

## Sustained Arctic Observing Networks (SAON) Survey

### *United States of America*



Cover Photograph: The Barrow Observatory of the NOAA Earth System Research Laboratory, Global Monitoring Division (top right) and the main North Slope of Alaska site of the Department of Energy, Atmospheric Radiation Measurement Climate Research Facility (lower left). Photo credit: Dr. Wanda Ferrell, USDOE.

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**U.S. Department of Agriculture  
Natural Resource Conservation Service  
SNOTEL (SNOWpack TELemetry)**

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

No response.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

Lack of resources for equipment and staff. Access to potential observing sites is limited, and disallowed in some cases, due to land status or their location in public lands designated and/or proposed as wilderness areas.

Contact person:

Richard McClure, Natural Resource Conservation Service, Alaska State Office  
[Richard.McClure@ak.usda.gov](mailto:Richard.McClure@ak.usda.gov)

Web site:

Alaska Snow Survey Program: <http://www.ak.nrcs.usda.gov/Snow/index.html>  
Alaska Snow, Water and Climate Services <http://www.ambcs.org/>

Main objective of the network:

Collect snow data and related environmental parameters for streamflow forecasting.

Member of or connected to a global network:

No response.

Type of activity:

- Theme: Terrestrial ecosystem, including freshwater.
- Locations: Sixty one (61), see <http://www.wcc.nrcs.usda.gov/snotel/Alaska/alaska.html>
- Community-based: No response.
- Coordination: No response

Main variables:

Snow water equivalent (SWE), snow depth, total precipitation, air temperature, solar radiation, relative humidity, barometric pressure, wind speed and direction, soil moisture/soil temperature.

When operational:

The first two sites went into operation in 1958 and data acquisition has been continuous since then.



Geographical coverage:

Alaska, see <http://www.wcc.nrcs.usda.gov/snotel/Alaska/alaska.html>

Data archive/centre:

See web sites above.

Data availability:

- Metadata are available.
- All data are available.
- No charge for data.

Main gaps:

No response, but see response to Question 2 above.

## **U.S. Department of Agriculture Natural Resource Conservation Service Alaska Soil Survey**

More information about the following long-term observing activity will be available in due course.

- Soil survey program description:  
<http://www.ak.nrcs.usda.gov/soils/index.html>
- Soil climate survey program description:  
<http://www.ak.nrcs.usda.gov/soils/SoilClimateSites/SoilClimateSites.html>
- For information and data, contact: Rick McClure, [richard.mcclure@ak.usda.gov](mailto:richard.mcclure@ak.usda.gov)

**U.S. Department of Agriculture**  
**U.S. Forest Service**  
**Remote Automated Weather Stations (RAWS)**

RAWS is an inter-agency program supported by the following land management agencies: U.S. Forest Service, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, Fish and Wildlife Service and the National Association of State Foresters.

- Question 1.** a. How can the SAON SG best assist you?  
 b. What do you see as the role of the SAON SG?

No response.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

The single most critical issue facing the inter-agency RAWS network is the execution of proper annual maintenance of each weather station to National Fire Danger Rating System (NFDRS) weather station standards.

Contact person:

Herb Arnold, Bureau of Land Management, [Herb\\_Arnold@blm.gov](mailto:Herb_Arnold@blm.gov)

Web site:

<http://raws.fam.nwcg.gov/>

See also: Alaska Inter-agency Coordination Center - <http://fire.ak.blm.gov/contacts.php>

Main objective of the network:

Support wildland fire management and protect life and property through the accurate measurement, recording and distribution of fire weather environmental data.

Member of or connected to a global network:

Not applicable.

Type of activity:

- Theme: Fire Weather
- Location: Alaska
- Community-based: Involves US Federal, State and local stakeholders in wildland fire management.
- Coordination: With NOAA for access to Geostationary Operations Environmental Satellite (GOES) data.

Main variables:

Wind speed, wind direction, peak wind speed, peak wind direction, precipitation, air temperature, relative humidity, solar radiation.

When operational:

Some sites have been in operation since the 1970s.

Geographical coverage :

Alaska, see <http://www.raws.dri.edu/wraws/akF.html>

Data archive/centre:

Western Regional Climate Center - <http://www.raws.dri.edu/wraws/akF.html>

Data availability:

All metadata and environmental data are publicly available at no charge.

Main gaps:

No response.

**Department of Energy (DOE)**  
**Atmospheric Radiation Measurement (ARM)**  
**Climate Research Facility (CRF)**

- Question 1.** a. How can the SAON SG best assist you?  
 b. What do you see as the role of the SAON SG?

No response.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

No response.

Contact person:

Dr. Wanda Ferrell, [wanda.ferrell@science.doe.gov](mailto:wanda.ferrell@science.doe.gov)

Web site:

<http://www.arm.gov>

Main objective of the network:

The Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) is a multi-platform national scientific user facility, with instruments at fixed and varying locations around the globe for obtaining continuous field measurements of climate data. Each ACRF site uses a leading edge array of cloud- and aerosol-observing instruments to record long-term continuous atmospheric and surface properties that affect cloud formation and radiation transport through the atmosphere. The ACRF also provides shorter-term (months rather than years) measurements with its two mobile facilities (AMFs) and its aerial measurements.

Member of or connected to a global network:

World Climate Research Programme, GRUAN.

Type of activity:

- Atmosphere, with a focus on the impact of clouds and aerosol on the Earth's radiation budget.
- Location: Primary site: Barrow, Alaska, 71° 19' 23.73" N, 156° 36' 56.70" W  
 Secondary site: Atkasuk, Alaska, 70° 28' 19.11" N, 157° 24' 28.99" W
- Community-based: No.
- Coordination: NOAA provides aerosol and radiosonde measurements at Barrow.

Main variables:

Cloud & aerosol properties, radiation budget, surface characterization, water vapour, precipitation (See <http://www.arm.gov/measurements>)

When operational:

1997.

Geographical coverage:

Alaska, U.S.A.

Data archive/centre:

<http://www.archive.arm.gov/armlogin/login.jsp>

Data availability:

- All data are available in near real time .
- Data are free unless large volumes are requested; then, data are available for the cost of reproduction only

Main gaps: No response.

**Department of Health and Human Services (DHSS)  
Centers for Disease Control and Prevention (CDC)  
Arctic Investigations Program**

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

Coordination of activities. To help facilitate network expansion.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

Engagement of the Russian Federation.

Name and acronym:

International Circumpolar Surveillance of Infectious Diseases (ICS)

Contact person :

Dr. Alan Parkinson MD, [ajpl@cdc.gov](mailto:ajpl@cdc.gov)

Web site:

<http://www.cdc.gov/ncidod/aip/>

Main objective of the network:

Connect public health laboratories and institutes throughout the circumpolar north for the purposes of monitor infectious diseases of concern.

Member of or connected to a global network:

No.

Type of activity:

- Human & socio-economic
- Location: Arctic Investigations Program, CDC, Anchorage, Alaska
- Community-based: No
- Coordination: Coordination of data collected. Collects data in the US Arctic (Alaska)

Main variables:

Rates of infectious diseases by patient age, sex, location,

When operational:

Since 1999

Geographical coverage:

The US Arctic (Alaska), northern Canada, Greenland/Denmark, Iceland, Norway, Finland, Northern Sweden.

Data archive/centre:

Arctic Investigations Program CDC, Anchorage Alaska.

<http://www.cdc.gov/ncidod/aip/>

Data availability:

- Metadata only: Yes
- No charge for data.

Main gaps:

Russian Federation



**Department of Interior (DOI)**  
**Bureau of Land Management (BLM)**  
**Remote Automated Weather Stations (RAWS)**

RAWS is an inter-agency program supported by the following land management agencies: Bureau of Land Management, U.S. Forest Service, Bureau of Indian Affairs, National Park Service, Fish and Wildlife Service and the National Association of State Foresters.

See pages 3-4.

## Department of Interior (DOI) Fish and Wildlife Service (FWS)

### 1. Circum Arctic Rangifer Monitoring and Assessment Network (CARMA)

Contact person:

Patricia Reynolds, [patricia\\_reynolds@fws.gov](mailto:patricia_reynolds@fws.gov)  
Ken Sylvestre, [ken.sylvestre@gmail.com](mailto:ken.sylvestre@gmail.com)

Web site:

<http://www.carmanetwork.com>

Main objective of the network:

To focus on the status of most of the large migratory *Rangifer* (caribou/reindeer) herds.

Member of or connected to a global network:

Arctic Council-→CAFF→CBMP-→CARMA→NRI of YC (administration)

Type of activity: Assessing and monitoring wild caribou/reindeer herds

- Theme: Terrestrial ecosystem related to reindeer/caribou.
- Location: Circumpolar north.
- Community-based: Yes, in northern communities dependent on wild caribou/reindeer.
- Coordination: No response.

Main variables:

Herd status, physiology, habitats, community use.

When operational (year):

Began in 1998, but officially launched in 2004.

Geographical coverage:

North America, Russia and a few herds in Scandinavia (Iceland).

Data archive/centre:

Data will be made available through metadata contributions and through sharing agreements.

Data availability:

Data are not yet available.

Main gaps:

No response.

## **2. USFWS R7 Marine Mammals Management: Marking Tagging & Reporting Program (MMM-MTRP)**

### **Question 1.** a. How can the SAON SG best assist you?

It would be useful to know about observation networks similar or in some way relative to the ones we present here.

### b. What do you see as the role of the SAON SG?

Initially, an informational role would be useful. Coordination and problem-solving might become additional roles once SAON has become well established and has demonstrated utility to participants.

### **Question 2.** What are the critical issues facing your observing program or data and information management program?

Assuming no change in funding or management mandates, there are at least three substantive issues that must be addressed in well established observation networks like the MTRP and WHMP. They are: (1) maintaining the system to some established standards; (2) interpreting the data to meet management requirements; and (3) responding to environmental, social and technical changes in a responsible manner. Assessing under-reporting bias is a specific example of one of these issues for both the MTRP and WHMP.

In newly established systems like the Polar Bear Human Influence Management System, early challenges are to get the system up and running for a meaningful time span and to establish meaningful participation from cooperators, in this case the other polar bear range states.

Contact person:

John Trent, [John\\_Trent@fws.gov](mailto:John_Trent@fws.gov), Brad Benter, [Brad\\_Benter@fws.gov](mailto:Brad_Benter@fws.gov)

Web site:

<http://alaska.fws.gov/fisheries/mmm/mtrp/mtrpmain.htm>

Main objective of the network:

- (1) Monitor the subsistence and handicraft harvest of polar bears, sea otters and walrus;
- (2) Obtain essential biological data needed to manage; and
- (3) Help prevent the illegal take, trade and transport of specified raw marine mammal parts.

The Marine Mammal Protection Act of 1972 allows Alaska Natives to harvest marine mammals for subsistence uses. The [Marine Mammal Protection Act](#) (pdf) requires that all sea otter and polar bear hides and skulls, and all walrus tusks be tagged by a representative of the U.S. Fish and Wildlife Service. This program is implemented through resident MTRP taggers located in coastal villages and communities throughout Alaska. There are more than 150 taggers located in about 100 villages. The information collected by the MTRP will help ensure the long-term survival of these species by monitoring the Native harvest and controlling the illegal take, trade, and transport of marine mammal parts. To find out how to contact taggers, call John Trent at 1-907-786-3815 or 1-800-362-5148.

Member of or connected to a global network:

No

Type of activity:

- Human & socio-economic: Harvest data collection and assessment, with some biomonitoring
- Location: Subsistence harvest data on polar bears and northern sea otters are collected from hunters in Alaska coastal communities.
- Community-based: Yes - data are collected by contract taggers in rural coastal communities and then then collected and analyzed in a central location, Anchorage, Alaska.
- Coordination: Data are collected and analyzed by MMM/MTRP

Main variables:

Date, location, sex and age of kill; dental collection, skull or tusk measurements

When operational:

Continuous since 1989. Walrus data from 1960 combined with data collected from beach landings.

Geographical coverage:

Communities in coastal Alaska, USA, with additional walrus harvest data from Chukotka, Russia.

Data archive/centre:

US Fish and Wildlife Service, Marine Mammals Management MS341, 1011 East Tudor Road, Anchorage, Alaska USA. Contacts: John Trent, [John\\_Trent@fws.gov](mailto:John_Trent@fws.gov) or Brad Benter, [Brad\\_Benter@fws.gov](mailto:Brad_Benter@fws.gov)

Data availability:

Harvest data for all three species are summarized several times a year for each participating community. There is no charge for this service.

#### Main gaps:

The MTRP harvest data are for 3 stocks of northern sea otter and, with data provided by Russian authorities, for the one stock of Pacific walrus. Polar bear harvest for the Chukchi Sea and southern Beaufort Sea polar bear stocks are for US communities only. Additional harvest occurs in Canada but is accounted for by the Inuvialuit-Inupiat Agreement of 1988.

In the largest Alaska walrus harvesting communities, MTRP data are supplemented and independently assessed by a Walrus Harvest Monitoring Program (WHMP) that has existed, more or less continuously since 1960. This program also collects biological specimens. The contact for WHMP is [Jonathan\\_Snyder@atfws.gov](mailto:Jonathan_Snyder@atfws.gov). Mr. Snyder is also in the Office of Marine Mammals Management, Region 7, USFWS MS 341 1011 East Tudor Road, Anchorage AK, 99503.

### 3. Polar Bear/Human Interaction Database

#### Question 1. a. How can the SAON SG best assist you?

It would be useful to know about observation networks similar or in some way relative to the one presented here.

#### b. What do you see as the role of the SAON SG?

Initially, an informational role would be useful. Coordination and problem-solving might become additional roles once SAON has become well established and has demonstrated utility to participants.

#### Question 2. What are the critical issues facing your observing program or data and information management program?

In newly established systems like the Polar Bear Human Influence Management System, early challenges are to get the system up and running for a meaningful time span and to establish meaningful participation from cooperators, in this case the other polar bear range states.

#### Contact person:

James Wilder, [James\\_Wilder@fws.gov](mailto:James_Wilder@fws.gov)

#### Web site:

Pending

### Main objective of the network:

Track and analyze all bear/human conflicts for all circumpolar polar bear range states (countries).

As a result of on-going and predicted future habitat loss, polar bears are expected to spend longer periods of time on land where they are susceptible to human disturbance. At the same time, human activity in coastal areas of the Arctic is increasing (e.g. oil and gas exploration, tourism) in conjunction with an increased number of nutritionally stressed bears occurring on land. The increasing trend of both polar bear and human use of coastal areas has the potential to result in increasing polar bear-human interactions. Harvest data indicates that defense of life kills have been increasing (USFWS unpublished data). To date, polar bear attacks have been rare but when they do occur, they evoke strong public reaction, especially for residents of communities within the range of polar bears. For sound management of polar bears to be implemented, and adequate protection afforded to people living, recreating, and working in polar bear country, it is imperative that polar bear managers assemble a database of critical information related to bear-human interactions.

Interactions with humans may threaten polar bears by: (1) displacement from preferred habitats, such as denning, feeding and resting areas; (2) ingestion of or exposure to contaminants or toxic substances; (3) association of humans with food (food-conditioning) resulting in nuisance bears being killed due to safety concerns for local residents/workers.

Polar bear managers can help maintain the current status of their polar bear populations by reducing lethal take of polar bears during bear-human interactions. To prevent escalating conflicts between polar bears and humans, bear-human interaction plans need to be developed and implemented.

During the March 2009 Polar Bear Range States Meeting in Tromsø, Norway the U.S. was tasked with taking the lead on developing a polar bear / human interaction initiative to address the anticipated future increase in interactions due to climate change. Tor Punsvik, Environmental Advisor, Office of The Governor of Svalbard, Norway and Dr. Terry D. DeBruyn, Polar Bear Project Leader, FWS, Alaska were requested by the Range States to develop a polar bear/human interaction database for the next Range States Meeting in Canada in 2011. It is anticipated that a draft database, populated with data from both the U.S. and Norway, will be ready by November 2009 for testing and comment by the Polar Bear Specialist Group (PBSG). The draft database will be distributed to PBSG members, comment sought, and a request made that members populate the database with pertinent polar bear/human incidents (of primary interest, initially, are records from each country that relate to the use of bear spray and fatalities (both bear and human) resulting from bear-human interactions). At a subsequent meeting of U.S. and Norway in spring 2010, the database will be updated and thereafter redistributed to the PBSG and Range State members. It is anticipated that data from all Polar Bear Range States will then be available for consolidation and validation in winter 2010 and ready to present at the Range States meeting in 2011. To ensure the success of the project, partnering with various agencies and pertinent groups in the range state countries will occur.

The Polar Bear Range States parties agree on the need to develop comprehensive strategies to manage bear-human conflicts. Some existing strategies include active deterrence, reduction of attractants, and community education and outreach. Expertise developed for management of other bear species should be consulted in the development of strategies specific to polar bears. The parties agreed to exchange experiences with management of bear-human interactions. Two specific opportunities were identified to develop bear-human interaction strategies: the

upcoming Bear-human Workshop in November 2009 in Canmore, Alberta, Canada and the Polar Bear Aversive Conditioning Workshop planned to be held in Alaska in 2010.

The Polar Bear-Human Information Management System (PBHIMS) has been developed to standardize the collection of polar bear data across the Range States. This system provides a user-friendly data entry interface and the ability to analyze the collected data. Data stored in the system includes bear-human conflicts, bear observations, bear harvests, and bear natural history data. Scanned images of the original bear forms, narratives, reports, and photos can be attached to each incident to provide additional information that may not be captured in the system.

Member of or connected to a global network:

Pending

Type of activity:

- Theme: Ocean, Human & socio-economic.
- Location(s): Data to be collected from all polar bear range states (countries).
- Community-based: No.
- Coordination: Directly involved in developing data base and collecting information.

Main variables:

Over 80 including date, time and location of interaction.

When operational:

2009

Geographical coverage:

Planned and pending for USA, Canada, Denmark, Greenland, Norway, Russian Federation.

Data archive/centre and data availability:

Not on the Web. Contact James Wilder ([James\\_Wilder@fws.gov](mailto:James_Wilder@fws.gov)), US Fish and Wildlife Service USFWS), Region 7, Office of Marine Mammals Management, 1011 East Tudor Road, Anchorage, Alaska 99503.

Main gaps:

Developed for use by USFWS; other range states are not using it yet.

#### **4. Yukon Flats National Wildlife Refuge**

**Question 1.** a. How can the SAON SG best assist you?

It would be helpful to the Yukon Flats National Wildlife Refuge and other Alaskan Refuges to made aware of similar inventories being conducted elsewhere in the northern polar region.



b. What do you see as the role of the SAON SG?

One potential role would be to act as a liaison between science organizations who are conducting similar work.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

Financial constraints – The US Fish and Wildlife Service is responsible for inventory and monitoring of resources in huge land bases in Alaska. We are limited by budget constraints to prioritize resources. Our long-term data sets are primarily avian-focused. However, our current needs are primarily focused on physical parameters such as water, temperature, etc. We do not have the capacity at this time to monitor physical parameters so we are reaching out to partners to assist.

Contact person:

Mark Bertram, [mark\\_bertram@fws.gov](mailto:mark_bertram@fws.gov) or [yukonflats\\_refuge@fws.gov](mailto:yukonflats_refuge@fws.gov)

Web site:

<http://yukonflats.fws.gov/>

Main objective of the network:

To inventory and monitor resources of the Yukon Flats Basin to achieve refuge purposes.

Member of or connected to a global network:

National Network – National Wildlife Refuge System.

Type of activity:

- Theme: Terrestrial ecosystem, including freshwater.
- Location: Yukon Flats National Wildlife Refuge, Alaska, USA.
- Community-based: No response.
- Coordination: No response.

Main variables:

See Appendix 1.

When operational:

See Appendix.

Geographical coverage:

See Appendix.

Data archive/centre:

See Appendix 1.

Data availability:

- Metadata only: No response.
- All data: No response.
- Charge or no charge for data: There is a charge for data.

Main gaps:

See Appendix 1.

## 5. Kanuti National Wildlife Refuge (Kanuti NWR)

**Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

I do not know enough about SAON or the SAON SG to answer.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

No response.

Contact person:

Christopher Harwood, [Christopher\\_harwood@fws.gov](mailto:Christopher_harwood@fws.gov) or [kanuti\\_refuge@fws.gov](mailto:kanuti_refuge@fws.gov)

Web site:

<http://kanuti.fws.gov/>

Type of activity:

- 1) Annual monitoring of molting Greater White-fronted Geese (Interior refuges)
- 2) Waterfowl (primarily) breeding pair survey (MBM- done 1997, 2008-09)
- 3) Breeding Bird Survey (2 routes; annual, though not in 2009)
- 4) Alaska Landbird Monitoring Survey (2 plots; biennial)
- 5) Refuge moose population survey (annual)
- 6) Refuge wolf survey (annual as conditions allow; minimum census)
- 7) Henshaw Creek fish weir (annual; TCC = operator)
- 8) Stream gages (operational Oct 2009; will operate at least 6 years)
- 9) Snow markers (6 on refuge; checked monthly in winter; statewide??)

Main variables:

See previous section.

When operational:

No response.

Geographical coverage:

66° 25' 0" N, 151° 50' 0" W, Central northern Alaska, USA.

Data archive/centre:

No response.

Data availability:

No response.

Main gaps:

No response.

## **6. Koyukuk National Wildlife Refuge (KNNWR)**

**Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

I have no idea. This is the first I've ever heard of SAON.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

Rising operational costs in rural Alaska are starting to become an issue for getting projects accomplished.

Contact person:

Brad Scotton, [Brad\\_Scotton@fws.gov](mailto:Brad_Scotton@fws.gov)

Web site:

<http://koyukuk.fws.gov/>

Main objective of the network:

Protect wildlife and habitat for future generations; fulfil international treaty obligations related to fish and waterfowl; provide opportunity for subsistence use by residents

Member of or connected to a global network:

No response.

Type of activity:

- Theme: Terrestrial ecosystem, including freshwater.
- Location: West-Central Interior Alaska,
- Community-based: No.
- Coordination: No response.

Main variables:

Wildlife populations (moose, geese, swans, passerines, caribou, voles etc.), habitat types, snow depth, flood events.

When operational:

The refuge was opened in 1980.

Geographical coverage:

65° 35' 0" N, 156° 30' 2" W, west-central Alaska.

Data archive/centre:

Local.

Data availability:

Some data are available. Availability depends on what is requested.

Main gaps:

Few data prior to 1981.

## 7. Alaska Pelagic Seabird Observer Program

**Question 1.** a. How can the SAON SG best assist you?

1. Provide easy access to remote sensing tools.
2. Provide network of research vessels, cruises, contacts for chief scientists to facilitate deployment of seabird observers on ships of opportunity.

b. What do you see as the role of the SAON SG?

Information clearing house? Providing easy-access to remote sensing tools.  
Information on metadata?

**Question 2.** What are the critical issues facing your observing program or data and information management program?

1. Funding beyond 2010.
2. Lack of good database manager in-house (USFWS)
3. Data propriety (being sure Principal investigators have opportunity to publish before general dissemination of raw data).

Contact person:

Kathy Kuletz, [Kathy\\_kuletz@fws.gov](mailto:Kathy_kuletz@fws.gov)

Web site:

No response.

Main objective of the network:

Place seabird/marine mammal observers on ships of opportunity – focusing on research vessels and programs such as NOAA stock assessment surveys and NFS-funded programs. To obtain data on seabird/marine mammal distribution and abundance throughout Alaska waters, with corresponding oceanographic and biological data from other projects on the same cruises. Data to be included in syntheses as part of Bering Sea Integrated Ecosystem Research Program (BSIERP, NPRB), and will be added to the N. Pacific Pelagic Seabird Database (NPPSD).

Member of or connected to a global network:

No.

Type of activity:

- Theme:           - Marine ecosystem
- Ocean
- Location:       - Pelagic waters of Alaska, including the Arctic.
- Community-based: No.
- Coordination: (1) N. Pacific Research Board, (2) Bering Ecosystem Study, BEST Program (NSF-funded studies of Bering Sea), (3) North Pacific Pelagic Seabird Database (USGS & USFWS database).

Main variables:

Marine birds and mammal counts processed into animals per km<sup>2</sup>.

When operational :

February – October, 2006-2010 (possibly some arctic work funded by Minerals Management Service in 2010-2013).

Geographical coverage:

Alaska, USA, and occasionally Russian waters (Bering Sea) or Canadian waters (Arctic).

Data archive/centre:

North Pacific Research Board ([www.nprb.org](http://www.nprb.org)) and North Pacific Pelagic Seabird Database (<http://www.absc.usgs.gov/research/NPPSD>)

Data availability:

- Metadata only: Yes.
- All data: Will be available two years after the end of the NPRB project. Summaries of historic data are available via the NPPSD web site
- Charge for data: None.

