

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:776 (219 conversations)

Created: 08-07-2018 at 16:59 PM

Conversation Contents

[EXTERNAL] [National Snow & Ice Data Center] Update: Re: [National Snow & Ice Data Center] Update: Re: Arctic Alaska Snow Information (fwd)

Attachments:

/88. [EXTERNAL] [National Snow & Ice Data Center] Update: Re: [National Snow & Ice Data Center] Update: Re: Arctic Alaska Snow Information (fwd)/2.1 Anwrmap.jpg

"Paul (National Snow & Ice Data Center)" <nsidc@nsidc.org>

From: "Paul (National Snow & Ice Data Center)" <nsidc@nsidc.org>
Sent: Tue Apr 03 2018 10:22:31 GMT-0600 (MDT)
To:
CC: Jeff Deems <jeff.deems@nsidc.org>, Wendy Loya <wendy_loya@fws.gov>, Miriam Hayes <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>, Donald Cline <dcline@usgs.gov>, Aimee Devaris <adevaris@usgs.gov>
Subject: [EXTERNAL] [National Snow & Ice Data Center] Update: Re: [National Snow & Ice Data Center] Update: Re: Arctic Alaska Snow Information (fwd)

Please do not write below this line

You are registered as a cc on this help desk request and are thus receiving email notifications on all updates to the request.

Reply to this email to add a comment to the request.

Paul, Apr 3, 10:22 MDT:

Hi Aimee (and Nichole and Wendy),

I'd be glad to help out with this. Can you please attach a document or file that shows area 1002 in the ANWF? Once I have that, I can be more detailed about the data that is available.

Thanks,
Paul

NSIDC User Services

CIRES, 449 UCB

University of Colorado

Boulder, CO 80309-0449, USA

Phone: +1 303-492-6199

Fax: +1 303-492-2468

Email: nsidc@nsidc.org

URL: <http://nsidc.org>

Twitter: @NSIDC

National Snow and Ice Data Center * Distributed Active Archive Center

Aimee Devaris, Mar 30, 12:44 MDT:

This is a follow-up to your previous request #87211 "Re: Arctic Alaska Snow Info..."

Hi Paul,

Just following up on this now -- as I was trying to find a contact for Fish and Wildlife and Bureau of Land Management in Alaska for this information. I've copied Wendy Loya from FWS and Nicole (Miriam) Hayes from BLM. They are trying to facilitate the cataloging of scientific information to establish a level of baseline information necessary to support the development of Environmental Impact Statements and other NEPA (National Environmental Policy Act) requirements.

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Thanks,
Aimee

This email is a service from National Snow & Ice Data Center.

[XZ89OM-K89D]

Wendy Loya <Wendy_loya@fws.gov>

From: Wendy Loya <Wendy_loya@fws.gov>
Sent: Tue Apr 03 2018 11:25:18 GMT-0600 (MDT)
To: "National Snow & Ice Data Center" <nsidc@nsidc.org>
CC: Jeff Deems <jeff.deems@nsidc.org>, "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>, Donald Cline <dcline@usgs.gov>, Aimee Devaris <adevaris@usgs.gov>
Subject: RE: [EXTERNAL] [National Snow & Ice Data Center] Update: Re: [National Snow & Ice Data Center] Update: Re: Arctic Alaska Snow Information (fwd)
Attachments: Anwrmap.jpg

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Thank you for your assistance,
Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From: Paul (National Snow & Ice Data Center) <nsidc@nsidc.org>

Sent: Tuesday, April 3, 2018 8:23 AM

Cc: Jeff Deems <jeff.deems@nsidc.org>; Wendy Loya <wendy_loya@fws.gov>; Miriam Hayes <mnhayes@blm.gov>; John Pearce <jpearce@usgs.gov>; Donald Cline <dcline@usgs.gov>; Aimee Devaris <adevaris@usgs.gov>

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[XZ89OM-K89D]

"Paul (National Snow & Ice Data Center)" <nsidc@nsidc.org>

From: "Paul (National Snow & Ice Data Center)" <nsidc@nsidc.org>
Sent: Wed Apr 04 2018 11:14:22 GMT-0600 (MDT)
To:
CC: Jeff Deems <jeff.deems@nsidc.org>, Wendy Loya <wendy_loya@fws.gov>, Miriam Hayes <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>, Donald Cline <dcline@usgs.gov>, Aimee Devaris <adevaris@usgs.gov>
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Paul, Apr 4, 11:14 MDT:

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I suggest researching these products before we proceed. I'd be happy to answer any questions you have about MODIS and/or VIIRS. If these are not what you're looking for, please let me know what specific parameters and temporal coverage you may need and we can go from there. The links to each mission are below. Keep in mind that the VIIRS Level 3, daily product (VNP10A1) has not yet been released yet but should be coming in the next few months. We can also discuss distribution methods and data customization methods for these products (programmatic access, downloading, reprojection, reformatting, etc) a bit later on.

