snowy owl.

In his later years, my father noticed how the climate seemed to be changing. He would comment on how spring came earlier and warmed up faster, making our whaling activities more hazardous. We hunt from the edge of the shorefast ice in the spring, and changes in the ice pack have a big impact on our ability to participate in this traditional hunt. As time went on, even us young folks could see the changes. The ice pack was shrinking, and shorefast ice was rotting earlier in the year, and the ice retreated farther out during the summer and stayed out longer. It's almost like a rug was gradually being pulled from under us.

The pace of these changes seems to be increasing, and we are very concerned about how it will affect the whale migration and the ability of other marine mammals and shore-based animals to survive. Since we are inextricably tied to these subsistence species, their fate is our fate. We recognize this, and we lose sleep over it. We need the scientific efforts and collaborative approach of NSSI if we are going to build an accurate understanding of the changes underway in this unique region of the world. Scientists and Iñupiat alike desperately need to know the extent of these changes and how they affect other links in the chain of life. Our people intuitively understand the concept of the interconnectedness of all things. We have seen it in action. We feel it. And collaboration is part of our DNA. Our culture depends on group effort. Nobody "goes it alone" in Iñupiaq culture. Survival depends on working together.

Climate change is not our only concern when it comes to the ecological stability of the Arctic Ocean. We are also faced with the likelihood of new industrial activity in the ocean. This could eventually include trans-Arctic maritime shipping and increased ocean-going tourism as the ice recedes. More immediately, it looks like there will be oil and gas exploration offshore. One of the policies that President Bush and President Obama seem to have agreed on is their support for offshore development

in the Arctic. There was limited exploration in the Chukchi Sea during the 1980s. Now there seems to be greater interest, and as the sea ice recedes, promising new areas will be exposed for the first time. This could introduce major changes in the way our ocean ecosystem is used, and it could have significant impacts.

As I said this morning, we generally support oil development. Ever since 10 billion barrels of it were discovered over at Prudhoe Bay 43 years ago, we have lived with the oil industry. But Prudhoe Bay production is onshore, where impacts can be more easily monitored and mitigated. The direct social and cultural impacts on our communities have been limited, although satellite fields have extended to the village of Nuiqsut, which is on the western edge of the oil fields and has seen its caribou hunting restricted by roads and pipelines across its subsistence hunting territory.

There is a powerful counterbalance to the impacts we have felt from onshore development. Oil has given us a tax base, which provided the foundation for our regional economy. The North Slope Borough is able to provide 800 jobs in our communities because of oil, and our private-sector Native corporations are among the largest economic engines in the state. After 40+ years of experience with oil, we have learned that we cannot live without our traditional subsistence hunting activities; nor can we live without jobs and a cash economy. How do we balance the protection of our subsistence resources and the need to make sure that our children and grandchildren will have a decent standard of living? This is the central challenge for Iñupiat in the 21st Century. We are people with one foot in our traditional Native world and one foot in contemporary America. Our challenge is to make it work, because we cannot thrive without both.

That is why we don't reject oil development. We have learned to live with it and even to welcome it if it is conducted with adequate safeguards and local involvement in the process. However, the reserves of onshore oil are running out, and if the pipeline is going to continue operating, it's going to need more oil. The oil companies seem to think their best chance for discovery is offshore.

But while we encourage development, we will also fight with our last breath to protect the ecosystem that allows the bowhead whale to thrive, along with the other animals we harvest for our sustenance. The bowhead is at the center of our traditional cultural life, and as I said before, its fate is our fate.

This is where you come in.

In the context of this delicate balance, science becomes an enormous asset to us. Our traditional ecological knowledge can't stand by itself in arguing for policies that adequately protect our subsistence animal populations. By merging traditional knowledge into the scientific process that you people are engaged in, our generations of observation can be put to work in the service of an accurate and quantifiable description that can drive policy.

So now you know our secret agenda as participants in NSSI. We need good science—and plenty of it—in order to thread the needle that leads to our future. I sure don't want you to feel any pressure … but yes, your involvement in NSSI can help to save a proud and ancient American culture. If that's not enough to get you focused on your work, I don't know what is!!

But seriously, my approach has been to take our concerns to the table when decisions are being made. We've already made significant progress, particularly with industry, in tightening up the rules that will govern offshore industrial activity. We've got more work to do on this, and it seems to me that good science is a good ally when you're pushing for good decisions.

Thank you again for joining us this week here in the capital of America's Arctic.

Quyanaqpak!