Main gaps:

No response.

## 8. Arctic Program for Regional and International Shorebird Monitoring (PRISM)

**Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

a. The SAON can best assist me by being a vehicle that allows us to establish and Arctic Shorebird Demographic Network (i.e., a series of sites throughout the Arctic that collect demographic data on shorebirds in a consistent fashion and in so doing allow us to obtain a better understanding if demographic factors on the breeding grounds are limiting populations of shorebirds).

b. SAON SG might best serve as an advocacy group and a mechanism to tie together groups across the Arctic doing similar things.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

No response.

Contact person:

Richard Lanctot, [Richard\\_lanctot@fws.gov](mailto:Richard_lanctot@fws.gov)

Web site:

No response.

Main objective of the network:

To collect contemporary data on the distribution, abundance and trends in abundance of Arctic-breeding shorebirds.

Member of or connected to a global network:

Our work is part of the Arctic PRISM surveys being conducted in North America (Alaska and Canada).

Type of activity:

- Theme: - Terrestrial ecosystem.
- Location: Arctic and sub-Arctic regions of Alaska.
- Community-based: No.
- Coordination: PRISM committee, organized via the US Shorebird Conservation Plan Council, Susan Skagen, chair.

Main variables:

We collect data on shorebird abundance, distribution and habitat use at rapidly surveyed sites that are randomly selected. We also conduct more intensive surveys at a much smaller number of intensively surveyed sites.

When operational:

1998 to present. Surveys are conducted in Alaska and Canada when funds are available. To date, surveys have been conducted on the North Slope of Alaska and to a limited degree on the Yukon Delta National Wildlife Refuge (NWR), Selawik NWR, Alaska Maritime NWR and Alaska Peninsula/Becharoff NWR (all in 2002).

Geographical coverage:

USA and Canada

Data archive/centre:

In-house at USFWS, Migratory Bird Management, Anchorage, AK.

Data availability:

- Data are available, but not at a Web site. Specific requests for particular data would be needed.
- Metadata only: No response.
  - All data: No response.
  - Charge or no charge for data: No response.

Main gaps:

No long term funding available to continue to conduct these surveys.

## 9. Breeding biology of Steller's eiders nesting near Barrow, Alaska

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

No response.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

No response.



Contact person:

David Safine, [David\\_Safine@fws.gov](mailto:David_Safine@fws.gov)

Web site:

No response.

Main objective of the network:

To conserve the federally listed Alaska-breeding population of Steller's eiders through monitoring breeding, surveying populations, predator management, and analyzing the effects of management actions.

Member of or connected to a global network:

No.

Type of activity:

- Theme:
  - Terrestrial ecosystem
  - Coastal
  - Human & socio-economic
- Location: Near Barrow, Alaska
- Community-based: Yes
- Coordination : We coordinate and conduct the project.

Main variables:

Nest and brood survival, habitat use, and breeding population size.

When operational:

Nest monitoring 1991- Present.  
Aerial and ground based breeding pair Survey 1999 – Present.

Geographical coverage:

Alaska, USA.

Data archive/centre:

U.S. Fish and Wildlife Service.

Data availability:

All data are available.

Main gaps:

We are only collecting data on the breeding biology of this species along the road system near Barrow, Alaska.

## 10. Barrow Long-term Breeding Ecology Study (Barrow Shorebirds)

**Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

a. The SAON can best assist me by being a vehicle that allows us to establish and Arctic Shorebird Demographic Network (i.e., a series of sites throughout the Arctic that collect demographic data on shorebirds in a consistent fashion and in so doing allow us to obtain a better understanding if demographic factors on the breeding grounds are limiting populations of shorebirds).

b. SAON SG might best serve as an advocacy group and a mechanism to tie together groups across the Arctic doing similar things.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

No response.

Contact person:

Richard Lancotot, Richard Lancotot, [Richard\\_lancotot@fws.gov](mailto:Richard_lancotot@fws.gov)

Web site:

No response.

Main objective of the network:

To collect contemporary data on shorebird demography and to compare these data to historic information collected at the site.

Member of or connected to a global network:

We are attempting to establish an Arctic Shorebird Demography Network patterned after the Barrow site. This is only at the beginning stages.

Type of activity:

- Theme: Terrestrial ecosystem
- Location: Barrow, Alaska.
- Community-based: Based at study plots along the road system outside of Barrow.
- Coordination: N. response.

Main variables:

We collect data on shorebird species breeding in the area. This includes nesting density, shorebird species composition, adult survival, nest success, brood survival, site fidelity, and natal philopatry. We also collect corrolary data such as snow melt-off, predator numbers, lemming numbers, and insect abundance and phenology.

When operational:

2003 to present, historic data from early 1950s to early 1980s, and 1993 and 1994.

Geographical coverage:

Barrow, Alaska, USA.

Data archive/centre:

In-house at USFWS, Migratory Bird Management, Anchorage, AK.

Data availability:

Data available but not on website. Specific requests for particular data would be needed.

- Metadata only: No response
- All data: No response
- Charge or no charge for data: No response

Main gaps:

No response.

## **Department of Interior (DOI)**

### **Minerals Management Service (MMS)**

#### **Question 1. a. How can the SAON SG best assist you?**

International meetings on Arctic Observing Networks for the exchange of ideas.

#### **b. What do you see as the role of the SAON SG?**

Assimilating information from all of the Arctic Observational Networks and communicating the findings from those efforts, including new technologies for the collection of data in the Arctic. Funding to test and deploy new under-ice instrumentation and AUV's. Develop remote power systems for the Arctic, since most of these areas are sparsely populated and far from the road systems making it very difficult to power and maintain the shore-based HF radar systems that are critical for an observation network.

#### **Question 2. What are the critical issues facing your observing program or data and information management program?**

Long term funding for this project is a critical issue. Present funding is limited to three years of fieldwork, which is insufficient to support an ongoing observing network and to establish community-based support system. A long term monitoring system is needed for this area since oil and gas exploration and development may continue for many years and the physical oceanographic processes need better understanding.

Developing technologies for under-ice measurements since, much of the year, the northeast Chukchi Sea is ice-covered (from November 20 through July 1). Develop and test remote power systems since many of the HF radar sites are at remote locations that are difficult to access and maintain.

Developing automated routines to process surface current measurements from HF radar returns in mixed ice conditions.

Working together to obtain an ocean circulation model that best fits Arctic wide conditions based upon other observing and modelling networks.

### **1. Application of High-Frequency Radar to Potential Hydrocarbon Development Areas in the Northeast Chukchi Sea: Physical Oceanography of the Chukchi Sea OCS**

Contact person:

At the U.S. Minerals Management Service (MMS), Warren Horowitz ([warren.horowitz@mms.gov](mailto:warren.horowitz@mms.gov)); at the University of Alaska Fairbanks, Institute of Marine Sciences, Dr. Thomas Weingartner, principal investigator ([weingart@ims.uaf.edu](mailto:weingart@ims.uaf.edu)).

Web site:

<http://www.ims.uaf.edu/hfradar/>

Main objective of the network:

Understanding the physical oceanography of the northeast Chukchi Sea through the collection of real time High Frequency Radar (HFR) surface current measurements from shore-based systems, deployment of sub-surface Acoustic Doppler Current Profilers (ADCP), and the use of Automated Underwater Vehicles (AUV). Providing oceanographic data sets for guiding the development and evaluation of ocean circulation, wave and oil spill trajectory models.

Member of or connected to a global network:

NOAA HF Radar Server and IOOS

Type of activity:

- Theme: Ocean, Coastal.
- Location: See attached map.
- Community-based: Working with the communities to set up HF radar systems.
- Coordination: Coordinating logistics with the local communities.

Main variables:

HF Radar: Surface current speed and direction, wave information, ADCP subsurface current speed and direction, temperature, depth, and conductivity, temperature and salinity profiles from AUV's, directional wave,

When operational:

Began first year of surface current data collection in September 2009. Data capture ended on November 15, 2009, at the end of the open water season. In 2010, HFR surface currents, ADCP's and gliders along with meteorological data are planned. Last planned field season is in 2011.

Geographical coverage:

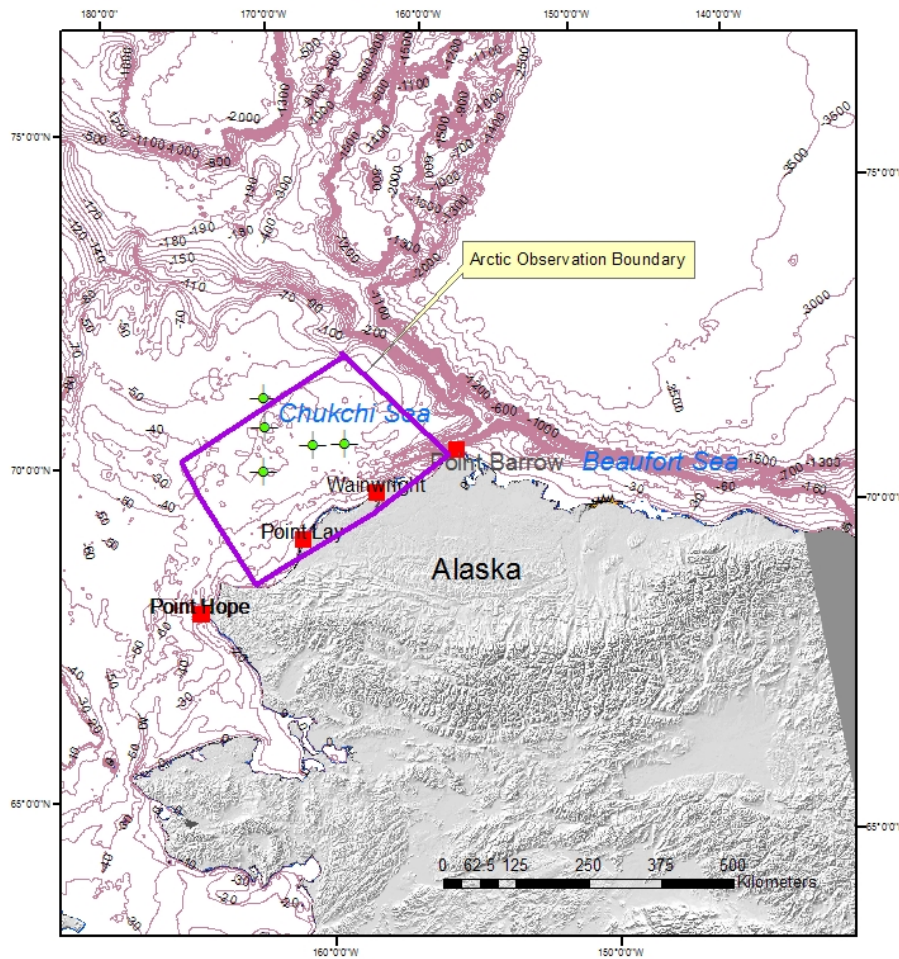
United States/Alaska

Data archive/centre:

<http://www.ims.uaf.edu/hfradar/D>

Data availability:

All of the data and metadata from this project will be released once the final report and database is completed. Real time data are available through the Web site during the open water season.



Location of high frequency radars (red squares) along the Chukchi Sea coast of northwest Alaska.

## 2. Beaufort and Chukchi Seas Mesoscale Meteorology Model

Contact person:

At the U.S. Minerals Management Service (MMS), Warren Horowitz ([Warren.Horowitz@mms.gov](mailto:Warren.Horowitz@mms.gov)); at the University of Alaska Fairbanks, International Arctic Research Center, Dr. Jing Zhang, [jzhang3@alaska.edu](mailto:jzhang3@alaska.edu).

Web site:

<http://mms-meso.gi.alaska.edu>

Main objective of the network:

1. Produce a geospatial surface meteorological database for the Beaufort and Chukchi Seas and the adjacent coastal areas by collecting available conventional and unconventional surface and atmospheric data and conducting field work;
2. Establish a well-tuned Beaufort/Chukchi seas mesoscale meteorology model through further modeling studies for the optimization and improvement of the model physics and configuration;

3. Conduct a long-term hindcast simulation with the optimized data-modeling system and produce a high resolution meteorological dataset for the Beaufort and Chukchi regions; and
4. Document the high-resolution climatological features of the Beaufort/Chukchi seas' surface winds, including an analysis of the interannual variability and long-term change, as well as the physical processes and mechanisms for shaping the Beaufort/Chukchi seas wind field climatology.

Member of or connected to a global network:

No

Type of activity:

- Theme: Atmosphere.
- Location: The red boundary in the attached map identifies the modelling domain.
- Community-based: No.
- Coordination: Coordinating data collection with private industry.

Main variables:

Observed and modeled wind speed, direction, temperature, relative humidity

When operational:

The mesoscale model will be operational in the later part of 2010 (5 year run).

Geographical coverage:

US and Russian waters (see map below).

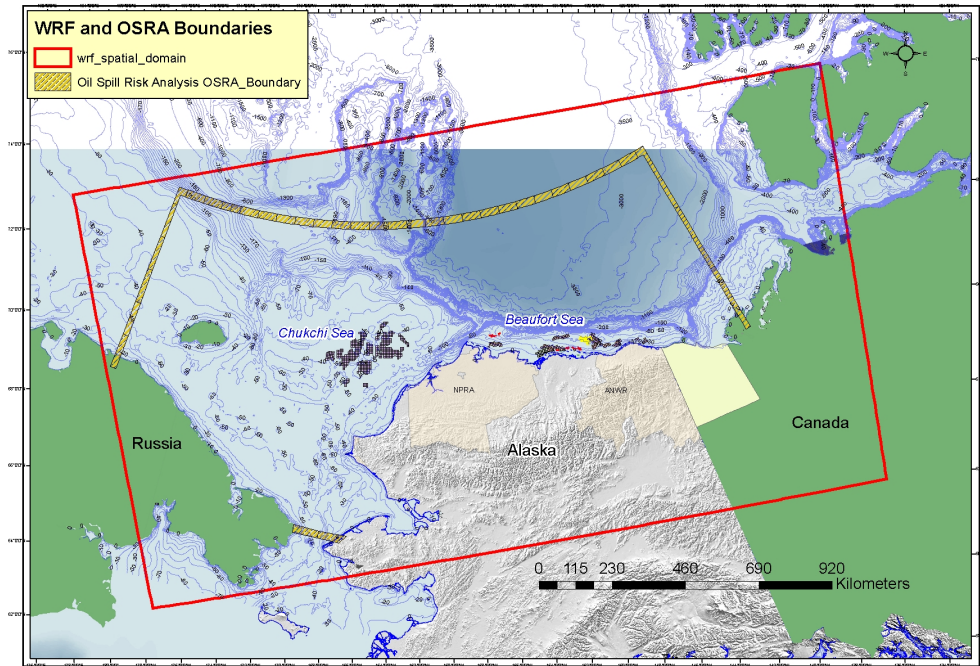
Data archive/centre:

<http://mms-meso.gi.alaska.edu>

Data availability:

Data will be available at the end of the contract period in 2013. The observational data may become available by the end of 2010.





Domain of the Beaufort and Chukchi seas Mesoscale Model (WRF).

**Department of Interior (DOI)**  
**National Park Service**  
**Inventory and Monitoring Program, Alaska Region**

- Question 1.** a. How can the SAON SG best assist you?  
 b. What do you see as the role of the SAON SG?

SAON SG can serve as a central place for information internationally on who is doing what in the Arctic with respect to inventory, monitoring, research, management, etc.

- Question 2.** What are the critical issues facing your observing program or data and information management program?
- 1) Ensuring continuity of the monitoring programs in the face of climate change;
  - 2) Integration of information across programs, agencies, and boundaries;
  - 3) Knowledge transfer as staff turns over.

Contact person:

Sara Wesser, [sara\\_wesser@nps.gov](mailto:sara_wesser@nps.gov)

Web site:

<http://science.nature.nps.gov/im/units/akro>

Main objective of the network:

To determine status and trend in the condition of selected natural resources in national park units in Alaska.

Member of or connected to a global network:

No response.

Type of activity:

- Theme:
  - Atmosphere
  - Cryosphere
  - Terrestrial ecosystem, including freshwater.
  - Marine ecosystem
  - Coastal
- Location: 16 Alaskan national parklands
- Community-based: No response.
- Coordination: No response

Main variables:

A suite of air, water, biological integrity and landscape indicators that are collectively called “vital signs”. For full list of “vital signs” see Appendix 2.

When operational:

2008.

Geographical coverage:

Alaska, USA. There are four networks, each encompassing activities in a set of national parks, preserves and other park lands:

- Arctic Network (ARCN): Gates of the Arctic, Noatak, Kobuk Valley, Cape Krusenstern, Bering Land Bridge.
- Central Alaska Network (CAKN): Yukon-Charley Rivers, Denali, Wrangell-St. Elias.
- Southwest Alaska Network (SWAN): Kenai Fjords, Lake Clark, Katmai, Alagnak Wild River, Aniakchak.
- Southeast Alaska Network (SEAN): Glacier Bay, Klondike Gold Rush, Sitka.

For a map of the networks and national parklands, go to:

Data archive/centre:

A data repository, <http://nrinfo.nps.gov>, is being developed in Fort Collins, CO, USA.

Data availability:

All data will be available at no charge.

Main gaps:

Not all data are currently available but we are working toward that goal. Funding limitations do not allow monitoring at detailed levels.

**Department of Interior (DOI)**  
**United States Geological Survey**  
**National Streamflow Information Program (NSIP)**

**Question 1.** a. How can the SAON SG best assist you?

SAON SG can best assist the USGS Arctic streamgaging network through advocacy and publicity. Government and funding agencies need continual reminders of the importance of long-term, continuous, accessible, documented and unbiased data.

b. What do you see as the role of the SAON SG?

No thoughts.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

Cyclical funding that doesn't recognize either inflationary cost increases in spite of a global recession or the high cost of working in the Arctic and other remote areas continually threatens continuous data collection. Differing and undocumented quality assurance can result in unrecognized errors that result from remote automated data collection in harsh climates.

Contact person:

David Meyer, [dfmeyer@usgs.gov](mailto:dfmeyer@usgs.gov)

Web site:

<http://water.usgs.gov/nsip/>

Main objective of the network:

The mission of the NSIP is to provide the streamflow information and understanding required to meet local, State, regional and national needs.

Member of or connected to a global network:

No.

Type of activity:

- Theme: Terrestrial ecosystem, including freshwater.
- Location: Alaska, <http://waterwatch.usgs.gov/?m=real&r=ak&w=map>
- Community-based: NO response
- Coordination: No response

Main variables:

Streamflow

When operational:

Since 1904.

Geographical coverage:

Alaska, <http://waterwatch.usgs.gov/?m=real&r=ak&w=map>

Data archive/centre:

<http://waterwatch.usgs.gov/?m=real&r=ak&w=map>

Data availability:

- Metadata: Not available online.
- All data: Available online.
- There is no charge for data

Main gaps:

Extremely sparse coverage in Alaska in general.

For additional information about USGS water resources programs and data, go to:

- Program Description: <http://alaska.usgs.gov/science/water/index.php>
- Contact: Steven Frenzel, [sfrenzel@usgs.gov](mailto:sfrenzel@usgs.gov)
- *Surface water* data availability: <http://waterdata.usgs.gov/ak/nwis/sw>
- *Water quality* data availability: <http://waterdata.usgs.gov/ak/nwis/qw>
- *Groundwater* data availability: <http://waterdata.usgs.gov/ak/nwis/gw>

**Department of Interior (DOI)**  
**United States Geological Survey (USGS)**  
**Benchmark Glaciers**

- Question 1.** a. How can the SAON SG best assist you?  
 b. What do you see as the role of the SAON SG?

No response.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

No response.

Contact person:

Shad O'Neel: [soneel@usgs.gov](mailto:soneel@usgs.gov)), Rod March: [rsmarch@usgs.gov](mailto:rsmarch@usgs.gov)

Web site:

<http://ak.water.usgs.gov/glaciology/>

Main objective of the network:

USGS operates a long-term "benchmark" glacier program to monitor climate, glacier geometry, glacier mass balance, glacier motion and stream runoff.

Member of or connected to a global network:

No

Type of activity:

- Theme: Terrestrial ecosystem, including freshwater & Cryosphere
- Locations: Gulkana and Wolverine glaciers, Alaska
- Community-based: No response
- Coordination: No response

Main variables:

Glacier mass balance

When operational:

1966

Geographical coverage:

Alaska

Data archive/centre:

- Alaska Science Center: <http://ak.water.usgs.gov/glaciology/index.html>
- World Glacier Monitoring Service (WGMS): <http://www.wgms.ch/dataexp.html>
- National Snow and Ice Data Center (NSIDC): <http://nsidc.org/>

Data availability:

- Metadata: No response
- All data: Available online
- No charge for data

Main gaps:

No response

## **Department of Interior (DOI)**

### **United States Geological Survey (USGS)**

#### **Permafrost**

More information about the following long-term observing activities will be available in due course:

#### **Permafrost**

1. Program Description: Real-time Permafrost and Climate Monitoring Network – Arctic Alaska, <http://data.usgs.gov/akcm/>
  - Data: <http://data.usgs.gov/akcm/station/list>
  - Contact: Frank Urban, [furban@usgs.gov](mailto:furban@usgs.gov)
2. Program Description: USGS Contributions to the Climate Change Science Program – Permafrost Monitoring, <http://geochange.er.usgs.gov/poster/permafrost.html>
  - Data: <http://esp.cr.usgs.gov/data/bht/alaska/>  
[http://nsidc.org/data/docs/fgdc/ggd223\\_boreholes\\_alaska/index.html](http://nsidc.org/data/docs/fgdc/ggd223_boreholes_alaska/index.html)
  - Contact: Gary Clow, [clow@usgs.gov](mailto:clow@usgs.gov)

## **Federal Aviation Administration (FAA) Automated Surface Observing System (ASOS)**

More information about the following aviation meteorology observing activities will be available in due course:

### **Automated Surface Observing System - Alaska**

- Program Description: [http://www.faa.gov/air\\_traffic/weather/asos/?state=AK](http://www.faa.gov/air_traffic/weather/asos/?state=AK)  
<http://www.nws.noaa.gov/asos/>  
<http://climate.gi.alaska.edu/Climate/Networks/ASOS.html>
- Data availability: Real-time only - <http://www.arh.noaa.gov/obs.php>  
<http://climate.gi.alaska.edu/Wx/current.html>
- Contact: Robert Lewis, Alaska Regional Administrator



## **National Oceanographic and Atmospheric Administration (NOAA) Alaska Ocean Observing System (AOOS)**

**Question 1.** a. How can the SAON SG best assist you?

Keep me informed of SAON activities about other Arctic network activities

b. What do you see as the role of the SAON SG?

To facilitate existing networks; support integration among them; advocate for filling major gaps.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

1. Sustainable funding, given federal budget challenges.
2. Managing expectations; they are huge and we face the very real issue of not being able to deliver.
3. Shifting landscape; everyone is getting into Arctic/climate change but it is very difficult to get a handle on what is really going on and facilitate coordination.
4. There is tremendous support for monitoring and observations, but agencies typically have not provided enough funding for it; consequently, we are losing platforms that the research community depends upon. For example, the 4 PMEL moorings in the Bering Sea always face uncertain funding, and the operation of USGS stream gauges is being discontinued.

### **1. Alaska Ocean Observing System (AOOS).**

Contact person:

Molly McCammon, Executive Director, [mccammon@aoos.org](mailto:mccammon@aoos.org)

Web site:

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

Main objective of the network:

To develop a coastal and ocean observing system in the Alaska region that meets the needs of multiple stakeholders by (1) serving as a regional data center providing data integration and coordination; (2) identifying stakeholder and user priorities for ocean and coastal information; (4) working with federal, state and academic partners to fill those gaps, including by AOOS where appropriate.

Member of or connected to a global network:

Global Ocean Observing System (GOOS)

Type of activity:

- Atmosphere
- Terrestrial ecosystem, including freshwater (river input)
- Marine ecosystem
- Coastal
- Ocean
- Cryosphere
- Human & socio-economic

Location:

Alaska coasts, estuaries, nearshore waters, and the ocean out to the 200 mile limit.

Community-based:

Statewide Alaska community.

Coordination:

AOOS plays a large role in coordinating multiple agency/entity activities.

Main variables:

Sea state, wind, waves, currents, circulation, temperature, salinity, nutrients, phytoplankton, zooplankton.

When operational:

Since 2004

Geographical coverage:

USA/Alaska.