<https://nsidc.org/data/modis>

<https://nsidc.org/data/viirs>

Thanks,

Paul

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Email: nsidc@nsidc.org

URL: <http://nsidc.org>

Twitter: @NSIDC

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Wendy Loya, Apr 3, 11:25 MDT:

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Office of Science Applications -Arctic Program

US Fish and Wildlife Service

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Attachment(s)

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This email is a service from National Snow & Ice Data Center.

[XZ89OM-K89D]

"Loya, Wendy" <wendy_loya@fws.gov>

From: "Loya, Wendy" <wendy_loya@fws.gov>
Sent: Thu Apr 05 2018 13:48:27 GMT-0600 (MDT)
To: "National Snow & Ice Data Center" <nsidc@nsidc.org>
Jeff Deems <jeff.deems@nsidc.org>, Miriam Hayes
CC: <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>, Donald
Cline <dcline@usgs.gov>, Aimee Devaris <adevaris@usgs.gov>
Subject: Re: [EXTERNAL] [National Snow & Ice Data Center] Update: Re:
[National Snow & Ice Data Center] Update: Re: Arctic Alaska
Snow Information (fwd)

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US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

On Wed, Apr 4, 2018 at 9:14 AM, Paul (National Snow & Ice Data Center) <nsidc@nsidc.org> wrote:

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US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

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From: Paul (National Snow & Ice Data Center) <nsidc@nsidc.org>

Sent: Tuesday, April 3, 2018 8:23 AM

Cc: Jeff Deems <jeff.deems@nsidc.org>; Wendy Loya <wendy_loya@fws.gov>; Miriam Hayes <mnhayes@blm.gov>; John Pearce <jpearce@usgs.gov>; Donald Cline <dcline@usgs.gov>; Aimee Devaris <adevaris@usgs.gov>
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Sent: Thu Apr 05 2018 14:46:29 GMT-0600 (MDT)
To:
CC: Jeff Deems <jeff.deems@nsidc.org>, Wendy Loya <wendy_loya@fws.gov>, Miriam Hayes <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>, Donald Cline <dcline@usgs.gov>, Aimee Devaris <adevaris@usgs.gov>
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Paul, Apr 5, 14:46 MDT:

Hi Wendy,

Thanks for the update. The use case for the data is also interesting as that provides a little clarity. I look forward to hearing from you or the other scientists soon.

Thanks,
Paul

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Wendy Loya, Apr 5, 13:49 MDT:

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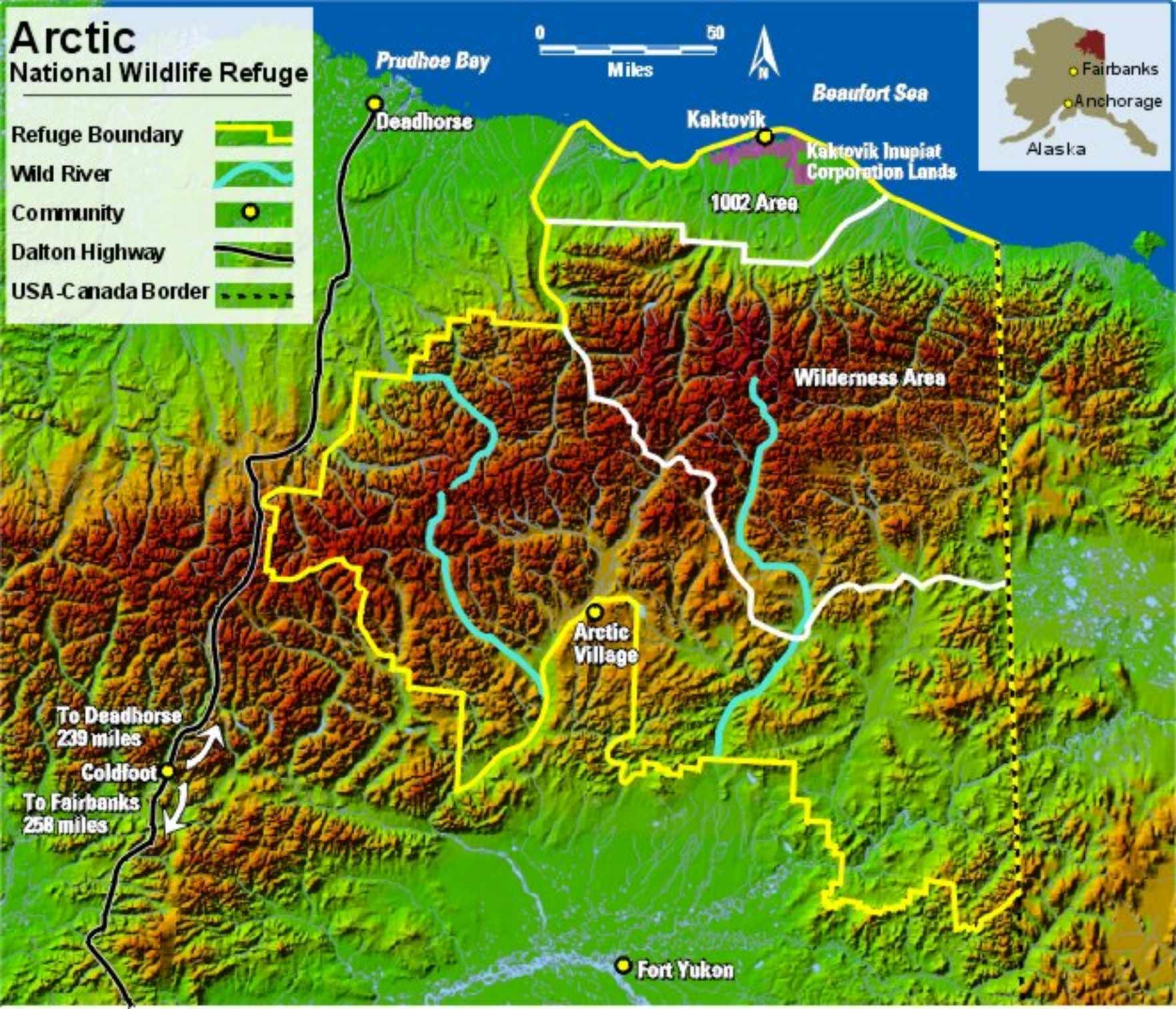
This email is a service from National Snow & Ice Data Center.

[XZ89OM-K89D]

Email Attachments

Arctic National Wildlife Refuge

- Refuge Boundary
- Wild River
- Community
- Dalton Highway
- USA-Canada Border



Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:776 (219 conversations)

Created: 08-07-2018 at 17:00 PM

Conversation Contents

[EXTERNAL] EIS Process for 1002

Attachments:

/91. [EXTERNAL] EIS Process for 1002/1.1 image003.png
/91. [EXTERNAL] EIS Process for 1002/2.1 image003.png
/91. [EXTERNAL] EIS Process for 1002/3.1 image003.png
/91. [EXTERNAL] EIS Process for 1002/4.1 image003.png

<Andrew.Smith@gov.yk.ca>

From: <Andrew.Smith@gov.yk.ca>
Sent: Wed Apr 04 2018 12:21:28 GMT-0600 (MDT)
To: <mnhayes@blm.gov>
Subject: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Good morning Nicole.

I got your contact information through Mike Sutor here at Yukon government.

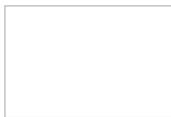
We are looking at how we will be able to participate in the EIS scoping and commenting period for the potential lease opportunities in the 1002 area.

Right now, I am just trying to find some resources that describe that process – stages and timelines, matters to be considered in the scoping, etc. Are there any quick reference guides to your process?

I'm sure I'll have some more questions later on, but for now am just trying to get YG up to speed on how the process will work.

Thanks for your help.

Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Wed Apr 04 2018 12:24:10 GMT-0600 (MDT)
To: Lesli Ellis-Wouters <lellis@blm.gov>
CC: "Murphy, Ted" <t75murph@blm.gov>, Serena Sweet <ssweet@blm.gov>
Subject: Fwd: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Hi Lesli,
Would you like me to respond or should you?