APPENDIX C: Workshop Participant List

Name	Affiliation
Amy Holman	NOAA
Amy Tidwell	ExxonMobil
Anne Jensen	UIC Science LLC
Anne Marie LaRosa	U.S. Fish & Wildlife Service, Arctic National Wildlife Refuge
Annie Tikluk	Kaktovik City Representative
Aqquilluk Hank	Point Hope Representative
Arnold Brower Jr.	UIC Real Estate
Ben Nageak	Self
Benjamin Jones	U.S. Geological Survey
Bernice Kaigelak	Nuiqsut Representative
Bill Streever	BP Alaska, NSSI STAP
Billy Adams	North Slope Borough
Brian Lawhead	ABR, Inc. - Environmental Research & Services
Brian Person	North Slope Borough Wildlife
Brooke Gondara	President, Ilisagvik College
Bruce St. Pierre	ConocoPhillips Alaska
Bud Cribley	Bureau of Land Management
C. Eugene Brower	North Slope Borough
Carl Uchytil	U.S. Coast Guard
Carlson Segevan	Self, Barrow
Caryn Rea	ConocoPhillips Alaska, Inc., NSSI STAP
Charles Brower	UIC
Cheryl Rosa	U.S. Arctic Research Commission
Chris Campbell	DOI, Bureau of Ocean Energy Management
Clyde Nummik	Barrow
Craig George	North Slope Borough Wildlife
Cyd Hans	North Slope Borough Wildlife
Dan Reed	Alaska Department of Fish and Game, NSSI STAP
Darcy Dugan	Alaska Ocean Observing System (AOOS)
Dave Yokel	Bureau of Land Management
David Christie	Alaska Sea Grant
Dee Williams	DOI, Bureau of Ocean Energy Management
Dorothy Edwardsen	Living Earth Foundation
Doug Vincent-Lang	Alaska Department of Fish and Game
Douglas Dasher	Alaska Department of Environmental Conservation
Douglas Kane	University of Alaska Fairbanks, NSSI STAP
Douglas Whiteman	Atqasuk City Representative
Ed Fogels	Alaska Department of Natural Resources
Edward Ahyakak	Barrow
Edward Itta	North Slope Borough
Eleanore Shaver	Ecosystems Center, MBL

Name	Affiliation
Elizabeth Logerwell	NOAA, NMFS
Ester Hugo	Anaktuvuk Pass Representative
Evelyn Noakunin	Barrow
Evie Witten	The Nature Conservancy
Fenton Rexford	Kaktovik Inupiat Corporation
Frederick Nelson	University of Delaware
Gary Kofinas	University of Alaska Fairbanks, NSSI STAP
Gary Shigenaka	NOAA/ Emergency Response Division
George Edwardsen	Inupiat Community of the Arctic Slope (ICAS)
George Itta	Self
George Olemaun	North Slope Borough
Glenn Sheehan	Barrow Arctic Science Consortium (BASC)
Gordon Brower	North Slope Borough Planning Department
Greg Balogh	Arctic Landscape Conservation Cooperative, USFWS
Gus Shaver	Arctic LTER, Toolik Lake
Hajo Eicken	University of Alaska Fairbanks
Harry Brower	North Slope Borough / Alaska Eskimo Whaling Commission
Henry Huntington	Pew Environment Group
Herbert Kinneeveauk, Jr.	Point Hope Representative
Ida Olemaun	Self, Olemaun Whaling Crew, Barrow
Jacob Adams	Chairman, ASRC Board of Directors
James Kendall	DOI, Bureau of Ocean Energy Management
James Nageak	North Slope Borough, North Slope Subsistence Regional Advisory Council
James Partain	NOAA Regional Climate Services
Jamie Suvlu	Barrow
Jana Harcharek	North Slope Borough School District
Jason Herreman	North Slope Borough Wildlife
Jason Taylor	Bureau of Land Management, NSSI
Jess Grunblatt	GINA
Jimmy Nayukok	Atqasuk Tribal Representative
John Kelley	University of Alaska Fairbanks, IMS/SFOS, NSSI STAP
John Payne	North Slope Science Initiative
Johnny Aiken	Alaska Eskimo Whaling Commission
Johnny K. Brower	Self
KaithrynOtt	U.S. Fish & Wildlife Service
Karin Berentsen	Statoil
Karla Dutton	Defenders of Wildlife Alaska Field Office
Karla Kolash	North Slope Borough
Kelly McFarlin	University of Alaska Fairbanks
LaVerne Smith	U.S. Fish & Wildlife Service
Leandra De Sousa	North Slope Borough
Leslie Holland-Bartels	U.S. Geological Survey