Data archive/centre:

[www.aoot.org](http://www.aoot.org) hosted by the Arctic Region Supercomputing Center, University of Alaska Fairbanks.

Data availability:

- Metadata: Yes.
- All data: Not all data are available.
- Charge for data: There is no charge for available data.

Main gaps:

AOOS and the data center are statewide activities, but thus far, available funding has limited observations and models primarily the Gulf of Alaska.

**National Oceanographic and Atmospheric Administration  
(NOAA)  
Earth System Research Laboratory (ESRL)  
Physical Sciences Division  
Polar Observations and Processes  
(International Arctic Systems for Observing the Atmosphere, IASOA)**

Note: IASOA is not a NOAA program per se, but the primary coordinators are NOAA scientists.

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

No response

- Question 2.** What are the critical issues facing your observing program or data and information management program?

No response

Contacts:

Taneil Uttal, NOAA, [taniel.uttal@noaa.gov](mailto:taniel.uttal@noaa.gov)  
Lisa Darby, NOAA, [lisa.darby@noaa.gov](mailto:lisa.darby@noaa.gov)  
James Drummond, Dalhousie University, Canada, [james.drummond@dal.ca](mailto:james.drummond@dal.ca)

Web site:

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

Main objective of the network:

The main mission of the International Arctic Systems for Observing the Atmosphere (IASOA) is coordination of atmospheric data collection at existing and newly established intensive Arctic atmospheric observatories. Data of interest to the IASOA consortium include measurements of standard meteorology, greenhouse gases, atmospheric radiation, clouds, pollutants, chemistry, aerosols, and surface energy balances. These measurements support studies of Arctic climate change attribution (why things are changing), not just trends (how things are changing). IASOA is responsive to growing evidence that the earth system may be approaching environmentally critical thresholds within decadal time scales. The information from IASOA will not only enhance scientific understanding but will also support decisions by the global community regarding climate change mitigation and adaptation strategies.

Observatory locations:

Barrow, USA (71.323N, 156.609W), since 1973  
Summit, Greenland (72.58N, 28.48W), in partnership with the US National Science Foundation (NSF) since 1989

Abisko, Sweden (68.35N, 18.82E), since 1903  
Alert, Canada (82.5017N, 62.3297), since 1950

Cherskii, Russia (69N, 161 E), since 1989  
 Eureka, Canada (80.05N, 86.417W), since 1947  
 Ny-Ålesund, Norway (78.908N, 11.881E), since 1968  
 Pallas and Sodankylä, Finland (67.37N, 26.65E), since 1858  
 Tiksi, Russia (71.5N, 128.92E), since 1932

Member of or connected to a global network:

*Global Atmosphere Watch (GAW)*: Alert, Barrow, Ny-Ålesund (Zeppelin Mountain), Pallas, Summit

*Baseline Surface Radiation Network (BSRN)*: Barrow and Ny-Ålesund are full BSRN members, Alert and Summit are candidate BSRN members

*Arctic Monitoring and Assessment Programme (AMAP)*: Abisko, Alert, Barrow, Eureka, Ny-Ålesund, Pallas, Sodankylä, Summit and Tiksi

Type of activity:

Predominantly atmospheric measurements.

Main variables:

All observatories make year-round measurements of basic surface meteorological variables. Other measurements vary according to each observatories' research objectives. For more details, visit the IASOA Observatories-at-a-Glance table (Appendix 3 and also [http://iasoa.org/iasoa/index.php?option=com\\_content&task=view&id=85&Itemid=123](http://iasoa.org/iasoa/index.php?option=com_content&task=view&id=85&Itemid=123)).

When operational:

IASOA was initiated during IPY 2007-2009, but the contributing observatories went into operation often long before that.

Geographical coverage:

Pan-Arctic

Data archive:

Each observatory has its own data archiving method. The IASOA Web site has a data portal ([http://iasoa.org/iasoa/index.php?option=com\\_content&task=view&id=85&Itemid=123](http://iasoa.org/iasoa/index.php?option=com_content&task=view&id=85&Itemid=123)) with links to observatory data.

Data availability:

Varies by observatory. For more information, go the the IASOA Data Portal: ([http://iasoa.org/iasoa/index.php?option=com\\_content&task=view&id=85&Itemid=123](http://iasoa.org/iasoa/index.php?option=com_content&task=view&id=85&Itemid=123))

### Main gaps:

Not all observatories are members of established global networks such as GAW and BSRN. It is recommended that IASOA observatories that are not members of these global networks be evaluated for potential membership and that roadblocks to membership be investigated.

Other types of measurement gaps include, but are not limited to: (1) Radar-lidar pairs at each observatory to assess cloud properties; (2) Flux towers at each observatory for methane and CO<sub>2</sub> fluxes; (3) Aerosol measurements at each observatory; and (4) Surface and upper air ozone measurements at each observatory.

## **National Oceanographic and Atmospheric Administration (NOAA)**

### **Earth System Research Laboratory (ESRL) Global Monitoring Division (GMD)**

More information about the following long-term observing activities will be available in due course:

#### **Atmospheric Baseline Observatories – Barrow, Alaska**

- Program Description: <http://www.esrl.noaa.gov/gmd/obop/brw/>
- Data availability: <http://www.esrl.noaa.gov/gmd/dv/ftpdata.html>
- Contact: Bryan Vasel, [bryan.vasel@noaa.gov](mailto:bryan.vasel@noaa.gov)

#### **Arctic Atmospheric Observatories**

- Program Description: <http://www.esrl.noaa.gov/psd/arctic/search/>
- Data availability: <http://www.esrl.noaa.gov/gmd/dv/ftpdata.html>
- Contact: Taneil Uttal, [Taneil.Uttal@noaa.gov](mailto:Taneil.Uttal@noaa.gov)

**National Oceanographic and Atmospheric Administration  
(NOAA)  
Ecosystems and Fisheries-Oceanography Coordinated Investigations  
(EcoFOCI)**

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

Support the concept that long-term observations are critical to understanding climate-ecosystem interactions in the Bering Sea and in the Arctic Ocean.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

Funding is the primary issue. While moorings have been maintained since 1995 at M2 (and for a lesser time at the other sites), there is insufficient funding for future deployments after September 2010.

**1. EcoFOCI Moorings M2, M4, M5 and M8**

Contact person:

Phyllis Stabeno, [Phyllis.stabeno@noaa.gov](mailto:Phyllis.stabeno@noaa.gov)

Web site:

<http://www.ecofoci.noaa.gov/>

Main objective of the network:

The Bering Sea is an extremely rich ecosystem providing almost half of the US catch of fish and shellfish. EcoFOCI has four moorings (M2, M4, M5 and M8), which are an important component in the observational system, monitoring changes in the ecosystem. Data are used by ecosystem managers, modellers (model validation), and scientists. They provide critical information on the spatial temperature structure, timing of phytoplankton blooms, cold pool and presence of marine mammals.

Member of or/connected to a global network:

No.

Type of activity:

In order of importance:

1. Marine ecosystem
2. Ocean and coastal
3. Cyrosphere and Atmosphere
4. Human & socio-economic

Location: Eastern Bering Sea shelf:

M2 – 56.87°N, 164.05W

M4 - 57.85°N, 168.87W

M5 - 59.90°N, 171.70W

M8 - 62.19°N, 174.67W

Main variables:

Temperature, Salinity, Currents (300 or 600 KHz ADCP), Fluorescence (at 1-3 depths on each mooring), Meteorological variables (on M2 during May – September), Nutrients (0-2 depths on each mooring), Oxygen (M2), Zooplankton biovolume (from acoustic sensors on M2 and M5), Ice thickness (M4), Sound (passive listening devices primarily for marine mammals), Subsurface PAR (M4).

When operational:

These moorings are not operational, but have been maintained by a combination of NOAA program funds and non-NOAA funds. M2 has been maintained almost continuously since 1995, M4 in 1996 and almost continuously since 1998, M5 and M8 continuously since 2004.

Geographical coverage:

United States continental shelf (eastern Bering Sea shelf along the 70-m isobath).

Data archive/centres:

Pacific Marine Environmental Laboratory database: <http://ecofoci.noaa.gov>

Bering Sea Ecosystem Study (BEST) data archive maintained by the National Center for Atmospheric Research, Earth Observation Laboratory (NCAR EOL, contact: Greg Stossmeister) <http://www.eol.ucar.edu/projects/best/>

North Pacific Research Board (NPRB)/Bering Sea Integrated Ecosystem Research Program (BSIERP) database: [http://bsierp.nprb.org/data\\_portal.php](http://bsierp.nprb.org/data_portal.php) (contact: Igor Katrayev)

Data availability:

All data are available at no charge. During summer some real-time data are available from M2. Physical data are available within 6 months of recovery. Chemical and biological data are available approximately 12-24 months after recovery.

Main gaps:

Expanding instrumentation to measure ice thickness, nutrients, oxygen, PAR, zooplankton biovolume and atmospheric variables to all four of the mooring sites.

Increase vertical resolution of nutrients.

Expand measurements northward into the Chukchi and Beaufort Seas.

**National Oceanographic and Atmospheric Administration  
(NOAA)  
National Data Buoy Center (NDBC)**

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

No response

- Question 2.** What are the critical issues facing your observing program or data and information management program?

No response

**1. National Data Buoy Center (NDBC)**

Contact person:

Bill Burnett, [bill.burnett@noaa.gov](mailto:bill.burnett@noaa.gov)

Web site:

<http://www.ndbc.noaa.gov>

Main objective of the network:

To provide real-time marine meteorological, oceanographic and geophysical observations in real-time to the World Meteorological Organization's Global Telecommunications Service (GTS).

Member of a global network:

TAO, Weather, Tsunameter, IOOS, GOOS

Type of activity:

- Atmosphere
- Marine ecosystem
- Coastal
- Ocean

Location:

Bering Sea, North Pacific Ocean.

Community-based:

No.



Coordination:

No response.

Main variables:

Barometric pressure, wind speed, direction and gust, air temperature, ocean temperature, ocean current, wave height, period and direction, bottom pressure observations

When operational:

1975.

Geographical coverage:

Bering Sea, Alaska, USA

Data archive/centre:

National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov),  
National Oceanographic Data Center, [www.nodc.noaa.gov](http://www.nodc.noaa.gov),  
National Geophysical Data Center, [www.ngdc.noaa.gov](http://www.ngdc.noaa.gov)

Data availability:

No response.

Main gaps:

No response.

## **National Atmospheric and Oceanographic Administration (NOAA)**

### **National Ocean Service (NOS), Center for Operational Products and Services (CO-OPS).**

#### **Question 1a. How can the SAON SG best assist you?**

The NOAA/NOS Center for Operational Products and Services (CO-OPS) needs historical water level, tidal currents, and other oceanographic and meteorological data sets from all other countries as well as information on existing water level stations and data sources, if the information is available.

The type of product information we need in Arctic waters is:

1. Historical water level data, high and low water level values, hourly heights, monthly means of water level data, annual mean sea level;
2. Information on estimated relative mean sea level trends computed from long-term coastal water level station records;
3. Information on each nation's national vertical reference system. For instance, the U.S. uses Mean Lower Low Water (MLLW) as the NOAA Nautical Chart product reference datum. Other countries use their own reference datum or the international Lowest Astronomical Tide (LAT).
4. Information of the reference determination of local mean sea level for each nation. The U.S. defines coastal mean sea level using a 19-year tidal datum epoch (1983-2001).
5. Co-tide and co-range maps of the tides in the Arctic region if available, especially from Russia and Canada.
6. Sources of long-term meteorological measurements
7. Information on sources of coastal surface tidal and circulation currents and current profiles in the Arctic.
8. Information on geodetic vertical reference systems being used to tie in water level measurement systems (Geoid models, orthometric levelling datums, etc..)

In addition, SAON SG can inform CO-OPS of all the relevant activities that are being done or planned in Arctic so that CO-OPS can learn and collaborate with other partners. There is a particular need for improved technology to observe water levels on a continuous basis in the challenging arctic environment.

#### **Question 1b. What do you see as the role of the SAON SG?**

We see SAON SG role as a facilitator and moderator for data sharing and science activities and possibly data standards. The products derived from such activities/applications will benefit all countries.

**Question 2. What are the critical issues facing your observing program or data and information management program?**

1. Lack of adequate water level, tidal currents, meteorological, and vertical reference system information, as described above for question (1a), in Arctic areas.
2. Need to develop newer technologies and methodologies to collect year round water level and other oceanographic and meteorological data in Arctic regions. Currently, because of the ice and harsh environment, and also due to lack of proper infrastructure (piers, utilities, access, satellite coverage, terrain, etc.) CO-OPS can not collect year round data in Arctic waters. At present, we have only three sites – Prudhoe Bay, Red Dog and Nome in Arctic waters where we collect year round water level data because at those locations proper infrastructure is available to protect from the harsh environment and ice. If there are sites in Russia or Canada where adequate infrastructure is available, or water level data are collected, or technology exists for collecting year – round data such as sea bottom mounted sensors, etc., then CO-OPS would like to collaborate on those projects with SAON SG partners. What remote sensing systems are possible?
3. CO-OPS has limited knowledge of co-tide lines (co-phase and co-range) in U.S. waters in Arctic. It would help if Canada and Russia could provide similar information for Arctic waters in their territory so that we could share the data.

**1. National Water Level Observation Network (NWLON)**

Contact person:

Manoj Samant, [Manoj.Samant@noaa.gov](mailto:Manoj.Samant@noaa.gov)

Web site:

<http://tidesandcurrents.noaa.gov/>

Main objective of the network:

The NWLON is a network of long term stations whose fundamental purpose is to provide vertical control (tidal datums) that support a host of national requirements. In addition, the NWLON collects continuous water level data and provides observations and derived data products that support: marine transportation and navigation ( hydrographic charting surveys, shoreline mapping surveys, tide predictions, forecast water levels, real time observations, dredging projects, hazardous material spill response); global sea level rise studies, storm surge and tsunami detection and warnings, marine boundary determination (federal/state, state/private, state/state), coastal zone management activities, ecosystem restoration, and effective marine spatial planning.

Member of or connected to a global network:

Global Sea Level Observing System GLOSS; also member of International Hydrographic Organization Tides and Water Level Working Group for setting water level observing system and data standards for nautical charting.

Type of activity:

- Terrestrial ecosystem, including freshwater - Yes
- Marine ecosystem - Yes
- Coastal - Yes
- Ocean - Yes
- Human & socio-economic - Yes

-Location:

U.S waters including east coast, west coast, Alaska, Hawaii, selected Pacific Islands, Puerto Rico, Great Lakes and U.S. Virgin Islands

-Community-based:

No.

Coordination:

Not Applicable.

Main variables:

Water Level Data, Water temperature, Meteorological Data (wind speed/direction, air temperature, barometric pressure).

When operational:

In Alaska there are three stations. The entire NWLON network has 210 stations presently in operation in FY 2010. Many of these have data series that began in the 1840's and continue to the present. Each year, there are approximately 50-100 additional gages in operation for short term projects spanning months to years.

Geographical coverage:

United States of America/Alaska

Data archive/centre:

<http://tidesandcurrents.noaa.gov/>

Data availability:

- Metadata only: Yes
- All data: Yes
- Charge for data: No charge for data on the web, nominal charge for large quantity of data requested from CO-OPS for appropriate parties.

Main gaps:

Gap analysis report completed in FY2008 identifying gaps based primarily on providing vertical (tidal datum) control. Largest gaps in Arctic region – gaps in data and information in Bristol Bay, Bering Sea, Bering Strait, Chukchi Sea, and Beaufort Sea areas.

## 2. National Current Observation Program (NCOP)

Contact person:

Laura Rear, [Laura.Rear@noaa.gov](mailto:Laura.Rear@noaa.gov)

Web site:

<http://tidesandcurrents.noaa.gov/>

Main objective of the network:

The NCOP collects, analyzes, and disseminates observations and predictions of tidal currents for over 2,700 locations throughout the United States. The NCOP conducts annual tidal current surveys in various locations which deploy current meters for 30-90 days to acquire enough data to generate accurate tidal current predictions.

Member of or connected to a global network:

No

Type of activity:

- Terrestrial ecosystem, including freshwater - Yes
- Marine ecosystem - Yes
- Coastal - Yes
- Ocean - Yes
- Human & socio-economic - Yes

Location:

U.S waters including east coast, west coast, Alaska, Hawaii, selective Pacific Islands, Puerto Rico, Great Lakes and U.S. Virgin Islands

Community-based:

No

Coordination:

Not Applicable

Main variables:

Current speed and direction profiles.

When operational:

NOAA has been conducting tidal current surveys to update tidal current prediction tables since the 1800s.

Geographical coverage:

United States of America/Alaska

Data archive/centre:

<http://tidesandcurrents.noaa.gov/>

Data availability:

- Metadata only: Yes
- All data: Yes
- Charge for data: No charge for data on the web, nominal charge for large quantity of data requested from CO-OPS for appropriate parties.

Main gaps:

NOAA maintains tidal current predictions at approximately 2,750 locations. However, there are little historical data north of the Aleutian chain, and those data are very old.

## **National Oceanographic and Atmospheric Administration (NOAA) Russian-American Long-term Census of the Arctic (RUSALCA).**

**Question 1a.** How can the SAON SG best assist you?

Suggest a pathway for data integration from network to network.

**1b.** What do you see as the role of the SAON SG?

Be at least 50% composed of individuals in government entities, who will have the “ability “ to facilitate cooperation between the countries involved.

**Question 2.** What are the critical issues facing your observing program or data and information management program?

1. Long-term funding
2. Russian Federation and U.S. relations
3. Local (Alaska and Chukotka) disconnect from Washington’s and Moscow’s national policies.

### **1. Russian American Long-term Census of the Arctic (RUSALCA)**

Contact person:

Kathy Crane, Kathleen Crane; [Kathy.crane@noaa.gov](mailto:Kathy.crane@noaa.gov)

Web site:

[www.arctic.noaa.gov](http://www.arctic.noaa.gov)  
[www.oceanexplorer.noaa.gov/explorations/09arctic](http://www.oceanexplorer.noaa.gov/explorations/09arctic)

Main objective of the network:

Observe changes in the ecosystem, fluxes of heat, salt, nutrients, CO<sub>2</sub>, and methane from the seafloor to the atmosphere above, as a function of changing climate in the Pacific Arctic region from the Bering Strait north to the high Arctic.

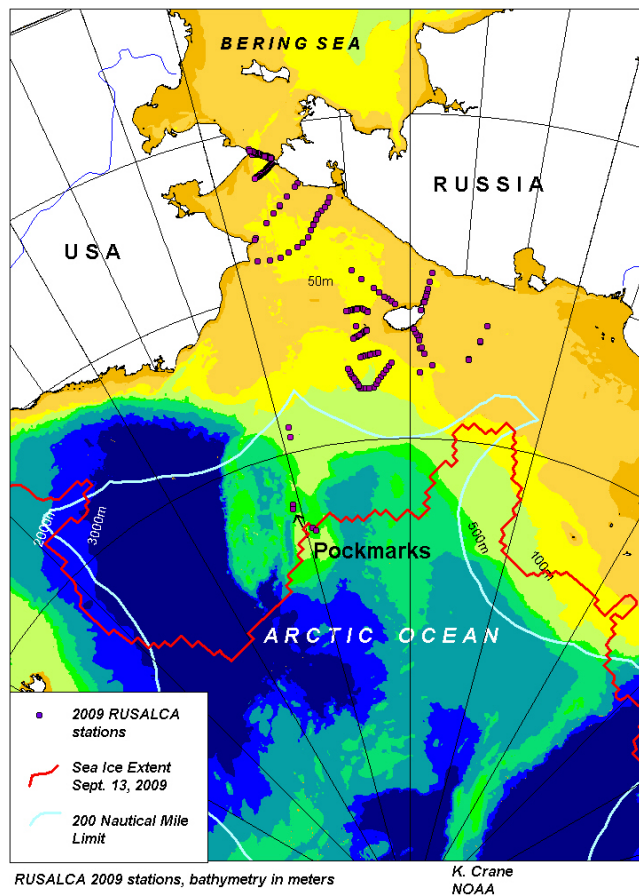
Member of or connected to a global network: Ocean Observing System.

Type of activity:

- Atmosphere
- Marine ecosystem
- Coastal
- Ocean
- Cryosphere

Location:

Bering Strait and north to the High Arctic (see map below).



-Community-based:

No

-Coordination:

U.S.-Russian Federation Science and Technology Agreement, MOU between NOAA and RAS on World Oceans and Polar Regions Studies.

Main variables:

Physical Oceanography, nutrients, productivity, CO<sub>2</sub>, CH<sub>4</sub>. Seafloor geology, benthic ecosystems, water column zoo and phytoplankton, fish (juvenile and adult), marine mammals, Microbiology.

When operational:

Yearly servicing of the Bering Strait moorings (a collaboration with the National Science Foundation, NSF), 4-5 year sampling of the ecosystem to monitor changes.

Geographical coverage:

USA-Russian Federation



Data archive/centres:

NOAA Office of Arctic Research, [www.arctic.noaa.gov](http://www.arctic.noaa.gov)  
Alaska Ocean Observing System, <http://www.aos.org>  
University of Washington (UW), <http://psc.apl.washington.edu/HLD/Bstrait/bstrait.html>  
Woods Hole Oceanographic Institution (WHOI)  
University of Alaska Fairbanks (UAF)

Data availability:

Physical Oceanography (R. Pickart, WHOI; R. Woodgate, UW) .  
Arctic Census of Marine Life (R. Hopcroft and B. Bluhm, UAF), <http://www.arcodiv.org/>  
No charge for data.

Main gaps:

So far unable to go far into the ice for investigation, although the geographical scope of the RUSALCA mission increased in 2009 because of the reduction of sea ice cover. (we were able to reach a northernmost site and to sample as far north as 77°30'N.

## **National Oceanographic and Atmospheric Administration (NOAA) National Weather Service (NWS)**

### **Alaska Region Headquarters**

<http://www.arh.noaa.gov/>

Weather station list and real-time observations

<http://www.arh.noaa.gov/obs.php>

Marine observations

<http://www.ndbc.noaa.gov/maps/Alaska.shtml>

Hydrology – Alaska Pacific River Forecast Center

<http://aprhc.arh.noaa.gov/>

### **Data availability**

Alaska Climate Research Center (ACRC)

<http://climate.gi.alaska.edu/Climate/index.html>

Western Regional Climate Center (WRCC)

<http://www.wrcc.dri.edu/index.html>

National Climatic Data Center (NCDC)

<http://www.ncdc.noaa.gov/oa/ncdc.html>

More information about NWS observing activities will be available in due course.

## **National Aeronautics and Space Administration (NASA)**

More information will be available in due course.

**National Science Foundation  
Division of Arctic Sciences  
Arctic Observing Network (AON)**

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

SAON can act as a facilitator of partnerships and synergies among (1) the observing ‘building blocks’ that need to be assembled to develop a pan-Arctic, multi-nation, research-driven observing network, and (2) the data archives and repositories that are necessary for long-term stewardship of data that are freely and openly available in a timely fashion to support research into understanding and predicting Arctic environmental system change.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

International cooperation is needed in two particular areas: (1) observing system/network designs to assist with network optimization, identification of observing site and data gaps, and to inform future investments in long-term, research-driven observing; and (2) adoption of an enforceable data policy for free, open and timely access to data that supports research into Arctic environmental system change.

**1. Arctic Observing Network**

Contact person:

Simon Stephenson, Director, Division of Arctic Sciences, [sstephen@nsf.gov](mailto:sstephen@nsf.gov)

Web sites:

Study of Environmental Arctic Change (SEARCH)

<http://www.arcus.org/search/index.php>

AON/SEARCH

<http://www.arcus.org/search/aon.html>

Cooperative Arctic Data and Information Service (CADIS)

<http://aoncadis.ucar.edu/home.htm>

Main objective of the network:

The overall goal of AON is to obtain data that will support scientific investigations of Arctic environmental system change. The observing objectives are to:

1. Maintain science-driven observations of environmental system changes that are already underway;
2. Deploy new, science-driven observing systems and be prepared for detection of future environmental system change;
3. Develop observing data sets that will contribute to (a) the understanding of Arctic environmental system change (via analysis, synthesis and modelling) and its connections to the global system, and (b) improved prediction of future Arctic environmental system change and its connections to the global system.

Member of or connected to a global network:

No.

Type of activity:

- Atmosphere
- Terrestrial ecosystem
- Ocean (including marine ecosystem)
- Cryosphere (including hydrology)
- Human & socio-economic
  
- Locations: Circum-Arctic, with emphasis on Alaska and the Arctic Ocean. Go to <http://arctic.utep.edu/aon/> for maps of specific locations.
  
- Community-based: AON includes some community-based observing, particularly in the Bering Sea region.
  
- Coordination: Yes, both within the network and with international partners, e.g., DAMOCLES (EU) and ArcticNet (Canada).

Main variables:

The following list is not exhaustive. Rather, it intended to give a good sense of the broad scope of the multi-disciplinary observing activities.

- *Atmosphere*: e.g., air temperature (surface, atmospheric profiles), snow depth, snow and atmospheric chemistry, cloud cover, cloud properties, radiation balance including UV.
- *Terrestrial ecosystem*: e.g., carbon/water/energy balance, plant phenology, plant community composition and abundance, stable isotopes and nutrients.
- *Ocean*: e.g., temperature/salinity/density, heat/salt/momentum fluxes, stable isotopes and nutrients, sea ice temperature and thickness, snow depth on ice, sea ice drift.
- *Cryosphere and hydrology*: e.g., active layer thickness and temperature, permafrost temperature, snow depth and density, river chemistry/isotopes/nutrients/discharge.
- *Human & socio-economic*: e.g., fisheries, marine mammal hunting, tourism, oil/gas/mining and marine transportation, community social indicators.

When operational:

NSF Long-term Arctic Observing (LTO) activities began in 1999. LTO was superseded by AON in 2007.

Geographical coverage :

Primarily USA (Alaska) and the Arctic Ocean, plus sites and partnerships in Canada, Greenland/Denmark, Iceland, Norway, Russia and Sweden.

Data archive/centre:

- CADIS (Cooperative Arctic Data and Information Service, <http://aoncadis.ucar.edu/home.htm>) and ELOKA (Exchange for Local Observations and Knowledge of the Arctic, <http://eloka-arctic.org/>) or others.
- AON scientists are encouraged to place their data with CADIS or with ELOKA. However, they can choose other options on condition that they are long-term and nationally- or internationally-recognized repositories, and complete metadata profiles are given to CADIS and ELOKA.

Data availability:

- Metadata: Yes. AON scientists are expected to develop full metadata profiles that conform to standards.
- Data: Yes. Complete data sets with full documentation are available at no charge.
- AON scientists are subject to the SEARCH data policy, i.e., they are community data with no embargo period. Consequently, scientists are expected to submit quality-assured/quality-controlled data as quickly as possible to a data repository.

Main gaps:

With NSF support, the SEARCH Observing Change Panel, with the assistance of the Understanding Change and Responding to Change panels, has formed an AON Design and Implementation (ADI) Task Force. Composed of Arctic and non-Arctic scientists with experience and expertise in scientific observing and observing system operation and design, the goal of the task force is to provide advice to the scientific community and NSF on observing system/network design options that are available for identifying gaps that hinder scientific understanding of Arctic environmental system change. The task force will hold two workshops and address two main objectives: (1) evaluate the current SEARCH science questions and observing priorities, and recommend new priorities in the light of the environmental system changes that have occurred since 2005; and (2) evaluate observing system/network design methods, including pilot projects and small-scale tests. A publicly available report will be released in summer 2010. It is anticipated that the report will be of interest to the broader Arctic science community, the governments of the Arctic countries and other countries, NGOs and numerous stakeholders.

## North Slope Science Initiative (NSSI), Alaska, USA

- Question 1.** a. How can the SAON SG best assist you?  
b. What do you see as the role of the SAON SG?

Interfacing with pan-Arctic observation systems to have linked access to both real-time and legacy monitoring sites for more accurate model development. The SG can add value by coordinating and articulating activities both on Arctic observing systems and data dissemination.

- Question 2.** What are the critical issues facing your observing program or data and information management program?

1. North Slope weather data collection is currently *ad hoc* at best. A systematic approach to data collection, data storage, data management, data dissemination, and equipment maintenance is critically needed for accurate assessment and prediction of weather and climate patterns.
2. Active layer depth and 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.
3. The implications and ramifications of changing North Slope vegetation are widespread and complex, and so interwoven with other management concerns that it would be helpful to develop a North Slope-wide plan for vegetation change detection and monitoring to produce a vegetation-change ramification model.

### 1. North Slope Science Initiative (NSSI) – General Description

Contact person:

John Payne, [jpayne@ak.blm.gov](mailto:jpayne@ak.blm.gov)

Web site:

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

Main objective of the network:

This mission of the North Slope Science Initiative is to improve the regulatory understanding of terrestrial, aquatic and marine ecosystems for consideration in the context of resource development activities and climate change. The vision of the North Slope Science Initiative 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

Type of activity:

Terrestrial ecosystem, including freshwater: Yes  
 Marine ecosystem: Yes  
 Coastal: Yes  
 Ocean: Yes  
 Cryosphere: Yes  
 Human & socio-economic: Yes

Location:

Entire North Slope of Alaska and the offshore continental shelf

Community-based:

Yes

- Coordination:

- University of Alaska Fairbanks, Geographic Information Network of Alaska
- Department of the Interior
- NOAA Fisheries
- North Slope Borough
- National Weather Service
- U.S. Arctic Research Commission
- State of Alaska
- U.S. Department of Energy

When operational:

NSSI started in 2005.

Geographical coverage:

Alaska, USA.

Data archive/centre:

[www.northslope.org](http://www.northslope.org); <http://catalog.northslope.org/>

Data availability:

All data are available at no charge.

Main gaps:

No information provided.



## 2. NSSI Stream Gaging Stations – Arctic National Wildlife Refuge

Contact person:

John Payne, [jpayne@ak.blm.gov](mailto:jpayne@ak.blm.gov)

Web site:

[http://waterdata.usgs.gov/ak/nwis/uv/?site\\_no=15955000&PARAMeter\\_cd=00065,00060](http://waterdata.usgs.gov/ak/nwis/uv/?site_no=15955000&PARAMeter_cd=00065,00060)  
[http://waterdata.usgs.gov/ak/nwis/uv/?site\\_no=15960000&PARAMeter\\_cd=00065,00060](http://waterdata.usgs.gov/ak/nwis/uv/?site_no=15960000&PARAMeter_cd=00065,00060)

Main objective of the network:

One station on the Tamayariak River measures tundra water flow. Another station on the Canning River measures flow from mountain discharge. Member of US Geological Survey National Water Information System.

Type of activity:

Terrestrial ecosystem, including freshwater

Location:

Tamayariak River, North Slope Borough, Alaska  
 Hydrologic Unit Code 19060501  
 Latitude 69°51'55", Longitude 145°35'34" NAD27  
 Drainage area 149 square miles  
 Gage datum 325 feet above sea level NGVD29

Location: Canning River, North Slope Borough, Alaska  
 Hydrologic Unit Code 19060501  
 Latitude 69°52'55", Longitude 146°23'09" NAD27  
 Drainage area 1,930 square miles  
 Gage datum 338 feet above sea level NGVD29

Main variables:

Discharge, Gage height, Precipitation, Air and water temperature

When operational:

Started in 2007.

Geographical coverage:

Alaska, USA.

Data archive/centre, including Web site:

[http://waterdata.usgs.gov/ak/nwis/uv/?site\\_no=15955000&PARAMeter\\_cd=00065,00060](http://waterdata.usgs.gov/ak/nwis/uv/?site_no=15955000&PARAMeter_cd=00065,00060)  
[http://waterdata.usgs.gov/ak/nwis/uv/?site\\_no=15960000&PARAMeter\\_cd=00065,00060](http://waterdata.usgs.gov/ak/nwis/uv/?site_no=15960000&PARAMeter_cd=00065,00060)  
[www.northslope.org](http://www.northslope.org)

Data availability:

All data are available at no charge

### **3. NSSI Climate Change/Vegetation Change and Fire Regime in Tundra Ecosystems**

Contact person:

Randi Jandt, [Randi\\_Jandt@ak.blm.gov](mailto:Randi_Jandt@ak.blm.gov)

Web site:

None

Main objective of the network:

In tundra areas of Alaska, we need to be able to ascertain that enough old-growth lichen-rich habitats remain for our caribou herds and that habitat diversity is maintained. Examination of long-term range monitoring transects previously deployed in remote tundra areas of Alaska on BLM lands show significant declines in available caribou forage lichens (which are highly sensitive to disturbance and slow-growing) for caribou and reindeer. Post-fire recovery of lichens may be prolonged or questionable under current climate conditions. The principal objective is to determine the magnitude of climate change impacts to tundra and boreal forest fire regime.

Type of activity:

Terrestrial ecosystem, including freshwater.

Location:

Northwestern Alaska reindeer grazing allotments affected by wildfire in 2007; North Slope area affected by large tundra fire in 2007; rapid change occurring in arctic plant communities important to wildlife.

Main variables:

Vegetation change and shifting fire regime.

When operational:

Started in 2007

Geographical coverage:

Alaska, USA

Data archive/centre:

None.

Main gaps:

No response.

## Appendix 1. Yukon Flats National Wildlife Refuge, Inventories, Projects and Archives.

### Yukon Flats National Wildlife Refuge (Alaska, USA)

US Fish and Wildlife Service

101 12<sup>th</sup> Avenue, Room 264

Fairbanks, Alaska 99701

Contact: Mark Bertram, Lead Wildlife Biologist

[Mark\\_Bertram@fws.gov](mailto:Mark_Bertram@fws.gov), 907-456-0446

Chapter 6 includes past and present projects including inventories.

Chapter 7 includes a more descriptive summary of ongoing and proposed projects and locations for data archives.

### 6.0 PAST AND PRESENT PROJECTS (Bolded titles are ongoing activities)

Projects are cross referenced with Section 7.0 - Descriptions of ongoing and proposed projects.

#### 6.1 Moose

##### *Western Yukon Flats*

- Trend surveys 1983, 1985-88, 1990-91
- Stratified, extrapolated population estimate, 1983 and 1986
- Population estimation (Gasaway method) 1992, 1996
- **Population estimation (GSPE method)** 1999-2001, 2003, 2004, 2006, 2008 (includes both fall (n=5) and spring surveys (n=4), (includes surveys of proposed land exchange parcels) annually conducted by Refuge. See Project 7.7.
- Intensive survey of Beaver and Fort Yukon Private lands – Conducted by ADF&G and CATG, 2008 (companion effort for bear estimation study schedule for May 2009)

##### *Eastern Yukon Flats*

- Trend surveys 1984, 1986-87, 1989-91
- Stratified, extrapolated population estimate, 1984 and 1989
- Population estimation (Gasaway method), 1995, 1997
- **Population estimation (GSPE method)** 1999-2001, 2004, 2008, (fall surveys=6, spring surveys=4), annually conducted by ADF&G and CATG (Refuge funded). See Project 7.7.
- Venetie Survey – conducted by ADF&G and CATG, fall 2004-2005
- Birch Creek Survey – conducted by ADF&G and CATG, fall 2006
- Moose telemetry studies conducted by Refuge and ADF&G, determined seasonal habitat use and movement patterns of adult moose, monitored calf survival and productivity and survival of adults,  
Western Yukon Flats-1983 (n=20), Eastern Yukon Flats-1989 (n=20)
- Moose calf and adult cow mortality study-conducted by Refuge, estimated survival rates of cows (n=30) and calves (n=63), estimated twinning rates, identified sources of predation, 1998-1999 (Bertram and Vivion 2002)
- ADF&G surveys contracted through CATG in 2000
- **Harvest data** - collected by CATG through Annual Funding Agreement, 2002 to present. See Project 7.22.

## 6.2 Bears

- The Refuge captured and marked 29 black bears in the western Yukon Flats, estimated home range, seasonal use, den length/emergence/entry, recruitment/reproductive interval, young/adult survival rate 1995-2001 (Bertram and Vivion 2002).
- **Bear estimation** - ADF&G and the Refuge scheduled to capture and mark 40 black bears and estimate population using mark/recapture methods, 2009/2010. See Project 7.13.
- **Harvest data** - collected by CATG through Annual Funding Agreement, 2002 to present. See Project 7.22.

## 6.3 Wolves

- **Wolf reconnaissance surveys** by ADF&G - 1983, 1984, 1992, 1997, 1999, 2000, 2001, and 2006 to estimate wolf density. 2-3 aircraft w/experienced trackers backtrack all fresh tracks encountered and estimate #wolves/pack. Next survey scheduled for March 2009. See Project 7.23.
- **Wolf kill rate study** - Refuge and ADF&G marked 14 wolves from 7 packs to estimate the kill rate by wolves on moose. See Project 7.12.
- **Harvest data** - collected by CATG through Annual Funding Agreement, 2002 to present. See Project 7.22.

## 6.4 Sheep

- **Population surveys** of the White Mountains Dall's sheep have been conducted by BLM, ADF&G and USFWS in 1970, 1977, 1982, 1986, 1989, 1991 to present). Since 1994 the sheep survey has been conducted through a coordinated effort with BLM and ADF&G. See Project 7.15.
- Conducted a reconnaissance flight of the Hodzana Highlands (northwest Refuge) and observed 10 sheep on the refuge boundary (1994)
- BLM and ADF&G monitored sheep movement in the White Mountains between 1983 and 1989. (n=10). Lambing, rutting, wintering, and mineral lick areas were documented in the Rocky Mountain, Mount Schwatka, and Victoria Mountain use areas.
- **Sheep movement study** initiated by Refuge, BLM, and ADF&G in 2004 to document sheep movements in the White Mountains (n=60). Emphasis on potentially affected habitats by proposed Yukon Flats land exchange. Study identified potentially sensitive sheep habitat, including mineral licks, lambing areas, rutting grounds, and access corridors between use areas. Data analysis ongoing. See Project 7.16.
- **Sheep harvest** monitored by ADF&G through registration permits.

## 6.5 Caribou

- **Population monitoring** ongoing for resident herds in the northwest (about 500) and southern borders (about 500) of the refuge, currently being monitored (aerial composition counts, telemetry to determine seasonal distribution by BLM and ADF&G)

## 6.6 Furbearers

- Cooperative furbearer track study with ADF&G to determine distribution and abundance of fox, marten, and lynx, and to develop an effective aerial survey technique, 1984-86.
- Beaver cache surveys to determine relative abundance of beaver, 1982-1988, 1991-2002.
- **Harvest data** - collected by CATG through Annual Funding Agreement, 2002 to present. See Project 7.22.

## 6.7 Upland game birds

No records of any specific inventory or monitoring.

## 6.8 Small mammals

- Pre/post burn small mammal inventory (snap trap) - 1985, 1986, 1989, 1991 to 1995, and 1997, conducted at 3 locations on western Yukon Flats.

## 6.9 Ducks

### Aerial Monitoring

**Waterfowl breeding pair surveys** conducted by Division of Migratory Birds, 1952 to present, (320 linear transect miles); part of a statewide survey conducted annually about May 18.

- Aerial monitoring by Refuge of fall staging areas (1986-1995, intermittent, primarily Ohtig Lake).
- Helicopter/fixed wing comparative waterfowl breeding population surveys, 1986-1988 by Division of Migratory Birds. These surveys developed sightability correction factors for waterfowl observed in fixed-wing aerial surveys.
- Expanded breeding pair surveys conducted by Division of Migratory Birds, 1989-1991 (2,670 linear transect miles), and 2000 (1,364 linear transect miles). These intensive surveys were initiated to better define waterfowl density distribution in response to proposed oil and gas development activities on the refuge. Findings from 1991 survey published in the Wildlife Society Bulletin in 1995.
- Waterfowl breeding pair surveys conducted by Refuge, 1984 to 1989, 1994, 1996, 2001 to 2005 (480 linear transect miles). Established by Refuge to establish a larger sample size and increase precision of estimate. Terminated in 2005.
- Waterfowl inventory survey conducted by Refuge on 350 ponds in eight townships in southern Refuge in response to proposed oil and gas development activities, 2000.
- Scoter/scaup breeding pair survey conducted by Division of Migratory Birds 2001 to 2005 (transect line volume 262 square miles). Survey temporally designed to be conducted during the greatest presence of scoters.
- **Scoter/scaup breeding pair survey** conducted by Refuge, 2007 to present. Protocol mimics Division of Migratory Birds Statewide breeding pair survey. See Project 7.2b

### Ground monitoring

- Production surveys conducted on 34 ponds by Division of Migratory Birds 1965-1985.
- Expanded production surveys conducted by Refuge, 11 - 4 square mile plots, 250 ponds, 1984-1989.
- Monitored brood production at Canvasback Lake and Marten Island (1992-1997).
- Brood production surveys of historical brood production plots, conducted by Refuge, 1999-2000.
- Statewide production surveys conducted by Division of Migratory Birds and Refuge 1990 (11 plots, 44 square miles, 243 ponds) to 1991 (20 plots, 80 square miles, 505 ponds), included helicopter survey of low density plots in 1990 to 1991 and all plots in 1992 (39 plots, 78 square miles) in 1992.

### Banding

- Division of Migratory Birds banded 23,500 ducks (majority divers) from 1953-1962. Focus of project was collecting baseline data to address the proposed Rampart Dam Project.
- Reconnaissance banding by Refuge of lesser scaup breeding females and young at Canvasback Lake 2000-2001.
- Refuge banded 6,489 ducks (majority dabblers: 46% pintails and 44% green-winged teal) 1989-2000.

- Student Intern Bryce Lake analyzed distribution and survival of waterfowl banded on the refuge 1989-1997. Published findings in Journal of Wildlife Management in 2006 "Survival of ducks banded in the boreal forest of Alaska."
- **Scaup banding program** scheduled to initiate by Refuge in 2009. Unfunded in 2009. See Project 7.3.
- **Avian influenza surveillance monitoring**, target species pintail and scaup, 2006 to present. See Project 7.5.

#### Research Projects

- "Relations between waterbird use and the limnological characteristics of wetlands on Yukon Flats National Wildlife Refuge, Alaska." M.S. thesis by Pat Heglund, University of Missouri, 1988.
- "Habitat use and activity patterns of interior Alaskan waterbirds." M.S. thesis by Kent Van Horn, University of Missouri, 1991.
- Fecal samples collected and tested for H4N6 (46 of 103 positive) and H3N8 (7 of 53 positive) avian virus by Hakkaido University.
- "Patterns of wetland use among aquatic birds in the interior boreal forest region of Alaska." Ph.D. dissertation by Pat Heglund, University of Missouri, 1992.
- Reproductive ecology of pintails in the Yukon Flats by Barry Grand and Dan Esler, USGS, 1989-1991.
- Scoter telemetry study conducted by Southeast Fish and Wildlife Field Office to measure contaminants (cadmium emphasis), attempted to determine if white-winged scoters were frequenting areas with elevated cadmium, 100% transmitter failures, 1995.
- "Lesser scaup nesting ecology in relation to water chemistry and macroinvertebrates on the Yukon Flats, Alaska." M.S. thesis by Robin Corcoran, University of Wyoming, 2005.
- "Breeding ecology of white-winged scoters on the Yukon Flats, Alaska." M.S. thesis by David Safine, University of Alaska Fairbanks, 2005.
- "Breeding ecology and fasting tolerance of scaup and other ducks in the boreal forest of Alaska." M.S. thesis by Kate Martin, University of Alaska Fairbanks, 2007.
- **"Relationship Between Physiological Condition and Reproduction of Lesser Scaup."** M.S. thesis by Kristin DeGroot, University of Alaska Fairbanks, 2007 to present. See Project 7.14.
- **Harvest data** collected by CATG in 2000.

#### **6.10 Swans**

- **Refuge wide swan census** every 5 years, conducted by Division of Migratory Birds and Refuge, 1975 to present. See Project 7.1.
- **Swan estimates** are calculated in aerial loon production survey conducted annually by Refuge, 2007 to present. See Project 7.2b.

#### **6.11 Geese**

- Aerial riverine goose production surveys were conducted on the Yukon River to determine feasibility of counting goose broods from the air, 1985-1988, 1992.
- Sampled 30 goose eggs for USGS study to develop DNA population indices for Lesser and Taverner's Canada geese in Alaska, 2002.

#### **6.12 Loons**

- Aerial line transect survey conducted by Refuge, 480 linear transect miles and included estimated population with confidence intervals, 1988. Methods later published: Lanctot, R.B., and P.X. Quang. 1992. Density of loons in central Alaska. Condor 94(1):282-286.

- **Statewide waterfowl breeding pair surveys** (includes loons) conducted by Division of Migratory Birds, 1952 to present, and in Refuge breeding pair surveys, 1984 to 1989, 1994, 1996, 2001 to 2005.
- **Annual aerial loon production survey** conducted by Refuge in August using same protocol as scoter/scaup survey, 2007 to present. See Project 7.2b.

#### 6.13 Passerines

- Point counts conducted at 3 sites, 1993 to 2002.
- Breeding bird survey on the Porcupine River, 1993 to 2002.
- Monitoring Avian Productivity and Survivorship (MAPS) at Canvasback Lake, 1995 to 2001.
- A statewide effort to monitor landbirds, Alaska Landbird Monitoring Survey (ALMS) has been proposed by USGS and Div of Mig Birds but the effort has not been funded.
- "Timing of breeding and reproductive success in a subarctic population of yellow warblers (*Dendroica petechia*)." M.S. thesis by Kristine Sowl, University of Alaska Fairbanks, 2003.
- **"Breeding ecology, habitat associations, and foraging ecology of an imperiled songbird, the Rusty Blackbird,"** conducted by Alaska Bird Observatory with logistic support from the Refuge at Shack Lake, 2009-2011. See Project 7.6.

#### 6.14 Raptors

- Middle Yukon River survey 1981-1991 by Endangered Species.
- Reconnaissance flight to potential falcon habitats, 1993.
- **Porcupine river survey** 1979 to present by Arctic Refuge (includes monitoring of 6 to 8 falcon eyries on the Refuge).

#### 6.15 Other migratory or resident birds

- Refuge Checklist migratory Bird observation program, recorded general abundance of migratory birds incidental to other refuge field programs, 1993 to 2003.
- Some incidental information gathered during duck breeding population surveys.

#### 6.16 Fisheries

- Hodzana River Fisheries Study by FFWFO (Reed Glesne), in response to potential mineral development proposed by Doyon, Limited., 1983-1984.
- Lake Fishery Study by FFWFO (Reed Glesne). Focus was on 37 upland and lowland lakes in the southcentral Yukon Flats, collected fish and water quality measurements, 1984-1986.
- **Sonar chum salmon escapement study** - by FFWFO, Chandalar River assessment and monitoring of salmon stocks, 1986-present. See Project 7.17.
- Aerial salmon surveys by FFWFO (Patty Rost), to assess salmon presence in Refuge drainages (Beaver and Birch creeks, Dall, Hodzana, Hadweenzic, Chandalar, Sheenjek, Black and Little Black rivers), 1984-1986.
- Baseline fisheries investigations on Little Black River and Beaver, Birch, and Preacher creeks, conducted by FFWFO and Refuge, 1994-1995.
- "Seasonal movement and length composition of Northern Pike on the Dall River," conducted by ADF&G (John Burr), 1999-2001.
- Sheefish monitoring on the Yukon River by FFWFO (Randy Brown), 1997-1999.
- Salmon monitoring by FFWFO and National Marine Fisheries Service (John Eiler) to evaluate movement of chum and king salmon on the Yukon River through the Yukon Flats, 1997-1999.
- "Beaver dam influence on fish distribution in lentic and lotic habitats in the Black River drainage, Alaska," conducted by FFWFO (Randy Brown) and CATG, 2001.



- Fisheries inventory of Burman Lake and 12 lakes in the core land exchange parcel by Refuge in response to the proposed land exchange, 2004.
- “Developing ecological escapement goals for pacific salmon: Role of marine-derived nutrients in the health and sustainability of resident and anadromous fishes of the Yukon drainage.” P.h.D. project by Chrissy Apodaca, University of Alaska Fairbanks, 2006. Status: incomplete, student withdrew from project in 2007.
- Beaver Creek Reconnaissance Fish Survey, contracted by ENSR/LGL in 2007. Initiated to fill data gaps in the DEIS for the proposed land exchange, the refuge has not received a copy of the summary report.
- “Characterization and dynamics of peripheral aquatic habitats in the middle Yukon River drainage, pilot study to collect baseline fish presence data to address future potential to model fish habitat in response to climate change,” conducted by University of Alaska Fairbanks (Stan Triebenbach), 2008. Status: incomplete, student withdrew from project in 2008. See Project 7.18.
- **Salmon harvest subsistence survey** conducted annually by the Refuge.