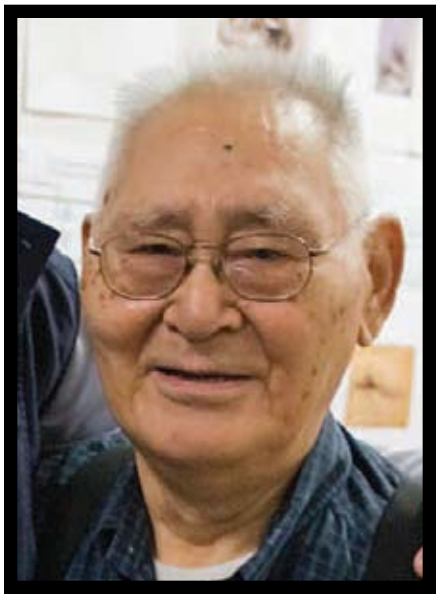
Name	Affiliation
Leslie Pierce	North Slope Borough Wildlife
Lewis Brower	Barrow Arctic Science Consortium (BASC)
Lincoln Parrett	Alaska Department of Fish and Game
Lisanne Aerts	OASIS Environmental, Inc.
Lon Kelly	Bureau of Land Management
Lorena Coates	Self
Louis Pitelka	NEON, Inc.
Margaret Opie	Self
Mark Morry	Anaktuvuk Pass Representative
Matthew Druckenmiller	University of Alaska Fairbanks Geophysical Institute
Matthew Martinsen	NOAA
Michael Lilly	GW Scientific
Michael Macrander	Shell Offshore
Mike Coffey	Alaska Dept. of Transportation and Public Facilities
Mike Pederson	North Slope Borough Wildlife
Murali Pai	North Slope Borough
Nate Olemaun	Self, Olemaun Whaling Crew
Neesha Stellrecht	U.S. Fish & Wildlife Service - FAI Endangered Species Program
Nelly O'Neil	Self
Nico Leiva	Ilisagvik College
Nils Warnock	Audubon Alaska
Pat Pourchot	DOI/ Office of the Secretary
Perry Matumeak	Self
Philip Martin	Arctic Landscape Conservation Cooperative, DOI
Phillip Tikluk	Kaktovik Corporation Representative
Price E. Brower	Barrow
Qaiyaan Harcharek	Barrow
Qaiyan Opie	Inupiat Community of the Arctic Slope (ICAS)
Rachel Cox	ExxonMobil Point Thomson Project
Richard Glenn	Arctic Slope Regional Corporation
Richard Prentki	DOI, Bureau of Ocean Energy Management
Robert Akpik	Self
Robert Shuchman	Michigan Tech Research Institute, NSSI STAP
Robert Suydam	North Slope Borough Wildlife
Robyn Angliss	NOAA, NMFS, Alaska Fisheries Science Center, NSSI STAP
Rossman Peetook	North Slope Borough: Wainwright City Council Member & Whaling Captain
Rusty Brown	ConocoPhillips Alaska, Inc.
Ryan Cody	University of Texas at El Paso
Ryan Wilson	The Wilderness Society
Sara Boen	Self , Barrow

Name	Affiliation
Sarah Conn	U.S. Fish & Wildlife Service
Satrina Lord	Bureau of Land Management
Sayers Tuzroyluk	Tikigaq Corporation
Scott Guyer	Bureau of Land Management, NSSI
Scott Pegau	Oil Spill Recovery Institute
Shirley Oliveira	BP
Simon Filhol	University of Alaska Fairbanks
Stacey Fritz	Bureau of Land Management
Stephanie McAfee	The Wilderness Society
Steve Grove	NOAA - Earth System Research Laboratory Observatory
Steve Zack	Wildlife Conservation Society
Syndonia Bret-Harte	University of Alaska Fairbanks
Taqulik Hepa	North Slope Borough Wildlife
Tatyana Venegas-Swanson	OASIS Environmental, Inc.
Ted Rockwell	Environmental Protection Agency
Thomas Olemaun	Native Village of Barrow
Tim Viavant	Alaska Department of Fish and Game, NSSI Senior Staff Committee
Todd Sformo	North Slope Borough Wildlife
Tom Opie	Self
Tommy Nageak	Inupiat History Language and Culture (IHLC)
Torre Jorgenson	Alaska Ecoscience
Walter Brower	DoE ARM Project
Wendy Loya	The Wilderness Society, NSSI STAP

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.

Arnold Brower, Sr.
1922-2008



Warren Matumeak
1927-2010

Dedication

This workshop was dedicated to two North Slope elders: Arnold Brower, Senior (1922–2008), and Warren Matumeak (1927–2010) were both respected elders of the North Slope and appointed for service, by the Secretary of the Interior, to the North Slope Science Initiative, Science Technical Advisory Panel (STAP). Their appointments to the STAP brought exceptional lifelong Arctic experience and observational science to this 15-member panel. They often "grounded" other panel members with their traditional knowledge of North Slope subsistence lifestyles and resourcefulness.