### 6.17 Habitat

- U.S. Forest Service Forest Inventory Plots, early 1980's
- Plant inventory conducted by Steve Talbot, ground truth data for Refuge vegetation classification map, ~1985.
- Northern Alaska vegetation and climate change history study on Arctic and Yukon Flats refuges by University of Washington (Mary Edwards), extracted two lake bottoms cores to measure fossil pollen, 1981 and 1993.
- Fire effects monitoring and vegetation/fuel surveys conducted by Refuge at Marten Island, Plot G and Plot D, 1985-1996.
- “Fluvial Geomorphology of the Yukon River, Yukon Flats, AK.” M.S. thesis by David Clement, University of Calgary, Alberta, Canada, 1999.
- Prescribed burns (fuel reduction and habitat enhancement objectives) conducted by Refuge and AFS in 1989, 1998 (Birch Creek), 1999 (Venetie, Beaver, Birch Creek, Stevens Village), 2000 (Venetie), 2001 (Beaver). Total acres burned: 3,600.
- Baseline contaminants investigations (sediments, water quality, fish) work on Beaver, Birch, and Preacher creeks and Chandalar and Hodzana rivers, collected by FFWFO and Refuge, 1986-1988, 1991.
- Moose habitat reconnaissance work conducted 1999-2001 by Refuge and ADF&G. Developed sampling methods to measure moose browse consumption. Nutrient analysis of browse collections incomplete. Collected samples of Willow leafblotch Miner. Published guide “Willows of the Yukon Flats” and “Biology of Willow leafblotch Miner in Alaska.”
- Vegetation (native and non-native) surveys in wetland, riparian, upland, steppe-bluff, and alpine habitats, 2000, 2003, 2005 and 2007.
- Biotic assessment conducted of land parcel in southcentral refuge proposed to be conveyed to Doyon in land exchange. Activities included assessment of 12 lake areas including passerine point counts, fish sampling, plant collected, water quality assessment, and bathymetry, 2003.
- Burned Area Emergency Response (BAER) Project - The project was implemented in response to the 2004 and 2005 fire seasons and included: fire severity and fire perimeter mapping, funds to purchase SPOT imagery of the 2004 burns, and invasive plant surveys in areas where fire suppression occurred.
- “Characterizing large river history with shallow geophysics: Middle Yukon River, Yukon Territory and Alaska.” Duane Froese et al. 2005.

- Refuge vegetation map produced by USGS. The product meets the requirements for the National Land Cover Database (NLCD) 2001 project administered by the U.S. Geological Survey (USGS) through the Multi-Resolution Land Characteristics (MRLC) consortium group, 1991-2006.
- National Wetlands Inventory Map completed by USFWS in 2007.
- **Contaminant monitoring of northern pike in the Yukon River** - conducted by FFWFO, measures methy-mercury levels in northern pike, 2007 to present.
- **Beaver creek water quality monitoring** - Refuge deploys two water quality multi-meters on Beaver Creek annually during ice free months; objective is to establish baseline limnological measurements for future response to potential oil spills on Beaver Creek, 2006 to present. See Project 7.14.
- **Estimate moose browse production and browse removal** for the western Yukon Flats (Game Management Unit 25D West ). To be conducted or supervised by Refuge, scheduled for implementation in 2010. See Project 7.11
- **“Yukon River Floodplains: Vegetation composition and structure of early successional stands in relation to terrace age, soil properties, and moose herbivory.”** M.S. thesis by Delia Vargas Kretsinger, University of Alaska Fairbanks, 2008 to present. See Project 7.1.
- **STATSGO (broad scale) and soil maps (fine scale)** - conducted by NRCS with Refuge collaboration 2008 to 2014.

Climate change related work:

- “Using remote sensing to examine changes of closed basin surface water area in Interior Alaska from 1950 – 2002.” M.S. thesis by Brian Riordan, University of Alaska Fairbanks, 2002. First research to analyze water changes in pond basins in the Yukon Flats.
- **“Magnitude, rate, and heterogeneity of lake drying in wetlands on National Wildlife Refuges in Alaska,”** Objectives are: a) identify mechanisms associated with drying effect, b) estimate potential implications of drying effect on wildlife habitat, and c) ground truth for remote sensed drying trends. Ph.D. project by Jennifer Roach, University of Alaska Fairbanks, 2006 to present (Field work on Yukon Flats conducted in 2006). Funded through Science Support Proposal.
- **Alaska frame based ecosystem code (ALFRESCO)** – successional dynamics model that simulated the response of subarctic vegetation to a changing climate and disturbance regime, primary use to identify fire-prone areas on the Refuge, completed by University of Alaska Fairbanks (Scott Rupp and Anna Springsteen), 2008. See Appendix 2.
- **“Implications of climate variability for optimal monitoring and adaptive management in wetland systems.”** This 2008 funded Refuge Cooperative Research Project (RCRP) identifies the level of monitoring necessary to detect changes over time in migratory trust species. The Refuge is one of four Alaska refuges participating in the project.
- **“Monitoring wetland birds and their habitats on the Yukon Flats.”** The goal of this project is to examine recent signals of climate change on Yukon Flats wetlands; identify the significant physical and ecological processes that occur in wetlands; and determine what consequent effects these processes have on wetland habitats and ultimately the numbers and distribution of waterfowl and other waterbirds. Although largely unfunded, tasks in this project are moving forward and it is the Refuges intention to include this project in the following funded USGS directive (immediately below). See Project 7.2a, 7.2b, 7.2c, and 7.2d.

- **“Effects of climate change on the Yukon River Basin: Changes in water and implications for wildlife habitat, human subsistence, and climate regulation.”**  
This national multi-year directive will be implemented in 2009 by USGS in collaboration with the Refuge. This project will include priority tasks identified in the unfunded proposal immediately above. One of the goals of this project is to model projected outcomes to wetland resources as a result of climate change; the Refuge plans to use this project as a framework to initiate a long-term wetland monitoring program for the Refuge. See Project 7.21.

#### 6.18 Climate

- **Snow monitoring** – 3 snow markers are monitored annually by Refuge in collaboration with NRCS (Figure 12). See Project 7.19.
- **Weather monitoring** – 8 Remote automated weather stations (RAWS) are in seasonal operation. An addition 5 RAWS are located near the refuge boundaries (Figure 12).
- **2-3 Meteorological Station** are proposed for installation in the Yukon Flats in 2010 in support of Yukon River Basin proposal described in habitat section above.

### 7.00 DESCRIPTIONS OF ONGOING AND PROPOSED PROJECTS

#### 7.1 Trumpeter swan breeding population survey (Ongoing)

Principal Investigators: Office of Migratory Bird Management

Collaborators: Yukon Flats Refuge

Questions:

- 1) What is the population of trumpeter swans on the Yukon Flats stratum and in Alaska?
- 2) What is the trend in swan counts on the Yukon Flats stratum and in Alaska?
- 3) What is the proportion of juveniles to adults in the fall flock?

Objectives:

- 1) Determine the number of swans on the Yukon Flats stratum and in Alaska.
- 2) Estimate the ratio of juvenile to adult swans.

Management Implications: Information obtained from the count of trumpeter swans in Alaska is the primary means by which managers measure the population objective. Accordingly, this survey is a priority of the Pacific Flyway management plan for trumpeter swans.

Geographic Inference: Sampling on the Yukon Flats stratum occurs throughout the Refuge. Sampling occurs elsewhere on 10 strata distributed across Alaska.

Methods: Swans are counted on linear transects from fixed-wing aircraft at 150m altitude. The survey takes place every five years during late summer and early fall.

Project Start: 1968

Project End: Sampling occurs every five years (next survey 2010).

Product: Report written by the Office of Migratory Bird Management.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Swan Surveys	0	40	0	5K

Data management method status (paper files only, spreadsheet, database): Data are archived and stored at Office of Migratory Bird Management offices.

Data analysis status and use (last time summarized, synthesized, or analyzed): Data are summarized by Division of Migratory Birds in a report (recently analyzed in a Ph.D. dissertation).

## **7.2 Monitoring wetland birds and their habitat on Yukon Flats (Ongoing)**

Project overview and management implications:

One of the purposes for establishing the Refuge was due to the importance of its wetland habitats to migratory waterbirds. Drying of these wetlands over the past 50 years has been documented by Riordan (2006) and Corcoran (2005), and drying trends are predicted to persist into the future due to increased temperatures (Springsteen 2008 *Manuscript in prep.*). Loss of water due to increased evapotranspiration is predicted to exceed the predicted increase in precipitation, causing a net drying effect, which will cause increased fire frequency, permafrost degradation, and drying and draining of soils and wetlands. Drying is apparent when visiting the Refuge, with rings of shrub succession surrounding wetlands and dry meadows in the shape of waterbodies providing visual evidence.

It is important for the refuge to establish long-term data sets of wetland bird populations and habitats in order to monitor changes in trust resources. Large scale ecological shifts from wetlands to more terrestrial habitats are predicted for Yukon Flats, and managers need to understand how such shifts will impact species and habitats for which they are currently managing. For example, if wetlands continue to dry at rates similar to those observed recently, will Refuge management objectives change to focus on terrestrial species or will we intervene to preserve wetland habitats? The population status of wetland birds, and the relative importance of Yukon Flats as breeding grounds to such populations will be an important factor in determining future management in the face of climate change.

The following four tasks are in varying stages of development. Some tasks are completed annually as part of the Refuge's annual monitoring program, such as the scoter, scaup and loon surveys (Task 2). Some tasks are in the early development pilot phase, such as the wetlands inventory and classification effort (Task 1), while others are still in the planning stages (Tasks 3 and 4). Tasks are presented together, as a part of this overall project of Wetland Birds and Their Habitats, to emphasize the level of integration among inventory, monitoring and research projects. This integrated project was originally packaged in a proposal prepared by Joel Schmutz (USGS – Alaska Science Center, Anchorage, AK) for the Refuge Cooperative Research Program Request for Proposals, 2008. The Refuge and USGS has proceeded with the below tasks, though funding was not received.

## 7.2a Task 1: Yukon Flats Wetlands Inventory and Classification (Ongoing)

Principle Investigators: Yukon Flats Refuge, USGS, Geology and WRD, Denver, CO

Collaborators: USGS – Alaska Science Center, USFWS – Region 3, NPS, Fairbanks

### Objectives:

- 1) Inventory wetland water chemistry and associated vegetation to document landscape variation across Yukon Flats.
- 2) Determine hydrological connectedness of wetlands using  $O_{18}$  isotope analyses.
- 3) Examine relationships among limnological parameters, vegetation, landscape parameters (GIS parameters) and hydrological connectedness of wetlands.
- 4) Apply Heglund's (1992) classification, or a modified classification, to Yukon Flats using satellite imagery.
- 5) Develop a spatially explicit model to predict hydrological connectedness across Yukon Flats.

Management Implications: Yukon Flats is a uniquely diverse wetland system relative to other areas in interior Alaska. Previous work has identified a wide range of wetland conditions from freshwater herb bogs (ombrotrophic, low nutrient concentrations, few aquatic plants, and narrow littoral zones with a quick transition to terrestrial forest communities) to brackish sedge marshes (high nutrient concentrations, extensive aquatic plant communities, extensive littoral zones with gradual transitions to sweeping meadows), to the unique "trona" alkali wetlands (milky white, highly eutrophic and brackish wetlands void of aquatic vegetation, with adjacent deposits of sodium bicarbonate and meadow vegetation dominated by species adapted to such conditions) (Heglund 1992). This range of wetland conditions provides diverse habitats with varying importance to different species at different times of year.

Documenting and mapping these different wetland types is critical to identifying biologically important, rare, or threatened habitats. This inventory and mapping project is the first step in landscape scale waterbird habitat work and in defining the ecological roles of these wetlands. Wetlands inventory and mapping products will be used to determine bird habitat associations and to extrapolate wetland bird habitat information to the Refuge scale.

Knowledge of the distribution of these habitats and their ecological roles will be critical to making informed management decisions, such as realty transactions, land trades, access requests, fire management decisions, etc. Information will also be used as a baseline for detecting and documenting future wetland change.

Geographic Inference: The study area was delineated to include most wetlands within and adjacent to Yukon Flats (Figures 1 and 2). It includes Refuge and private lands to allow for geographically seamless data.

Methods: Methods are in development. The study area was divided into 4 strata. Strata were delineated based on natural divisions of geography, topography and hydrology. Given the large size of the Refuge, strata are used as sampling panels, with 1 – 2 strata sampled per year. This allows for inferences to be made per strata prior to completion of the entire project.

A sample grid, with a grid cell size of 2.8 km (grid cell area = 778 ha), was overlayed on the study area. The grid was aligned with the loon, scoter and scaup aerial transects (Figure 2, see Task 2) to aid in easy integration of wetlands and bird data for habitat analyses. Grid placement was assumed random since bird aerial transects were selected with a systematic random design.

Ten percent of the grid cells per strata were randomly selected for sampling. In the event that a randomly selected unit was not accessible with a float plane, the next closest accessible unit was sampled. Units not accessible by float plane will be sampled with a helicopter. Grid cells were also opportunistically sampled to allow for sampling of unique habitats.

In 2008, 39 wetlands were sampled during the 2008 pilot year. Grab samples were taken to measure water chemistry parameters (CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>, DIC, DOC, O<sub>18</sub> isotopes, tritium isotopes, alkalinity, UV, temperature, specific conductivity, depth, major cations (Ca, Mg, Na, K) and major anions (NO<sub>3</sub>, SO<sub>4</sub>, NH<sub>4</sub>)), dominant vegetation communities were recorded, and aerial photos were taken.

Wetlands will be classified according to Heglund (1992) based on vegetation and specific conductivity. Water chemistry parameters will be correlated with classes to determine the strength of the classification. Data collection methods will be refined based on pilot findings.

Use of satellite imagery, aerial photography and the National Wetlands Inventory will be explored as a means to extrapolate the classification to the entire study area.

Project Start: 2008

Project End: 2011

Product:

- 1) Annual and final reports of findings.
- 2) A GIS data layer of classified wetlands.
- 3) A GIS data layer of sampled wetlands with linked tabular water chemistry data.
- 4) A GIS data layer of hydrologic connectedness.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Wetlands Inventory	10	20	10	10K

Data management method status (paper files only, spreadsheet, database): Data will be stored at USGS - Colorado and Yukon Flats in spreadsheets, databases and GIS data layers.

Data analysis status and use (last time data summarized, synthesized, or analyzed): Pilot work was completed for this project in 2008. Data is currently being analyzed and an annual report is forthcoming. Future years data to be analyzed collaboratively.

## **7.2b Task 2: Monitor Loon, Scoter, and Scaup populations (landscape focus) (Ongoing)**

Principle Investigators: Yukon Flats Refuge, USGS – Alaska Science Center

Objectives:

- 1) Estimate loon, scoter and scaup population size on Yukon Flats.
- 2) Estimate loon, scoter and scaup distribution and produce a map of predicted distribution on Yukon Flats.
- 3) Identify important loon, scoter and scaup habitats, and monitor changes in use of such habitats.

#### Management Implications:

Scoters are the least studied of North American waterfowl, and little is known of their life history, ecology, and distribution. Additionally, a gradual decline in scoter populations has been documented (Mallek and Groves 2007). An annual scoter survey was initiated by Migratory Bird Management in 2000, with initial efforts (2000 – 2002) including within year replicates to assess temporal variability in estimates and distribution, and to identify optimum survey timing (Mallek 2002).

Scaup are of interest to the Refuge because of their declining population trends, coupled with the importance of Yukon Flats as breeding grounds for the population. Diving duck populations are not well estimated with the Continental waterfowl surveys (Mallek and Groves 2007) because it is timed to maximize detection of dabbling ducks. Beginning in 2002, scaup were included in annual scoter surveys. By including scaup in the Scoter survey we are able to monitor scaup populations at the appropriate time at no added cost or effort.

Surveys indicate that Yukon Flats is an important breeding area for Pacific loons (*Gavia pacifica*) (Groves et al. 1996, Lanctot and Quang 1992). Statewide aerial surveys indicate that Yukon Flats provides habitat for approximately 75% of boreal forest nesting Pacific Loons, and 8% of the Pacific Loons detected statewide. High densities of Pacific Loons on the Yukon Flats are more comparable to coastal tundra ecosystems than to other lower density boreal habitats (Groves et al. 1996). Yukon Flats may also be an important breeding area for common loons (*G. immer*) (Lanctot and Quang 1992), where approximately 18% of the estimated total number of common loons within a statewide study area occurred in Yukon Flats (Groves et al. 1996). Red-throated loons (*G. stellata*) also use the Refuge, but at very low densities.

Annual surveys provide species population estimates, and information on species distribution across the landscape of Yukon Flats. Additionally, location information can be analyzed relative to habitat characteristics and wetland type (see Task 1) to understand habitat relationships and better predict distribution across the landscape. Population monitoring allows us to detect declines in trust species. Habitat information helps us to understand the value of our different wetlands to trust species, which aids in making informed management decisions, especially those related to realty transactions, access requests, and climate change. The Refuge is enormous, and future management issues are unpredictable in where and how big their footprint of impact will be on the landscape. This underlines the importance of having landscape scale information so as to provide us with maximum flexibility for response to future unforeseen issues.

Geographic Inference: The study area is composed of four strata determined to have high densities of waterbodies and high bird densities (Platte and Butler 1992), and are located within the waterfowl production area (Figure 3). Study areas are located in the eastern, southern, northern and western areas of the Yukon Flats. The spatial balance and large size of the study area allows for landscape scale inference, however, eliminating areas with very little habitat (i.e. water) allows for more intensive sampling, more precise estimates, and prevents extrapolation to unsuitable habitats (i.e. no water).

#### Methods:

- 1) Objective 1: The survey area (9,728.3 km<sup>2</sup>) includes 58 transects systematically randomly located in the four strata. Transects were 400 meters wide resulting in 678.4 km<sup>2</sup> of sample area. The survey was flown at 100-150 feet above ground level and at 90-105 mph. Aircraft navigation and altitude were maintained with a Global Positioning System (GPS) and altimeter, respectively.

Scoter and scaup breeding pairs are surveyed in the same effort between 1 and 9 June (scoter and scaup survey), and loons were surveyed during the first and second week of August (loon survey). Observations of scoters, scaup and loons were recorded according to breeding pair survey protocol (U.S. Fish and Wildlife Service and Canadian Wildlife Service 1987). Individual observation locations (latitude and longitude) were recorded onto a laptop using a computer program developed by John Hodges (USFWS, Region 7, Waterfowl Management-Juneau – retired annuitant), and with digital audio recorders for scoters and scaup and loon survey efforts, respectively.

Population indices and variance estimates were calculated using standard statistical procedures for stratified analyses as described by Smith (1995).

2) Objectives 2 and 3: Incorporate results from above Task 1. Relate wetland birds to wetland habitats. Methods to be developed.

Project Start: 2000

Project End: Annual survey.

Product:

- 1) Annual reports of findings.
- 2) GIS products: annual density distribution maps and habitat maps.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Monitor loon, scaup and scoter	5	16	5	13K

Data management method status (paper files only, spreadsheet, database): Data is in spreadsheets and ArcGIS.

Data analysis status and use (last time data summarized, synthesized, or analyzed): Annual reports have been prepared by Refuge, which include population estimates. Habitat analyses and density distribution maps have yet to be completed by Refuge. Objectives 2 and 3 need to be addressed.

### **7.2c Task 3: Monitor change in wetland character and bird use (wetland scale) (Proposed)**

Principle Investigators: Yukon Flats Refuge, USGS – Alaska Science Center

Collaborators: NPS, Fairbanks

Objectives:

- 1) Monitor seasonal use of individual wetlands by wetland birds.
- 2) Monitor seasonal and annual changes in wetland characteristics.
- 3) Relate wetland use by birds to wetland characteristics, and monitor seasonal and annual changes in use relative to changes in wetlands.



Management Implications: This effort will allow us to link changes in wetlands within and among years with changes in use by wetland birds. This project addresses use on the wetland scale, providing finer scale data than that under Task 2. Data at this scale is critical to interpreting landscape scale patterns (Task 2).

Geographic Inference: Inference will be to the five strata identified in Figure 1. The sampling grid in Figure 2 will be used for random selection of wetlands, similar to the wetlands inventory design described under Task 1.

Methods:

- 1) Objective 1: Methods are still in development. Develop methods for conducting aerial breeding pair surveys for dabblers and divers (late May and early June surveys, respectively) of individual wetlands. Traditionally, aerial breeding pair surveys are done along strip transects in order to maximize area sampled and minimize disturbance and movement of birds, and bird information is not linked to a specific wetland. Because wetland based bird counts are required in order to relate birds to wetland characteristics, this project will explore methods for conducting aerial bird surveys that use individual wetlands as sample units. Additionally, wetlands will be similarly surveyed in August to examine use by molting birds. Feasibility of conducting ground surveys of broods, and ground surveys of other wetland birds (e.g. Rusty Blackbirds) will also be examined.
- 2) Objective 2: Methods are still in development. Develop methods to monitor changes in wetlands characteristics within and among years. Measures will include water level, wetland extent, water chemistry, isotopes, and basic vegetation. Within year changes will be measured within a subset of all selected wetlands, as multiple ground visits to every site is too labor intensive for long-term monitoring.
- 3) Objective 3: Methods are still in development. Develop analytical methods for examining spatial and temporal changes in habitat use by wetland birds throughout the breeding season and among years. Produce spatially explicit extrapolations of information to the Yukon Flats study area.

Project Start: Pilot year - 2009

Project End: Annual

Product:

- 1) Annual reports on wetlands and wetland bird status on the refuge.
- 2) Protocols for monitoring wetland birds and habitat at a broad spatial scale.
- 3) Publication of techniques and approach in a scientific journal.
- 4) A GIS data layer of wetlands attributed with wetland bird counts and wetland characteristics.
- 5) A GIS data layer of predicted distribution of wetland characteristics and bird use/density for Yukon Flats.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Monitor wetland change and bird use	5	16	5	4K

Data management method status (paper files only, spreadsheet, database): Data will be stored at the Refuge and USGS-Alaska Science Center in paper and digital formats, to include ArcGIS spatial layers and databases.

Data analysis status and use (last time data summarized, synthesized, or analyzed): In development.

#### **7.2d Task 4: Identify change in wetland habitats (Heglund historical plots) (Proposed)**

Principle Investigators: USGS – Alaska Science Center, Yukon Flats Refuge

Collaborators: USFWS – Region 3, University of Alaska, Fairbanks, AK

Objectives:

- 1) Conduct change detection using 1980's 1:6,000 aerial photos and recent aerial photos of waterfowl plots (Heglund 1988). Examine changes in wetland extent, and plant community composition.
- 2) Examine change in water chemistry parameters from 1980's to present.
- 3) Examine change in wetland bird use from 1980's to present.

Management Implications: The comprehensive data set collected by Heglund (1988, 1992) provides us with a unique and valuable opportunity to examine fine-scale processes related to wetland change. The objectives of this study are to replicate aerial photos and ground-based sampling of Heglund's (1992) 106 lakes, which are distributed among 9 different wetland areas in the Refuge (Figure 4). Loss of wetland extent on Yukon Flats has been documented (Riordan 2006, Corcoran 2005), but little work has been done examining the ecological implications of such change on the unique wetland systems of Yukon Flats. Fine-scale, process related studies are important to interpreting landscape scale observations of wetlands and wetland birds (Tasks 1 – 4).

Geographic Inference: Geographic inference is limited to the extent of the nine 2X2 mile plots (Figure 4). Plots represent the range of wetland conditions occurring on the refuge.

Methods:

- 1) Objective 1: This project is using photo interpretation methods to examine change in wetland extent and vegetation communities. 1:6,000 aerial photos taken in 1988 will be compared to recent (2007 and 2009) aerial photos taken at a similar scale. Photos have been geo-referenced, and the extent of water and vegetation communities will be delineated, and compared among years.
- 2) Objectives 2 and 3: Water chemistry parameters and wetland bird use will be measured on the historic plots, and compared with results from the 1980's. Methods will be the same as those used by Heglund (1988, 1992), and includes measures of bird abundance, limnology, bathymetry, depth of active layer (i.e., depth to permafrost), and vegetation (submergent, emergent, and nearshore terrestrial).

Project Start: 2006

Project End: unknown

Products:

- 1) Publication of results in a scientific journal.
- 2) A database including all ecological parameters (bird abundance, limnology, bathymetry, depth of active layer, and vegetation) for the 2 time periods (1980's and present)
- 3) GIS data layers of aerial photo interpretations, including vegetation community maps and wetland extents from the 2 time periods.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Monitor wetland change historical plots	5	16	5	11.5K (2009) <sup>1</sup>

<sup>1</sup>These estimates will increase significantly after final study design.

Data management method status (paper files only, spreadsheet, database): Data from the 1980's has been recently organized and entered into a current database program. Aerial photos from the 1980's have been scanned and geo-referenced for use in ArcGIS. Additionally, recent aerial photos of some of the plots have been taken (2007) and geo-referenced for use in ArcGIS. Photo work is being done through a contract with the Upper Midwest Environmental Center, La Crosse, WI.

Data analysis status and use (last time data summarized, synthesized, or analyzed): This project needs further funding and support. Photo interpretation under objective 3, and data collection for objectives 2 and 3 has not been initiated.

### **7.3 Survival of lesser scaup banded in the Alaska boreal forest (Proposed)**

Principal Investigators: Yukon Flats Refuge, Office of Migratory Bird Management

Collaborators: Village of Chalkyitsik

Questions:

- 1) What are estimates of survival for Lesser Scaup banded in the boreal forest of Alaska?
- 2) Have estimates of survival changed since the 1960s?

Objectives:

- 1) Estimate survival for scaup banded in the boreal forest of Alaska using band recovery models.
- 2) Compare future estimates of survival with those from the past.

Management Implications: The combined breeding population of Lesser and Greater Scaup is 46% below the goal of the North American Waterfowl Management Plan and has steadily declined since the mid 1980s. In response to this decline, a workshop of managers and researchers held in 2006 identified annual survival and the factors influencing this vital rate as a high priority for future research (Austin et al. 2006). The Refuge is uniquely positioned to address this priority. Unlike elsewhere, large numbers of scaup breed and molt on the refuge and large scale banding efforts could target these birds. Such an effort has occurred previously (King 1963) and Refuge staff could replicate this work. Future estimates of

survival could be compared with those previously estimated (Lake et al. 2006) from the banding that occurred on the Refuge in the 1960s.

Geographic Inference: Sampling would occur throughout the refuge on lakes that contain sufficient numbers of molting scaup. We assume that samples are representative of the boreal forest of Alaska.

Methods: Flightless, molting ducks are herded into traps with boats and airplanes where they are captured with dipnets and placed in mesh sacks. Ducks are marked with U.S. Fish and Wildlife Service metal leg bands and released.

Project Start: 2009

Project End: No less than six years. Ideally, the project would occur for at least ten years.

Product: Annual report written by Refuge staff. Publication on duck survival prepared for a peer-reviewed journal. Estimates of survival would likely be incorporated into modeling efforts by other researchers who are working on reasons for the decline in scaup population numbers.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Scaup Banding	50	140	40	50K

Data management method status (paper files only, spreadsheet, database): Banding data are entered into a program (BANDIT) by Refuge and stored at the Bird Banding Laboratory in Laurel, Maryland.

Data analysis status and use (last time summarized, synthesized, or analyzed): Previously collected scaup banding data were analyzed and reported in Lake et al. (2006). Future data would be similarly analyzed by Refuge.

#### **7.4 Does physiological condition affect reproduction of lesser scaup in the Alaska boreal forest? (Ongoing, nearly completed)**

Principal Investigators: Yukon Flats Refuge, University of Alaska-Fairbanks

Collaborators: as above

Questions:

- 1) What is the body composition of pre-breeding female lesser scaup?
- 2) Does body condition affect subsequent breeding probability, clutch size, and nesting success of lesser scaup?
- 3) How does the current condition of lesser scaup compare with previous measures taken at the same study site and with measures during spring migration on the Mississippi Flyway?

Objectives:

- 1) Determine body condition of pre-breeding female lesser scaup nesting on the Refuge in 2007-2008 and it's potential effects on reproduction; compare current condition of scaup to measures taken at the same study site in 1991 and to those taken along the spring migration route.

Management Implications: Lesser scaup populations have been declining continent-wide for about 20 years. They are an important game species and reasons for their decline have still not been determined. One hypothesis suggests that birds are arriving on breeding grounds in poor condition and that this is, subsequently, affecting reproductive performance. This project will address this hypothesis by relating female body condition to reproduction. The Refuge is an ideal place to study scaup. It is home to the second-largest concentration of ducks in Alaska and scaup are the most abundant duck species on the refuge. This project is important to help determine reasons for the species decline so that bird watchers, and subsistence and sport hunters can continue to use the resource.

Geographic Inference: The Refuge, Shack Lake study site (25km west of Beaver, AK)

Methods: We will use both capture-resight methods and lethal means to determine body condition and reproductive success of females. In 2007 and 2008 birds were captured upon arrival, marked with radio transmitters, and located 1-2 times per day to determine breeding probability, clutch size, and nest success. We measured body condition of marked birds using an oral dose of labeled water (D<sub>2</sub>O). This method measures total body water space and, therefore, total body lipid. We found that five birds initiated nests in 2007 and three in 2008. None of these nests were successful.

Blood plasma samples from marked birds (n=33 and 39 birds in 2007 and 2008, respectively) and whole bodies of collected birds (n=47 birds for both years) will be processed in the lab to determine body condition and reproductive status for each individual. We will measure levels of the yolk precursors vitellogenin and very low density lipoprotein in plasma to determine if birds have entered Rapid Follicle Growth (RFG). For collected birds, we will also examine ovarian follicles. We will then examine the relationship between body composition and several reproductive parameters (RFG status for all birds; breeding probability, clutch size, and nest success for marked birds).

Project Start: January 2007

Project End: December 2009

Product: Graduate thesis, two papers published in peer-reviewed journals, several presentations at professional conferences.

Estimate of effort and cost (unit=person days):

<u>Project Year</u>	<u>Preparation</u>	<u>Data collection (field and lab)</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
2007	60	1000	7	93K
2008	30	1100	20	101K
2009	0	400	170	19K

Note that eastern survey is funded through annual funding agreement and contribution from ADF&G. Western survey is funded from refuge base funds.

Data management method status (paper files only, spreadsheet, database):

Stored as electronic files (spreadsheets and word-processing documents) in USFWS laptop, on a UAF server, and on K. DeGroot's personal hard-drive.

Data analysis status and use (last time data summarized, synthesized, or analyzed): Data still being generated through work in the laboratory. Data analysis will take place in summer 2009 and a written thesis completed December 2009. A summary will be completed and submitted to the Refuge at project completion.

## **7.5 Early detection and monitoring of highly pathogenic H5N1 avian influenza Virus (Ongoing)**

Principal Investigators: Office of Migratory Bird Management

Collaborators: Yukon Flats Refuge

Questions:

- 1) Is highly pathogenic avian influenza H5N1 virus present in waterfowl in interior Alaska?
- 2) What is the prevalence of low pathogenic virus in waterfowl in interior Alaska?

Objectives:

- 1) Determine presence/absence of highly pathogenic avian influenza H5N1 virus.
- 2) Examine trends in low pathogenic virus relative to season and species.

Management Implications: Alaska represents a unique crossroads where migratory flyways from Asia and North America overlap. Thus, highly pathogenic H5N1 virus may first arrive to North America via birds migrating from Asia, and early detection and monitoring of the highly pathogenic H5N1 virus is necessary to developing any kind of a response by managers.

Geographic Inference: Sampling occurs on lakes in the north-central portion of the Refuge. Samples from the Refuge are compared with those collected statewide.

Methods: Ducks are captured with either swim-in and walk-in traps baited with corn or herded with airplanes and boats while flightless during wing molt. The oral cavity and cloaca of all captured ducks are swabbed and samples are stored in dry nitrogen containers. Samples are sent to a lab in Madison, Wisconsin for analysis.

Project Start: 2006

Project End: Until sampling is no longer a national priority.

Product: Annual report written by the Office of Migratory Bird Management with contribution by Refuge staff. Various publications authored by USGS staff.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
AI Surveillance	25	42	8	20K

Data management method status (paper files only, spreadsheet, database): Data are stored in a national database (HEDDS; Highly pathogenic avian influenza early detection data system).

Data analysis status and use (last time summarized, synthesized, or analyzed): Data are summarized in an annual report. Data are analyzed for various publications in peer-reviewed journals.

## **7.6 Breeding ecology, habitat associations, and foraging ecology of an imperiled songbird, the Rusty Blackbird (Ongoing)**

Principle Investigators: US Forest Service, Alaska Bird Observatory, ADF&G, Yukon Flats Refuge, University of Arkansas, Smithsonian Institution, Canadian Wildlife Service, Biodiversity Institute, Michigan State University, Loyola University, University of Notre Dame, Humboldt State University

### Questions:

- 1) What habitats are important to Rusty Blackbirds?
- 2) What is their reproductive success and are there factors limiting it?
- 3) Are there environmental contaminants in adults and young, and do they affect reproduction?
- 4) Does exposure to avian influenza or parasites affect reproduction or survival?
- 5) What are their foraging strategies and target prey species?

### Objectives:

The goal is to study habitat selection, foraging ecology, reproductive success, and potential limiting factors for Rusty Blackbirds breeding on the Copper River Delta and Yukon Flats National Wildlife Refuge in Alaska. We will address the following objectives:

- 1) Identify areas and habitats important for supporting nesting, foraging, and high reproductive success;
- 2) Identify factors limiting reproductive success such as low rates of mate pairing, low egg viability, or high rates of nest predation;
- 3) Determine whether concentrations of environmental contaminants in eggs and adults are of concern;
- 4) Determine exposure to avian influenza and blood parasites; and
- 5) Identify foraging strategies, areas and available food types.

Management Implications: The Rusty Blackbird (*Euphagus carolinus*) has suffered one of the steepest declines of any bird species in North America with populations reduced by 90–98% since 1966 (Greenberg and Droege 1999, Greenberg et al. *in review*).

Alaska is particularly important for breeding populations of Rusty Blackbirds because the species still breeds commonly in its undeveloped wetland habitats (Andres et al. 1999). However, these Alaskan habitats are not without threats, with warming summer temperatures resulting in the drying of boreal wetlands over the past 50 years. Contaminants, such as mercury, migrate from industrial areas through the atmosphere and concentrate in northern wetlands. Detailed studies of Rusty Blackbirds are urgently needed to identify the causes of the population collapse. This information will provide land managers and policy-makers with information vital to protecting the Rusty Blackbird before the species becomes further imperiled.

### Geographic Inference:

Study areas will be selected based on local conditions. Study units will consist of clearly defined water bodies or a 500m x 500m grid. Units will contain potential breeding habitats for Rusty Blackbirds. Inference will be limited to the selected study area(s).

Methods: General surveys.— Surveys will be conducted to (1) identify wetland types supporting breeding Rusty Blackbirds, and (2) determine the influence of potential nest predators on breeding success. Site occupancy and abundance will be estimated from rapid surveys (Bart and Ernst 2002), which will be conducted during the period of peak detectability (pair formation to early incubation: 10-25 May). Units will be surveyed twice, and all locations and movements of adult Rusty Blackbirds will be mapped on aerial photographs. Similar information will be collected on shorebirds, nest predators, and other species of interest. Survey units with active Rusty Blackbird territories will be revisited to 1) monitor nest success, 2) characterize habitats used for nesting and foraging, 3) identify specific habitat features selected for nest sites within territories, 4) identify the major factors contributing to reproductive failures; and 5) identify habitat features that are associated with high rates of nest survival. Nestlings will be weighed, measured, and banded 9 days following hatch to assess their condition prior to fledging. Blood samples will be collected to measure: 1) contaminant burdens, 2) ratios of hydrogen stable isotopes, and 3) presence of avian influenza and blood parasites. All unhatched eggs will be collected and six will be analyzed for metals, organochlorines, and total polychlorinated biphenyls. Feather samples will be analyzed for ratios of stable isotopes of hydrogen.

Invertebrates brought to nest for provisioning will be collected through limited neck-collaring of nestlings (Orians and Horn 1969). Invertebrate samples will be identified and compared to invertebrate availability in nearby ponds. Water samples will be taken from sample units to determine the water chemistry profile of wetlands used by Rusty Blackbirds.

Project Start: 2008

Project End: 2011

Products:

- (1) GIS coverages of important habitats for Rusty Blackbirds and other species of conservation concern for each study area.
- (2) Yearly progress reports as required at the end of each state fiscal year summarizing accomplishments, important findings, and any changes to the study.
- (3) Final report that summarizes key findings and recommendations for conservation of the species in Alaska. The report will include the combined data for all years of study. These findings will later be submitted for publication in a peer-reviewed journal and a popular birding magazine.
- (4) A public presentation of results of study to members of the Fairbanks community.
- (5) Presentation of findings at the American Ornithologist's Union annual meeting, the Boreal Partners in Flight and the Alaska Bird Conference.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Logistical support only	4	10	5	10K

Data management method status (paper files only, spreadsheet, database): Data will be managed by the Alaska Bird Observatory in the form of GIS coverages, databases, and written reports.

Data analysis status and use (last time data summarized, synthesized, or analyzed): The first field season for Yukon Flats is spring/summer 2009.



## 7.7 Moose population monitoring (Ongoing)

Principal Investigators: Yukon Flats Refuge and ADF&G

Collaborators: Alaska Council of Athabascan Tribal Governments, Village of Beaver

Questions:

- 1) What are the current moose populations in the eastern and western Yukon Flats?
- 2) What are the fall sex and age composition of moose in the eastern and western Yukon Flats?
- 3) What are the population trends of moose in the eastern and western Yukon Flats?

Objectives:

- 1) Estimate moose population size and sex and age composition in the eastern and western Yukon Flats.

Management Implications: The Refuge is responsible for providing subsistence opportunities for local residents. Moose are an integral part and key component of the annual subsistence harvest of local communities in the Yukon Flats. To adequately monitor moose populations that occurs within Game Management Unit 25D, estimates of density, composition, and trend need to be generated. This data is necessary to manage subsistence moose harvest and to respond to proposals and inquiries from game management boards and councils, Native representatives, and the general public.

Geographic Inference: Yukon Flats Refuge, Game Management Unit 25D

Methods: This survey uses methods based on spatial correlation (refer to the GeoSpatial Survey Operations Manual by Kellie and DeLong 2006). Project Start: 1999 (previous work: Stratifications surveys conducted in 1983 and 1986, Population estimation surveys using Gasaway methods completed in 1992, 1995-97; trend surveys conducted 1983 to 1994)

Project Start: Ongoing

Project End: Annual survey

Product: Annual reports

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
Eastern Yukon Flats	5	32	7	22K <sup>1</sup>
Western Yukon Flats	5	48	7	22K <sup>2</sup>

<sup>1</sup>eastern survey is funded through annual funding agreement and contribution from ADF&G.

<sup>2</sup>western survey is funded from refuge base funds.

Data management method status (paper files only, spreadsheet, database): Stored in ADF&G managed wildlife information system database, paper and spreadsheets on file at Refuge

Data analysis status and use (last time data summarized, synthesized, or analyzed): data summarized and presented to State Fish and Game Advisory Councils and Eastern Interior Federal Subsistence Regional Advisory Council annually and State Board of Game Meeting every other year.

## 7.8 Monitoring moose demographics (Proposed)

Principal Investigators: Yukon Flats Refuge and ADF&G

Collaborators: Council of Athabascan Tribal Governments, Village of Beaver

Questions:

- 1) What is the annual calf production, twinning rate and recruitment of moose in the eastern and western Yukon Flats?
- 2) What are the annual survival rates of calf and adult cow moose?
- 3) What is annual pregnancy rate and age of first reproduction in cow moose in the eastern and western Yukon Flats?
- 4) What are the annual weights of short yearlings?

Objectives:

- 1) Monitor moose demographics.

Management Implications: Monitoring moose demographics including calf production, twinning rate, recruitment, calf and cow survival rates, pregnancy rate, and age at first reproduction, and short yearling weights provide important indicators of the nutritional health of moose. Monitoring these population statistics on an annual basis is essential to understanding its growth, or lack of it. These statistics, combined with population estimates, sex and age composition, habitat assessment, harvest estimates and predator studies provide managers a better understanding of moose on the Yukon Flats. This information is necessary to manage subsistence moose harvest and to respond to proposals and inquiries from game management boards and councils, Native representatives, and the general public.

Geographic Inference: Yukon Flats Refuge, Game Management Unit 25D

Methods: Maintain 30-40 radio-collared cow moose annually, radio track on a monthly basis, weekly during calving.

Project Start: 2010

Project End: Annual monitoring

Product: Annual reports

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Collaring</u>	<u>Radiotracking</u>	<u>Data</u> analysis/report	<u>Cost</u>
Demographics	20	15	5	40K

Data management method status (paper files only, spreadsheet, database): Stored in spreadsheet format and stored on harddrive backup at Refuge.

Data analysis status and use (last time data summarized, synthesized, or analyzed): Data summarized and presented to State Fish and Game Advisory Councils and Eastern Interior Federal Subsistence Regional Advisory Council annually and State Board of Game Meeting every other year.

## 7.9 Re-evaluate wood bison forage habitat potential in the Yukon Flats (Proposed)

Principal Investigators: Yukon Flats Refuge

Collaborators: ADF&G

Questions:

- 1) What is the current distribution and extent of potential wood bison habitat on the Yukon Flats?
- 2) What is the current forage production of potential wood bison forage habitat in the Yukon Flats?

Objectives:

- 1) Map the distribution and extent of potential wood bison habitat on Yukon Flats (GMU 25D) within an ArcGis framework.
- 2) Develop a spatially balanced- or stratified random sampling design to sample potential wood bison forage habitat availability and estimate annual net above ground primary production on the Yukon Flats (GMU 25D).
- 3) Identify potential summer and winter ranges on the Yukon Flats (GMU 25D).
- 4) Collect snow depth information in areas identified as potential wood bison winter range to assess suitability of area for use during winter.

Management Implications: The ADF&G is interested in introducing wood bison into several regions of interior Alaska to provide an alternative prey base for the hunting public and also to provide wildlife viewing opportunities. The Minto Flats and Yukon Flats have been identified as priority release sites. An earlier assessment of potential wood bison habitat on the Yukon Flats by Berger et al. (1995) indicated that the area could support up to 2,000 wood bison (Gardner et al. 2006). The State has indicated that the Yukon Flats region offers the best habitat for wood bison and would like to introduce wood bison on the Refuge. The Refuge would like to conduct an additional evaluation of potential wood bison habitat to estimate how many bison Yukon Flats habitats could support. Given the availability of current satellite and other remotely sensed data, and more information on climate change scenarios for the Yukon Flats region, we can perhaps improve on the original wood bison habitat assessment. Additionally this data would be used in a future Environmental Impact Statement (EIS) if the Service supports a bison release on Refuge lands.

Geographic Inference: Public and private lands within the exterior boundary of the Yukon Flats Refuge (including Game Management Unit 25D).

Methods: Use the 2006 Yukon Flats land cover map, color infrared aerial imagery and other satellite imagery to delineate and estimate the area of potential wood bison foraging habitat. Use an inferentially based sampling design to sample from the population of potential habitats in the Refuge. The Yukon Flats may be stratified by region and/or by other factors including size of meadows. To insure sampling points fall in the correct habitat type, vegetation type will be classified at each site, either via helicopter and/or when on the ground. Using quadrat, transect or plotless methods, vegetation crews will collect data on vegetation composition, abundance, substrate, and successional stage. In addition general information such as proximity of potential wood bison habitat to other vegetation types, wetlands, rivers, nesting ground birds, burn areas as well as other biological and environmental variables will be collected (some can be done in ArcGis). This information will be used to estimate potential wood bison forage production. Most sites will be accessed by helicopter during peak growth of graminoid species.

Project Start: No start date planned.

Project End: N/A

Product: Potential wood bison foraging habitat digital map layers, report

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
Habitat Assessment	30	100	20	75K

Data management method status (paper files only, spreadsheet, database): Stored in spreadsheet format and stored on harddrive backup at Refuge

Data analysis status and use ( last time data summarized, synthesized, or analyzed): Data summarized and presented to State Managers of wood bison release program, data used for bison management plan for Yukon Flats, data provided to State Fish and Game Advisory Councils and Eastern Interior Federal Subsistence Regional Advisory Councils for regulatory decisions.

#### **7.10 Population structure of early successional shrub communities on the Yukon River in relation to moose herbivory (Ongoing)**

Principal Investigators: Yukon Flats Refuge, University of Alaska Fairbanks , US Forest Service

Collaborators: University of Alaska (Institute of Arctic Biology) and USDA Forest Service

Background: The general working hypothesis is that the Tanana River model of primary floodplain succession applies to the Yukon Flats study area. However, we expect to observe differences in structure and composition of early successional shrub vegetation between the two areas due to lower moose densities (USFWS 2008) and lower browsing intensity (Paragai et al. 2008) on the Yukon Flats. Additionally, the absence of large, early successional alder-dominated stands may be a legacy of low herbivory levels across the Yukon Flats landscape.

#### Questions:

- 1) Is the ratio of willow to alder stem density higher in 10 year old willow stands on the Yukon Flats than has been recorded for vegetation on the Tanana River floodplain (a high moose density area)?
- 2) Is the age distribution of willow stems (forage species) shifted towards older age classes as a result of low browsing pressure and perhaps an increased competitive capacity over alder? Is alder recruiting later into these Yukon River riparian willow communities compared to when it recruits into willow stands on the Tanana River floodplain (where browsing pressure is higher)?
- 3) What is forage production and browse consumption in the Yukon River study area? How does it compare to other areas? What are the characteristics (species and twig diameter) of the browsed forage?

Objectives:

- 1) Measure riparian shrub vegetation and soil stand characteristics, including species composition, abundance, canopy height, and age distribution.
- 2) Estimate forage production and off-take (removal) of current annual growth twigs of primary moose winter forage species at sites where vegetation data was collected as well as collect nutritional forage quality data.

Management Implications: This study is a first step at understanding how early successional shrub communities are structured and their production. These shrub communities are likely important to moose in late winter. The study area will be one of the strata (riparian) used to estimate moose browse production (and possibly consumption) in a larger area (GMU 25D west) and will complement predator-prey studies implemented in 2008 (wolf moose kill rates) and in 2009 (black bear population survey).

Geographic Inference: The study area is located on private and refuge lands along a 100 km stretch of the Yukon River upstream (66°28'N, 146°51'W) and downstream (66°10'N, 148°31'W) of Beaver, Alaska.

Methods: This study uses an inferentially based and spatially-balanced sampling design implemented in ArcGIS (Theobald et al. 2006) to create sampling points within the targeted vegetation type (deciduous vegetation within 50 m of shoreline). In the field, site selection was further refined and the point sampled if it occurred in a relatively homogeneous stand and shrub height was 1.5 m or taller. Vegetation (structure, composition, abundance, and stand age) and soil physio-chemical data, and site terrace elevations will be collected from temporary plots at locations generated from the sampling design procedure. Moose forage production (in fall 2009) and consumption (late winter 2010) will be estimated in these same plots using published protocols (Paragai et al. 2008), Seaton et al. (in press)).

Project Start: June 2008

Project End: Field component – April 2010; thesis defense – December 2010.

Product: Masters of Science Thesis, publication in a peer-reviewed journal

Estimate of effort and cost:

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
Yukon River Shrub Succession	200	300	300	59K

Data management method status: Georeferenced data files and digital images are stored on the Fairbanks FWS GIS network and on the graduate student's computer hard drive. A backup copy is stored on an external hard drive. Hard copy data is stored at the UAF graduate student's office. Field samples are stored in the Refuge administrative office in Fairbanks, AK.

Data analysis status and use (last time data summarized, synthesized, or analyzed): 2008 field data were summarized winter 2008/2009 and are located in the above mentioned locations.

### **7.11 Estimate moose browse production and browse removal for the western Yukon Flats (Proposed)**

Principal Investigators: Yukon Flats Refuge

Collaborators: ADF&G

Questions:

- 1) What is the ratio of browse consumption to browse production (proportional browse removal) (Seaton et al. in press) in the western Yukon Flats west relative to other interior Alaska game management units?
- 2) What are the characteristics of the browsed and unbrowsed forage species (diameter of current annual growth (DCAG), and diameter at point of browse (DPB))?

Objectives:

- 1) Estimate proportional browse removal in 25D west.
- 2) Assess characteristics of browsed and unbrowsed forage.

Management Implications: Moose densities in the western Yukon Flats are among the lowest in interior Alaska. The Eastern Regional Advisory Committee (RAC) and local subsistence hunters have requested the Service consider implementing intensive predator management in this region. Baseline information on moose habitat quality and quantity is required by Service policy prior to considering intensive management as a management tool. The Refuge has information on relative browse production/removal for a portion of the Yukon River riparian corridor (Seaton et al. in press) but not for a significant portion of the western Yukon Flats. Managers need sufficient moose habitat quality and quantity information to determine if 1) habitat restricts population growth, and 2) if sufficient browse is present to support increased numbers of moose should intensive management occur.

Geographic Inference: The sampling area is in the western Yukon Flats. Stevens Village, Beaver, and Doyon Native corporation lands and refuge lands are located within this region.

Methods: Stratify the sampling area based on landform (riparian corridor and off-river), then conduct a secondary stratification based on high and low moose survey units (Paragai et al. 2008). In the office, sample sites will be randomly selected from a proportion of high and low moose survey units in riverine and off river areas and generated using GIS, Visual Sampling Program (EPA), or a spatially-balanced sampling algorithm implemented in GIS. Sites will be accessed via helicopter. If suitable forage habitat is present, site will be sampled per Seaton et al. (in press) methods. Twig diameter of current annual growth (DCAG) and diameter at point of browsing (DPB), if present, will be measured for each forage species within a 15 m. diameter circular plot. Diameter of current annual growth and DPB is used to predict forage production and removal, respectively (Oldemeyer 1983, Seaton et al. in press).

Project Start: Spring 2010

Project End: Spring 2010

Product: An estimate of available moose browse in the western Yukon Flats.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Moose browse production	30	200	20	75K

Data management method status (paper files only, spreadsheet, database): Stored in spreadsheet format and stored on harddrive backup at Refuge

Data analysis status and use ( last time data summarized, synthesized, or analyzed): Data would be summarized and presented to State Fish and Game Advisory Councils and Eastern Interior Federal Subsistence Regional Advisory Council annually and State Board of Game Meeting.

## **7.12 Kill rate by wolves on moose in the western Yukon Flats (Ongoing)**

Principal Investigators: Yukon Flats Refuge

Collaborators: ADF&G

Questions:

- 1) What is the moose kill rate by wolves in Interior Alaska during winter?
- 2) How much moose biomass do wolves consume during winter?

Objectives:

- 1) Estimate kill rate by wolves on moose and per wolf consumption of moose.
- 2) Use inputs of kill rate and biomass consumed in a predator/prey model of moose population dynamics.

Management Implications: Densities of both moose (0.07 moose/km<sup>2</sup>) and wolves (0.005 wolves/km<sup>2</sup>) are relatively low on the Refuge. In such a system, little is known about the functional response of wolves to moose. Estimating the kill rate of wolves on moose in this system will allow for managers to make more informed decisions. With estimates of kill rates and biomass consumption, a predator/prey model can be used to examine the outcomes of perturbations by managers. Such an effort can provide a defensible framework from which to guide management of wolves and moose on the Refuge.

Geographic Inference: Sampling is conducted in the region around Beaver, Alaska where a moose mortality study was previously conducted and where a black bear abundance estimation study is planned for summer 2009.

Methods: Wolves are captured by darting from a helicopter. Kill rate is estimated by locating wolf packs and kill sites daily for up to three two week periods during the winter months.

Project Start: November 2008

Project End: April 2011

Product: Annual report written by Refuge staff. Publication on kill rates by wolves on moose in interior Alaska prepared for a peer-reviewed journal.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Wolf kill rate	50	300	40	85K

Data management method status (paper files only, spreadsheet, database): Data are stored by Refuge in spreadsheet format and backed up on an internal server.

Data analysis status and use (last time summarized, synthesized, or analyzed): N/A; data are in the collection phase.

### **7.13 Black bear abundance estimation study in the western Yukon Flats (Ongoing)**

Principal Investigators: ADF&G

Collaborators: Yukon Flats Refuge

Questions:

- 1) What is the black bear density and sex and age composition in the western Yukon Flats?

Objectives:

- 1) Estimate the density and sex and age composition of black bear in a 500 square mile study area in the western Yukon Flats.

Management Implications: High rates of black bear capture (1995-1997) and observations by Refuge staff and local residents indicate that black bears likely occur at high densities on the Yukon Flats. Previous work (1998-1999) has identified black bears as a significant predator of moose calves. Black bears have also been identified as a target harvest species in the Yukon Flats Moose Management Plan in an effort to elevate moose numbers. Consequently efforts to liberalize harvest of black bears by the Yukon Flats Advisory Committee and Federal Subsistence Councils have increased since 2002. Since black bears have relatively low reproductive rates, managers need additional vital statistic data to full evaluate proposals that are designed to decrease the bear population.

Geographic Inference: Western Yukon Flats, Game Management Unit 25D

Methods: Approximately 40 black bears will be captured and collared in 2009 and 2010. In 2010 replicated mark/resight methods coupled with line transect surveys will be used to estimate black bear density in a 500 square mile area of the western Yukon Flats near Beaver, Alaska.

Project Start: 2008 (collar purchase only, marking is initiated in 2009)

Project End: 2010

Product: Annual reports coauthored by ADF&G and Refuge Staff. Results will be published in a peer reviewed journal.



Estimate of effort and cost (unit=Refuge person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Black bear estimation	20	20	40	18K

Data management method status (paper files, spreadsheet): Data will be stored at ADF&G with duplicate data files at Refuge. Plans are underway to design relational database for data storage.

Data analysis status and use ( last time data summarized, synthesized, or analyzed): Data will be made available to Yukon Flats game management councils.

#### **7.14 Beaver Creek water quality monitoring (Ongoing)**

Principal Investigators: Yukon Flats Refuge

Collaborators: Fairbanks Fish and Wildlife Field Office

Questions:

- 1) What are water quality baseline parameters in Beaver Creek?
- 2) How will baseline parameters change in the event of a catastrophic event such as an oil spill?

Objectives:

- 1) Implement long-term water resource monitoring on Beaver Creek with emphasis above and below the confluence of Victoria Creek and downstream from private lands with potential for oil and gas development.

Management Implications: Water quality data on Beaver Creek are sparse. In the event that oil and gas resources are developed within the Beaver Creek watershed, additional baseline data collection is necessary to mitigate future potential water resource impacts. A long-term water quality monitoring program on Beaver Creek will address this need.

Geographic Inference: Yukon Flats Refuge, Game Management Unit 25D

Methods: Multi-parameter water quality multi-meters (YSI Model 6600EDS-O) will be installed at miles 110 and 200 in the substrate of Beaver Creek. Mile 110 is about ¼ mile upstream from the Victoria Creek confluence in the Steese White Mountain Conservation Area, and mile 200 is located on Refuge lands just downstream of Doyon conveyed land. Sites will be accessed by float equipped C185 or Aviat Husky. Multi-meters will be deployed from late May to late September and data will be downloaded monthly. The following data will be collected once per hour, 24 hours per day, seven days a week: temperature, conductivity, dissolved oxygen, pH, and turbidity. A protocol has been developed to retrieve data from water quality multi-meters.

Project Start: 2006

Project End: Annual survey

Product: Annual reports

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
Beaver Creek Monitoring	4	5	5	3K

Data management method status (paper files only, spreadsheet): Data stored on spreadsheet on Supervisory Biologist Computer. Data is archived in Refuge database (in development).

Data analysis status and use ( last time data summarized, synthesized, or analyzed): Data last summarized in 2007 for inclusion in the draft EIS for proposed Yukon Flats Land Exchange.

### **7.15 Dall's Sheep Population Surveys (Ongoing)**

Principal Investigators: Yukon Flats Refuge

Collaborators: BLM and ADF&G

Questions:

- 1) What is the current Dall's sheep population in the White Mountains?
- 2) What is the sex and age structure of the Dall's sheep in the White Mountains?
- 3) What are the population trends of Dall sheep in the White Mountains?

Objectives:

- 1) Estimate Dall's sheep population size, and sex and age structure in the White Mountains.

Management Implications: During the last 15 years lambing success, legal ram numbers and the population estimate has all fluctuated (n= 400-700). We have observed that the population is sensitive to environmental conditions such as high winds and icing event. The population benefits to some degree by poor hunter access. Despite difficult access sheep harvest and hunter effort has increased steadily over time and it is necessary to closely monitor both the population and harvest.

Geographic Inference: White Mountain-Tanana Hills sheep management areas, including Mount Schatka, Victoria Mountain, Limestone Ridge, Limestone Peak, Rocky Mountain, Cache Mountain and Mount Prindle.

Methods: Aerial surveys are flown in small 2-person fixed-wing aircraft (ie. SuperCub, Husky or Scout) at an altitude of 200- 500 feet above ground level. Both pilot and an observer search areas of known sheep occupancy and movement corridors.

Project Start: 1970. Population estimation surveys have been completed in 1970, 1977, 1982, 1986, 1989, 1991 to present.

Project End: Annual survey

Product: Annual reports.

Estimate of effort and cost (unit person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
Sheep Monitoring	2	2	2	2K

Data management method status (paper files only, Spreadsheet, database): Data is archived by BLM, paper files and spreadsheet is archived in the Refuge geodatabase

Data analysis status and use (last time data summarized, synthesized, or analyzed):  
Analyzed annually and available to Yukon Flats game management councils.

## **7.16 Demography of Dall's Sheep in the White Mountain-Tanana Hills (Ongoing)**

Principal Investigators: Yukon Flats Refuge

Collaborators: BLM and ADF&G

Questions:

- 1) What are the seasonal movement patterns, range fidelity, and home ranges of female and male sheep in the White Mountains-Tanana Hills?
- 2) Where are potentially sensitive sheep habitats, including mineral licks, lambing areas, rutting grounds, and access corridors between use areas?
- 3) To what extent do sheep interchange between use areas?
- 4) What is the sightability of Dall's sheep during the population surveys.

Objectives:

- 1) Obtain baseline information on Dall's sheep and their habitats in order to assess potential impacts of oil and gas development on the Refuge and a potential access corridor.
- 2) Develop a sightability correction factor for annual sheep population surveys using mark/recapture techniques.

Management Implications: Doyon Limited (Doyon) has proposed to exchange certain lands Doyon owns within the Refuge for 110,000 acres of Refuge land. The purposes of this proposed land exchange are: 1) to facilitate oil and gas exploration and development by Doyon, and 2) to protect high-quality wetland wildlife habitats within the Refuge that are currently owned by Doyon. One of two identified pipeline corridors bisects Dall's sheep habitats in the northern White Mountains. This data will be used to: 1) assess the potential impacts of oil and gas development, the associated pipeline and access corridors on this sheep population, 2) protect sensitive habitats identified in this study, 3) establish baseline data to monitor the effects should oil and gas development occur. Developing a sightability correction factor for the sheep population surveys will improve the accuracy of the annual population estimates.

Geographic Inference: White Mountain-Tanana Hills sheep management areas, including Mount Schatka, Victoria Mountain, Limestone Ridge, Limestone Peak, Rocky Mountain, Cache Mountain and Mount Prindle.

Methods: Seventy-one Dall's sheep were captured using a hand-held net gun and an R-44 helicopter. The sheep were immobilized and fitted with GPS collars. Hair samples, blood samples, fecal pellets and throat swabs were collected to evaluate pregnancy rates, and trace minerals, and to screen for parasites and pathogens.

The Lotek collars were programmed to record a location every 1 or 2 hours and the Telonics collars recorded locations every 24 hours at 0700 AST and during June and July at 1900 AST. Sheep with Telonics collars were monitored via ARGOS transmissions and mapped using GIS software.

Aerial sheep surveys are conducted annually in July to estimate population size, and sex and age structure. Radio tagged sheep will provide an opportunity to use mark recapture techniques to estimate a sightability correction factor for the population estimate.

Project Start: September 2004

Project End: Data collection ended in October 2008. Another attempt will be made to recover data-logging collars after snow melt in 2009 and analysis will be completed in 2009.

Product: A final report will be prepared at the termination of the project.

Estimate of effort and cost (unit person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Sheep Demography	0	2	80	1K

Data management method status (paper files only, Spreadsheet, database): Data stored in an ESRI ArcGIS Geodatabase and Excel Spreadsheets at Refuge.

Data analysis status and use (last time data summarized, synthesized, or analyzed):  
Statistical analysis has not been completed.

## **7.17 Abundance and run timing of adult fall chum salmon in the Chandalar River (Ongoing)**

Principal Investigators: Fairbanks Fish and Wildlife Field Office

Collaborators: Council of Athabascan Tribal Governments, Yukon Flats Refuge

Questions:

- 1) What is the spawning escapement estimate for fall chum salmon on the Chandalar River?

Objectives:

- 1) provide daily in-season counts of Chandalar River fall chum salmon to fishery managers,
- 2) estimate annual passage of fall chum salmon, and
- 3) describe annual variability in run size and timing.

Management Implications: The fall chum salmon population in the Chandalar River is one of the largest in the Yukon River drainage and is an important wildlife and subsistence resource in the the Refuge. The Service is responsible for providing subsistence opportunities for local residents and salmon are an integral part and key component of the annual subsistence harvest of local communities in the Yukon Flats. Accurate salmon escapement counts on Yukon River tributaries are important for assessing the results of annual harvest management decisions; responding to proposals and inquiries from game management boards and councils, Native representatives, and the general public; predicting run strength based on brood year returns; and monitoring long-term population trends.

Geographic Inference: Chandalar River, Yukon Flats Refuge, Game Management Unit 25D

Methods: Dual Frequency Identification Sonar (DIDSON) were used to estimate fish passage on the Chadalar River DIDSON units were deployed in fixed locations in the river and communicated with laptop computers for control and data management. The sonar systems were operated 24 hours per day from early August to late September. Data were analyzed using DIDSON control and display software, exported to ASCII files, and compiled and summarized using Microsoft excel Visual Basic for Applications macro. Daily upriver fish counts for each bank were calculated by summing all hourly counts for that day. For the season, total passage was calculated by summing all estimated daily counts. Hourly fish passage rates for each bank were plotted for the season and examined for diel patterns. Range distributions of fish targets within the ensonified range were evaluated to assess the likelihood of fish passing beyond the detection range of the DIDSON.

Project Start: 1995 to 2006 Split Beam Sonar used to monitor fish passage; 2007 to present DISSON sonar used.

Project End: Annual survey

Product: Daily updates of fish passage estimates are provided to fisheries managers in-season, with annual reports produced post season.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/repor t preparation</u>	<u>Cost</u>
Chandalar River Sonar	150	225	50	180K

Data management method status (paper files only, spreadsheet, database): Project findings and results are reported annually in Region 7 Fisheries Data Series Reports, available from the FFWFO office or on the FFWFO website. The raw data files from the DIDSON sonar are very large files, therefore, they are only retained until the end of the following season due to the expense of archiving them for a longer period of time. The DIDSON count files (ASCII) and daily and seasonal summary files (Excel) are archived and saved in multiple locations for data security. Also all paper field data sheets are kept and filed by the project biologist.

Data analysis status and use ( last time data summarized, synthesized, or analyzed): During the season daily passage estimates are provided to state and federal fisheries managers the following day, with an annual report produced post season. Managers use the data to make management decisions, evaluate previous strategies and decisions, for making future run size predictions, and monitoring population trends. Some of the data is also included in the

Yukon River Joint Technical Committee annual report, and may be cited/referenced in several other reports.

### **7.18 Assessment of peripheral freshwater habitats for salmon in the middle Yukon River (Ongoing, pending funding)**

Principal Investigators: University of Alaska Fairbanks

Collaborators: Yukon Flats Refuge and the Fairbanks Fish and Wildlife Field Office

Questions:

- 1) How will observed climate related changes affect dynamic peripheral aquatic habitats in the middle Yukon River?
- 2) Which peripheral habitat features affect rearing and overwintering salmonid and nonsalmonid fish distribution in the middle Yukon River?
- 3) What is the temporal and spatial distribution of fish communities in these habitats?
- 4) How will physical changes to peripheral aquatic habitats affect local subsistence use of these Fishery resources?

Objectives:

- 1) Use remote sensing data and field information to evaluate, characterize, assess, and classify peripheral habitats for rearing and overwintering salmon and nonsalmonids in the middle Yukon River;
- 2) Conduct a change detection analysis using aerial photography and satellite imagery to document changes in peripheral fish habitat over the last 50 years;
- 3) Use GIS to extrapolate observed habitat change trends and predict changes in the near future based on our current understanding of anticipated climate change in the Arctic.

Management Implications: increase understanding of past, current, and projected fishery use of peripheral habitats to mitigate effects of climate change and to provide for continued subsistence opportunities (as mandated by ANILCA).

Geographic Inference: The samplings areas are near Beaver, Alaska (66.3598° N, 147.3899° W) within the Yukon Flats Refuge exterior boundary, and include lower Beaver Creek, the Mud Lakes region and Elbow Slough.

Methods:

Fish sampling – various capture methods (nets, minnow traps, sport fishing gear) were used to assess fish community composition in sampled lakes.

Habitat characterization – several habitat variables were measured for each lake during fish sampling and include temperature and dissolved oxygen profiles, conductivity, pH, and water depth.

Remote sensing – the following habitat characteristics including lake perimeter, lake surface area, shoreline development index, distance between lake and nearest river, water surface temperature, and susceptibility to full depth freeze up will be derived using aerial photography and satellite and synthetic aperture radar imagery.

Project Start: 2008

Project End: still in progress, pending funding and new student

Product: annual summary reports, published dissertation, articles published in scientific journals, development of a model that incorporates fish response to physical dynamics associated with climate change

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Salmon habitat assessment	6	16	4	30K

Data management method status: Data will be housed within the University of Alaska Fairbanks and provided in full to the Refuge and Fairbanks Fish and Wildlife Field Office upon completion of the project.

Data analysis status and use (last time data summarized, synthesized, or analyzed): 2008 field data summarized and presented in "Characterization and dynamics of peripheral aquatic habitats in the middle Yukon River drainage" summary report by Stan Triebenbach and Amanda Rosenberger.

### **7.19 Monitor snow depth on Yukon Flats using aerial markers (Ongoing)**

Principle Investigators: Natural Resources Conservation Service

Collaborators: Yukon Flats Refuge

Questions: What is the annual snow fall distribution on the Yukon Flats?

Objectives: To monitor snow depth in Yukon Flats.

Management Implications: Snow markers provide information on winter severity that is necessary to understand wildlife population trends and habitat use. Information is also valuable for monitoring long-term weather trends and hydrology that may be affected by climate change, as well as for predicting severity of fire seasons. Snow data is baseline information that aids in understanding ecosystem processes.

Geographic Inference: Yukon Flats, but limited due to small sample size and non-random placement of markers.

Methods: This is a cooperative project with the Natural Resource Conservation Service (NRCS), USDA. Standard protocols used throughout Alaska for snow depth monitoring have been followed. There are 3 aerial snow markers, (Graphite Lake, Lower Beaver Creek, and Vunzik Lake) to monitor snow depth within the Refuge. Aerial markers are read annually from a fixed wing aircraft within 2 days before or after 1 November, 1 December, 1 February, 1 March, and 1 April.

Project Start: 1998

Project End: Annual

Product:

- 1) Annual state-wide snow report from NRCS, USDA.
- 2) Database of snow depth.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Snow monitoring	1	10	2	3K

Data management method status (paper files only, spreadsheet, database): Data collected for this project will be incorporated into statewide database (maintained by NRCS) and Refuge databases and reports.

Data analysis status and use (last time data summarized, synthesized, or analyzed): Data last summarized, synthesized and analyzed in the 2008 NRCS annual snow report.

## **7.20 SPOT Imagery Acquisition for Habitat Analysis and Project Support (Proposed)**

Principal Investigators: Yukon Flats Refuge

Collaborators: Yukon Flats Refuge

Questions:

- 1) What is the current wetland acreage of the Refuge? Evidence indicates wetlands on the Yukon Flats are drying.
- 2) What is the condition of winter moose habitat in AK Game Management Unit 25Dwest?
- 3) What habitat changes have taken place since ~1980 when the High Altitude CIR photography was taken?

Objectives:

- 1) Obtain 10 meter multi-spectral imagery and 5 meter panchromatic imagery of the entire Refuge to support current and future projects.

Management Implications: It has been over 30 years since the High Altitude CIR photography was taken and there is not complete coverage of the Refuge. The National Wetland Inventory (NWI) was completed using this imagery. The only imagery available that covers the entire refuge is 30 meter Landsat. It is not a high enough resolution identify wetlands less than an acre. The Yukon Flats NWI identified Over 6000 wetlands less than 1 acre in size, totaling over 4000 acres. This imagery will enable better monitoring of habitat on the Refuge and provide a snapshot from which to evaluate the effects of climate change.

Geographic Inference: Yukon Flats Refuge

Methods: Acquisition of 10 meter multi-spectral and 5 meter panchromatic SPOT satellite imagery of the entire refuge. This imagery would be ortho-rectified. Seven SPOT scenes were acquired in 2005 and 2006 of areas burned in the 2004 fires. Fifteen additional scenes are needed to obtain complete coverage of the refuge. Two to four scenes will be collected each year



Project Start: 2009

Project End: 2015

Product: Ortho-referenced SPOT Imagery for the Refuge

Estimate of effort and cost (unit person days): Cost per year based on collecting 3 scenes per year over a six year period

<u>Project</u>	<u>Preparation</u>	<u>Data Collection</u>	<u>Data Analysis/Report Preparation</u>	<u>Cost/year</u>
Imagery Collection*	5 days	\$25,500	0	\$27K
GCP Collection (staff-days)	1 day	4 days	3 days	\$3K
Helicopter for GCPs (Hourly costs and fuel)**		16 hours		\$11K
<b>TOTAL</b>				

\*Cost per Scene - \$8,500 \* 15 Scenes = \$127,500 Imagery Cost for entire Refuge

\*\* 4 hours wet rate of \$650/hr, 12 hrs dry rate of \$580/hr and ~200 gallons of fuel(100LL) at \$8/gal.)

The cost of collecting GCPs should decrease as GCPs could be used for multiple images.

Data management method status (paper files only, Spreadsheet, database): GIS imagery will be stored as GeoTiffs or Imagine files. GCPs will be stored in ArcGIS geodatabase and some will be available to use for additional .

Data analysis status and use (last time data summarized, synthesized, or analyzed): Data will be analyzed for each project as needed or as time permits by Refuge.

## **7.21 Effects of climate change on the Yukon River Basin: Changes in water and implications for wildlife habitat, human subsistence, and climate regulation (Ongoing) (Harden et al. 2009)**

Principle Investigators: U.S. Geological Survey

Collaborators: Yukon Flats Refuge

Questions: This project proposes to answer many questions. Below is a partial summary.

### Detecting and monitoring water change:

- 1)\_What are the historical and observed changes in lakes and wetlands, specific to size, number, area, and water volume?
- 2) What are observed changes in spatial and temporal patterns of ice-out, inundation and stream flows?
- 3) How has the position of the seasonal water table and associated soil moisture changes over time?

Effects of water change:

- 4) How do the distributions, sizes, and ages of lakes affect biodiversity and wildlife habitat quality?
- 5) How are subsistence and climate regulation services, including trace gases and albedo, impacted by changes in open water and wetlands?
- 6) Which streams and which water sources are likely to change in the future, how will subsistence and transportation be affected? How are exports of nutrients and carbon to the Bering Sea impacted by changes in surface and subsurface water?
- 7) What are the effects of permafrost degradation on the storage and flux of surface and soil water, soil carbon, trace gases, and on shifts in vegetation composition?

Mechanisms underlying change:

- What processes may be controlling changes in lakes and wetlands of the Beaver/Birch region and of the greater Yukon River Basin with regard to climate change, permafrost change, and vegetation change?
- 8) What are the contributions of rain, snow, and frozen ground to the water budget? How might hydrologic pathways be changing as permafrost degrades?
  - 9) How are contributions of water from seasonal thaw and permafrost table changing?

Objectives: Specific objectives will be derived from the above questions.

Management Implications: The Refuge is assisting in sample design for this project and nesting it into an ongoing project (see projects in Sections 7.2). The Refuge is planning on implementing a long-term wetland monitoring program based on this proposed project. Data gathered from this and future wetland monitoring will assist in identifying sensitive wetlands habitats and making management decisions on proposed land exchanges or proposed development activities.

Geographic Inference: Yukon Flats Basin

Methods: Water change will be detected using historical imagery (Landsat 7 etc.) and newly acquired LIDAR and radar imagery. Historical stream gage data will be reviewed and new gages installed to analyze stream flow. Permafrost extent and rate of change will be assessed through photo-interpretation and ground based measurements. Soil moisture characteristics including surface and soil temperatures will be mapped using SAR and ground based measurements. Ponds will be stratified and sampled for resource measurements including distance sampling to estimate avian species abundance and richness, mark-recapture and observational methods to estimate mammalian species richness and biodiversity, standard methods to estimate vertebrate and invertebrate aquatic species, and transect methods to estimate vegetation characteristics. Sediment cores, water quality, gas flux emission rates and sediment carbon estimates will be collected at all ponds.

Project Start: 2009

Project End: 2013

Product:

- 1) Model that can assess expected changes to the Yukon Flats landscape including water resources and fish, wildlife and their habitats

Estimate of effort and cost (unit=person days):

Projects in Section 7.2 are nested into this project. Below are additional effort projection which include primarily logistical support.

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Yukon River Basin Monitoring	20	50	10	6-20K

Data management method status (paper files only, spreadsheet, database):

Data collected for this project will be maintained by USGS. Shared data will be stored in the Refuge database.

Data analysis status and use (last time data summarized, synthesized, or analyzed): N/A

## **7.22 Yukon Flats Wildlife Harvest Survey**

Principle Investigators: Council of Athabascan Tribal Governments and Alaska Department of Fish and Game

Collaborators: Yukon Flats Refuge

Questions:

- 1) How many large game (moose, caribou, black bear, brown bear) and small game (lynx, marten, wolf) are harvested annually by Yukon Flats residents?

Objectives:

- 1) Conduct household surveys to document use of large and small game by Yukon Flats residents.

Management Implications: Community level harvest estimates are one of the most critical pieces of information available to agencies and organizations in developing management strategies for an area and animal population. Several management actions have been implemented on the Yukon Flats as outlined in the Yukon Flats Moose Management Plan which include decreasing harvest of cow moose and increasing harvest of wolves and bears. Accurate harvest data is essential for tracking the effects of these moose management actions on moose population growth

Geographic Inference: Yukon Flats Villages including Venetie, Chalkyitsik, Birch Creek, Beaver, Fort Yukon, Stevens Village, and Circle

Methods: The survey form will be developed by ADF&G and reviewed by CATG, FWS, and Beaver Tribal Council. Survey forms will ask questions about harvest, use, and distribution of all species. CATG will hiring local researchers through the tribal councils to collect survey data by household. Surveyors will be trained by ADF&G staff in conjunction with CATG staff. Data collection should take approximately one month. After data is collected and reviewed, data sheets will be sent to ADF&G Information Management (Anchorage) for analysis. Results will be extrapolated to produce community level estimates comparable to other areas of Alaska.

We will attempt to collect harvest location data for all large game species and wolves; trapline areas will be documented for small game species. Additionally, the moose section will include questions about how many hunters hunted moose during the 12 month period and will also attempt to measure effort put forth by those hunters to harvest moose.

Project Start: 2009

Project End: Annual survey

Product:

- 1) A report will be produced including community level harvest estimates for each species.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Harvest Monitoring	3	0	3	58K <sup>1</sup>

This project is funded partly by USFWS funds (26K) provided through the Annual Funding Agreement with CATG.

Data management method status (paper files only, spreadsheet, database):

Data collected for this project will be maintained by ADF&G. ADF&G will prepare the final report. CATG will prepare the final report with assistance from ADF&G in 2010. Data will be archived by ADF&G Information Management.

Data analysis status and use (last time data summarized, synthesized, or analyzed):

This project was initially implemented in 2004. Data has been presented annually to Yukon Flats game management councils.

### **7.23 Yukon Flats Wolf Reconnaissance Survey**

Principle Investigators: Alaska Department of Fish and Game and Council of Athabascan Tribal Governments

Collaborators: Yukon Flats Refuge

Questions:

- 1) How many wolves and wolf packs are in the Yukon Flats?

Objectives:

- 1) Conduct aerial surveys to track movements of wolves and estimate number of wolves and packs.

Management Implications: Wolves have been monitored on the Yukon Flats since 1983 and occur at low densities (0.005 wolves/km<sup>2</sup>). There is primary focus on increasing the moose population on the Yukon Flats, thus management actions are proposed regularly in an effort to increase harvest of wolves. Baseline information on wolf abundance is required to make sound decisions. These data are also input by managers into a predator/prey model to examine the outcomes of management actions.

Geographic Inference: Game management unit 25 (D) which encompasses the Yukon Flats.

Methods: Aerial surveys are initiated after a fresh snowfall. Pilots with tracking experience follow flight lines that are distributed across the landscape. A GPS track log is followed to ensure uniform coverage. Intercepted tracks are followed until a pack or individual observation is made. Kills and pack locations are recorded on a 1:250,000 map and later digitized.

Project Start: 1983

Project End: Conducted every 3-5 years.

Product: A report will be produced including estimated wolf densities and locations.

Estimate of effort and cost (unit=person days):

<u>Project</u>	<u>Preparation</u>	<u>Data collection</u>	<u>Data analysis/report preparation</u>	<u>Cost</u>
Harvest Monitoring	2	12	3	12K <sup>1</sup>

This project is funded by ADF&G.

Data management method status (paper files only, spreadsheet, database):

Data collected for this project will be maintained by ADF&G. ADF&G will prepare the final report. Data will be archived by ADF&G Information Management.

Data analysis status and use (last time data summarized, synthesized, or analyzed):

Data are shared with the Refuge for use in predator/prey models.

## Appendix 2. National Park Service - Vital Signs.

**Table 1. Vital signs of the Arctic Network**

Monitoring Framework	Vital Sign	Parks Where Monitored				
		BELA	CAKR	GAAR	KOVA	NOAT
Air and Climate	Airborne Contaminants			●		
	Climate	●	●	●	●	●
	Snowpack	●	●	●	●	●
Geology and Soils	Coastal Erosion	●	●			
	Sea Ice	○	○			
	Permafrost	●	●	●	●	●
Water	Lake Communities and Ecosystems	●	●	●	●	●
	Lagoon Communities and Ecosystems		●			
	Stream Communities and Ecosystems	●	●	●	●	●
	<i>Surface Water Dynamics</i>	+	+	+	+	+
Biological Integrity	Land Birds	●	●	●	●	●
	Yellow-billed Loons	●	●			
	Brown Bears	●	●	●		●
	Dall's Sheep			●	●	●
	Muskox	●	●			
	Caribou	○	○	○	○	○
	Moose	○	○	○	○	○
	<i>Fish Assemblages</i>	+	+	+	+	+
	<i>Small Mammal Assemblages</i>	+	+	+	+	+
	Terrestrial Vegetation and Soils	●	●	●	●	●
	<i>Invasive/Exotic Species</i>	+	+	+	+	+
Human Use	Subsistence/Harvest	○	○	○	○	○
	<i>Point Source Human Effects</i>		+	+		+
Landscapes	Fire Extent and Severity	○	○	○	○	○
	Landscape Patterns and Dynamics	●	●	●	●	●

● Vital signs for which the network will develop protocols and implement monitoring with funding from the vital signs or water quality monitoring program.

○ Vital signs that are currently being monitored long-term by a network park, another NPS program, or by another federal or state agency. The network will collaborate with these other monitoring efforts where appropriate but will not use vital signs or water quality monitoring program funds.

+ Vital signs for which monitoring will likely be done in the future but which cannot currently be implemented due to limited staff and funding.

**Table 2. Vital signs of the Central Alaska Network**

Monitoring Framework	Vital Sign	Parks where Monitored		
		DENA	WRST	YUCH
Air and Climate	Air quality	○		
	<b>Climate</b>	●	●	●
	<b>Snow pack</b>	●	●	●
Geology and Soils	<b>Glaciers</b>	●	●	
	<b>Permafrost</b>	●	●	●
	<i>Disturbance - volcanoes and tectonics</i>	+	+	+
Water	<b>Disturbance - Stream flooding</b>	●	●	●
	<b>River/stream flow</b>	●	●	●
	<b>Water Quality</b>	●	●	●
Biological Integrity	<b>Freshwater fish</b>	●	●	●
	<b>Passerines</b>	●	●	●
	<b>Bald Eagle</b>		●	
	<b>Golden Eagles</b>	●		
	<b>Peregrine Falcon</b>			●
	<i>Ptarmigan</i>	+	+	+
	<b>Moose</b>	●	●	●
	<b>Sheep</b>	○	●	○
	<b>Small mammals</b>	●	+	+
	<b>Caribou</b>	●	●	○
	<b>Snowshoe hare</b>	●	●	●
	<i>Arctic ground squirrel</i>	+	+	+
	<b>Wolves</b>	●	+	●
	<i>Brown Bear</i>	+	+	+
	<b>Vegetation structure and composition</b>	●	●	●
	<i>Disturbance - Exotic species</i>	+	+	+
	<i>Insect Damage</i>	+	+	+
	<i>Subarctic steppe</i>			+
Human Use	<b>Consumptive use</b>	○	○	○
	<i>Human populations</i>	+	+	+
	<i>Human presence/use</i>	+	+	+
	<i>Trails</i>	+	+	+
Landscapes	<b>Disturbance - Fire occurrence and extent</b>	○	○	○
	<b>Land Cover</b>	●	●	●
	<b>Soundscape</b>	○	+	+
	<b>Plant phenology</b>	○	○	○

**Table 3. Vital signs of the Southwest Alaska Network**

Monitoring Framework	Vital Sign	Parks where Monitored				
		G	ANIA	M	KEFJ	L
Air and Climate	Visibility and Particulate Matter		○	●		○
	Weather and Climate			●	●	●
Geology and Soils	Glacier Extent			●	●	●
	Geomorphic Coastal Change		+	+	●	●
	Volcanic and Earthquake Activity	○	○	○	○	○
Water	Freshwater Chemistry	●	●	●	●	●
	Surface Water Hydrology	●	●	●	●	●
	Marine Water Chemistry			●	●	●
Biological Integrity	Invasive/Exotic Species	○	○	○	○	○
	Insect Outbreaks	○		○	○	○
	Kelp and Seagrasses			●	●	
	Marine Intertidal Invertebrates			●	●	●
	Resident Lake Fish	●		●		●
	Salmon	○		○		○
	Black Oystercatcher			●	●	
	Marine Birds			●	●	●
	Bald Eagle	+	+	●	●	●
	Brown Bear	+	+	●		●
	<i>Wolf</i>	+		+		+
	Moose			●		●
	Sea Otter			●	●	
	Caribou			○		○
	Harbor Seal			○	○	○
	Vegetation Composition and Structure	●	●	●	●	●
	Sensitive Vegetation Communities			●	●	●
Human Use	Consumptive use	○	○	○		○
	Visitor Use	○	○	○	○	○
Landscapes	Land Cover	●	●	●	●	●
	Landscape Processes	●	●	●	●	●



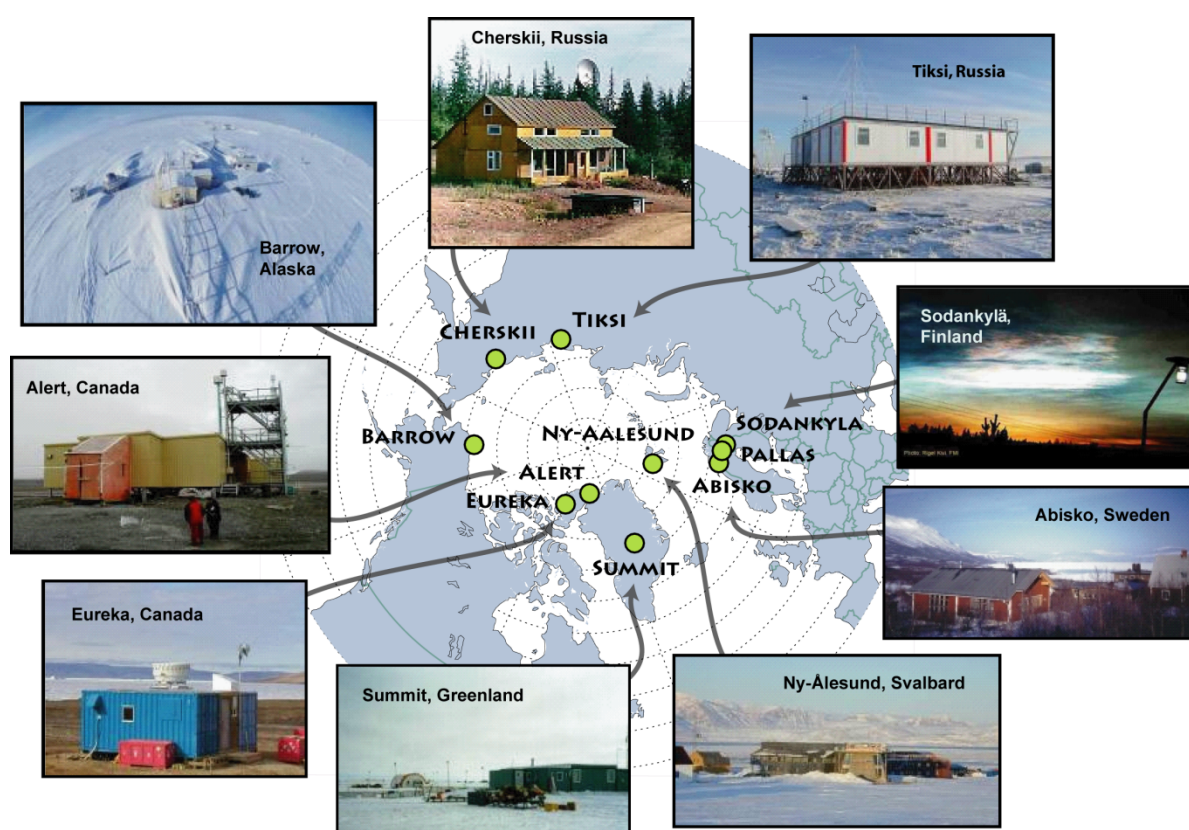
**Table 4. Vital signs of the Southeast Alaska Network**

Monitoring Framework	Vital Sign	Parks where Monitored		
		GLBA	KLGO	SITK
Air and Climate	<b>Airborne Contaminants</b>	●	●	●
	Visibility and Particulate Matter	+	+	+
	<b>Weather and Climate</b>	●	●	+
Geology and Soils	<b>Glacier Dynamics</b>	●	●	
	<b>Landform and Landcover</b>	●	●	●
Water	<b>Streamflow</b>	●	●	●
	<b>Oceanography</b>	●		
	<b>Freshwater Benthic Macroinvertebrates and Algae</b>	+	+	●
	<b>Freshwater Water Quality</b>	●	●	●
	<b>Freshwater Contaminants</b>	●	●	●
	<b>Marine Contaminants</b>	●	○	●
Biological Integrity	<i>Invasive/Exotic Animals</i>	+	+	+
	<i>Invasive/Exotic Plants</i>	○	○	○
	<i>Pests and Diseases</i>	+	+	+
	<i>Bald Eagles</i>	+	+	+
	<i>Bears</i>	+	+	+
	<i>Biodiversity of Select Groups</i>	+	+	+
	<i>Breeding Land Birds Assemblages</i>	+	+	+
	<i>Forage Fishes</i>	+	+	
	<i>Harbor Seals</i>	+		
	<b>Intertidal Communities</b>	+	+	●
	Killer Whales	+		
	<b>Marine Predators</b>	●		
	<b>Kittlitz's Murrelets</b>	●		
	<i>Salmonids</i>	+	+	+
	<i>Ungulates</i>	+		
	Western Toads	+	○	
	<i>Wetland Communities</i>	+	+	+
	Humpback Whales	○		
	<i>Steller Sea Lions</i>	+		
	<i>Consumptive Uses</i>	+	+	+
	Human Uses and Modes of Access	○	○	○
	<i>Airborne Sounds</i>	+	+	+
	Underwater Sound	○		
	<i>Phenology, Plant Communities</i>	+	+	+

## Appendix 3. International Arctic Systems for Observing the Atmosphere (IASOA).

# International Arctic Systems for Observing the Atmosphere IASOA

SAON Inventory of Interested Networks  
26 January 2010



**Name and acronym:** International Arctic Systems for Observing the Atmosphere (IASOA)

**Contacts:** Taneil Uttal (taniel.uttal@noaa.gov)  
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**Web site:** [www.iasoa.org](http://www.iasoa.org)

**Main objective of the network:**

**IASOA MISSION**

The main mission of the International Arctic Systems for Observing the Atmosphere (IASOA) is coordination of atmospheric data collection at existing and newly established intensive Arctic atmospheric observatories. This effort supports the International Polar Year ([www.ipy.org](http://www.ipy.org)) but is intended to establish a continuing network consortium into the foreseeable future. Data of interest to the IASOA consortium include measurements of standard meteorology, greenhouse gases, atmospheric radiation, clouds, pollutants, chemistry, aerosols, and surface energy balances.

These measurements support studies of Arctic climate change attribution (why things are changing), not just trends (how things are changing). IASOA is responsive to growing evidence that the earth system may be approaching environmentally critical thresholds within decadal time scales. The information from IASOA will not only enhance scientific understanding but will also support decisions by the global community regarding climate change mitigation and adaptation strategies.

The full description of the IASOA IPY Activity can be found at:

<http://classic.ipy.org/development/eoi/proposal-details.php?id=196>

**Observatory locations:**

Abisko, Sweden (68.35N, 18.82E), since 1903  
Alert, Canada (82.5017N, 62.3297), since 1950  
Barrow, USA (71.323N, 156.609W), since 1973  
Cherskii, Russia (69N, 161 E), since 1989  
Eureka, Canada (80.05N, 86.417W), since 1947  
Ny-Ålesund, Norway (78.908N, 11.881E), since 1968  
Pallas and Sodankylä, Finland (67.37N, 26.65E), since 1858  
Summit, Greenland (72.58N, 28.48W), since 1989  
Tiksi, Russia (71.5N, 128.92E), since 1932

**Member of other global networks include:**

**Global Atmosphere Watch (GAW):** Alert, Barrow, Ny-Ålesund (Zeppelin Mountain), Pallas, Summit

**Baseline Surface Radiation Network (BSRN):** Barrow and Ny-Ålesund are full BSRN members, Alert and Summit are candidate BSRN members

**Arctic Monitoring and Assessment Programme (AMAP):** Abisko, Alert, Barrow, Eureka, Ny-Ålesund, Pallas, Sodankylä, Summit and Tiksi

**Type of activity:** Predominantly atmospheric measurements

**Main variables:** All observatories collect year-round measurements of basic surface meteorological variables. Other measurements vary according to each observatories' research objectives. For more details, visit the IASOA Observatories-at-a-Glance table ([http://iasoa.org/iasoa/index.php?option=com\\_content&task=view&id=85&Itemid=123](http://iasoa.org/iasoa/index.php?option=com_content&task=view&id=85&Itemid=123)) which is also included in Appendix A.

**When operational:** Year-round

**Geographical coverage:** Pan-Arctic

**Data archive** (data center): Each observatory has its own data archiving method. The IASOA website provides links to observatory data easily found through the internet.

**Data availability:** Varies by observatory.

**Main gaps:** Not all observatories are members of established global networks such as GAW and BSRN. It is recommended that non-member observatories of these global networks be evaluated for potential membership and that roadblocks to membership be investigated.

Other types of measurement gaps include, but are not limited to:

Radar-lidar pairs at each observatory to assess cloud properties

Flux towers at each observatory for methane and CO<sub>2</sub> fluxes

Aerosol measurements at each observatory

Surface and upper air ozone measurements at each observatory

**Appendix A – Observatories-at-a-Glance table from [www.iasoa.org](http://www.iasoa.org)**

Measurement or Instrument	<a href="#">Abisko, Sweden</a>	<a href="#">Alert, Canada</a>	<a href="#">Barrow, U.S.A.</a>	<a href="#">Cherskii, Russia</a>	<a href="#">Eureka, Canada</a>	<a href="#">Ny- Ålesund, Norway</a>	<a href="#">Pallas/Sodankylä Finland</a>	<a href="#">Summit, Greenland</a>	<a href="#">Tiksi, Russia</a>
<a href="#">Meteorology - surface (T, Td, P, Ws, Wd)</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>
<a href="#">Meteorology - upper air</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>
<a href="#">Precipitation</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<b>Y</b>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>
<a href="#">Snow depth</a>		<a href="#">Y</a>	<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>
<a href="#">Micrometeorology tower</a>			<a href="#">Y</a>		<b>Y</b>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>
<a href="#">Surface energy balance</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Radiation</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Aerosol (surface and upper air)</a>		<a href="#">Y</a>	<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>		
<a href="#">Radar wind profiler</a>			<a href="#">Y</a>						
<a href="#">Cloud radar</a>			<a href="#">Y</a>		<a href="#">Y</a>				
<a href="#">Sea ice radar</a>			<a href="#">Y</a>						
<a href="#">Cloud lidar</a>			<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>			
<a href="#">Sky camera</a>			<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>		
<a href="#">Webcams</a>			<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>		<a href="#">Y</a>	
Measurement or Instrument	<a href="#">Abisko, Sweden</a>	<a href="#">Alert, Canada</a>	<a href="#">Barrow, U.S.A.</a>	<a href="#">Cherskii, Russia</a>	<a href="#">Eureka, Canada</a>	<a href="#">Ny- Ålesund, Norway</a>	<a href="#">Pallas/Sodankylä Finland</a>	<a href="#">Summit, Greenland</a>	<a href="#">Tiksi, Russia</a>
<a href="#">Ceilometer</a>			<a href="#">Y</a>				<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Ozone lidar</a>					<a href="#">Y</a>				
<a href="#">Ozone - surface</a>		<a href="#">Y</a>	<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>
<a href="#">Ozone - upper air</a>		<a href="#">Y</a>	<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Total ozone</a>		<a href="#">Y</a>	<a href="#">Y</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Greenhouse gases</a>		<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Radio nuclides</a>		<a href="#">Y</a>	<b>Y</b>			<b>Y</b>	<b>Y</b>	<a href="#">Y</a>	
<a href="#">Reactive gases</a>		<a href="#">Y</a>	<a href="#">Y</a>			<a href="#">Y</a>	<a href="#">Y</a>	<a href="#">Y</a>	
<a href="#">Heavy metals - atmosphere</a>						<a href="#">Y</a>			
<a href="#">Inorganic compounds - atmosphere</a>						<a href="#">Y</a>			
<a href="#">Local water chemistry</a>	<b>Y</b>								
<a href="#">Precipitation chemistry</a>		<a href="#">Y</a>		<b>Y</b>		<a href="#">Y</a>	<a href="#">Y</a>	<b>Y</b>	
<a href="#">Snow chemistry</a>		<a href="#">Y</a>						<a href="#">Y</a>	
<a href="#">Heavy Metals</a>						<b>Y</b>	<b>Y</b>		
<a href="#">Organic compounds</a>						<b>Y</b>	<b>Y</b>		

<u>Inorganic compounds</u>						Y	Y		
<u>BSRN member</u>		<u>Y</u>	<u>Y</u>			<u>Y</u>		<u>Y</u>	
Measurement or Instrument	<u>Abisko, Sweden</u>	<u>Alert, Canada</u>	<u>Barrow, U.S.A.</u>	<u>Cherskii, Russia</u>	<u>Eureka, Canada</u>	<u>Ny-Ålesund, Norway</u>	<u>Pallas/Sodankylä, Finland</u>	<u>Summit, Greenland</u>	<u>Tiksi, Russia</u>
<u>GAW member</u>		<u>Y</u>	<u>Y</u>			<u>Y</u>	<u>Y</u>	<u>Y</u>	
<u>AMAP member</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>		<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>
<u>Evaporation</u>							Y		
<u>Soil measurements</u>	<u>Y</u>			<u>Y</u>			<u>Y</u>		<u>Y</u>
<u>Local river water levels</u>	Y								
<u>Ground water level</u>	<u>Y</u>								
<u>Water discharge, sediment transport</u>						Y			
<u>Fast ice thickness</u>									Y
<u>Ice Thickness (local lakes)</u>	<u>Y</u>								
<u>Mass balance of glaciers</u>						Y			
<u>Ice core drilling</u>						Y		Y	
<u>Persistent Organic Pollutants (POP)</u>		Y	Y			<u>Y</u>	Y		
Measurement or Instrument	<u>Abisko, Sweden</u>	<u>Alert, Canada</u>	<u>Barrow, U.S.A.</u>	<u>Cherskii, Russia</u>	<u>Eureka, Canada</u>	<u>Ny-Ålesund, Norway</u>	<u>Pallas/Sodankylä, Finland</u>	<u>Summit, Greenland</u>	<u>Tiksi, Russia</u>
<u>Cosmic rays</u>						Y	<u>Y</u>		
<u>Radar aeronomy</u>						Y			
<u>Ionosphere measurements</u>							Y		
<u>Riometer measurements</u>	Y						<u>Y</u>		
<u>Infrasound</u>							Y		
<u>ELF-VLF</u>							Y		
Measurement or Instrument	<u>Abisko, Sweden</u>	<u>Alert, Canada</u>	<u>Barrow, U.S.A.</u>	<u>Cherskii, Russia</u>	<u>Eureka, Canada</u>	<u>Ny-Ålesund, Norway</u>	<u>Pallas/Sodankylä, Finland</u>	<u>Summit, Greenland</u>	<u>Tiksi, Russia</u>
<u>Pulsation</u>							Y		
<u>Geomagnetism</u>	<u>Y</u>					<u>Y</u>	<u>Y</u>		
<u>Seismic</u>						Y	Y		
<u>Photo phenology</u>	Y								