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

----- Forwarded message -----

From: <Andrew.Smith@gov.yk.ca>
Date: Wed, Apr 4, 2018 at 10:21 AM
Subject: [EXTERNAL] EIS Process for 1002
To: mnhayes@blm.gov

Good morning Nicole.

I got your contact information through Mike Sutor here at Yukon government.

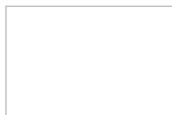
We are looking at how we will be able to participate in the EIS scoping and commenting period for the potential lease opportunities in the 1002 area.

Right now, I am just trying to find some resources that describe that process – stages and timelines, matters to be considered in the scoping, etc. Are there any quick reference guides to your process?

I'm sure I'll have some more questions later on, but for now am just trying to get YG up to speed on how the process will work.

Thanks for your help.

Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

"Ellis-Wouters, Lesli" <lellis@blm.gov>

From: "Ellis-Wouters, Lesli" <lellis@blm.gov>
Sent: Wed Apr 04 2018 12:26:23 GMT-0600 (MDT)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Subject: Re: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Have you started an interested parties list? You can answer and let him know we can add him to that list as well to check our website for updates. It would be okay to explain the basic NEPA process.

Lesli J. Ellis-Wouters

Communications Director
Alaska State Office
Bureau of Land Management
907-271-4418 | cell - 907-331-8763

On Wed, Apr 4, 2018 at 10:24 AM, Hayes, Miriam (Nicole) <mnhayes@blm.gov> wrote:

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Nicole Hayes
Project Coordinator
Bureau of Land Management
[222 W. 7th Avenue #13](#)
[Anchorage, Alaska 99513](#)
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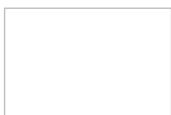
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Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

Sent: Wed May 09 2018 15:39:19 GMT-0600 (MDT)
To: Andrew.Smith@gov.yk.ca
Subject: Re: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Hi Andrew,
BLM is in the scoping phase which began April 20, 2018. The National Environmental Policy Act guides the EIS process, and you can obtain more information about meeting times/locations (when announced) at our website which will have the most up to date information.

<https://www.blm.gov/programs/planning-and-nepa/plans-in-development/alaska/coastal-plain-eis>

Thank you,
Nicole

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Wed, Apr 4, 2018 at 10:21 AM, <Andrew.Smith@gov.yk.ca> wrote:

Good morning Nicole.

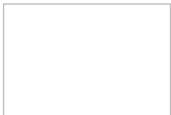
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Thanks for your help.

Andrew



Andrew G. Smith
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Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:776 (219 conversations)

Created: 08-07-2018 at 17:01 PM

Conversation Contents

Fwd: International Porcupine Caribou Herd (PCH) Agreement...

Attachments:

/95. Fwd: International Porcupine Caribou Herd (PCH) Agreement.../1.1
02_AppA_Legal.pdf
/95. Fwd: International Porcupine Caribou Herd (PCH) Agreement.../1.2 1987
International PCH Agreement.docx
/95. Fwd: International Porcupine Caribou Herd (PCH) Agreement.../1.3
1987_0717_USFWS News Release - Intl PCH Agreem.pdf
/95. Fwd: International Porcupine Caribou Herd (PCH) Agreement.../1.4 ADFG
porcupine_caribou_news_summer_2017.pdf

"Murphy, Ted" <t75murph@blm.gov>

From: "Murphy, Ted" <t75murph@blm.gov>
Sent: Mon Apr 02 2018 08:39:33 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: International Porcupine Caribou Herd (PCH) Agreement...
02_AppA_Legal.pdf 1987 International PCH Agreement.docx
Attachments: 1987_0717_USFWS News Release - Intl PCH Agreem.pdf ADFG
porcupine_caribou_news_summer_2017.pdf

Nicole,

I asked Mark Miller what information they had on the Porcupine Caribou herd and agreements.

Ted

----- Forwarded message -----

From: Miller, Mark <memiller@blm.gov>
Date: Fri, Mar 30, 2018 at 12:34 PM
Subject: International Porcupine Caribou Herd (PCH) Agreement...
To: "Ted A. Murphy" <t75murph@blm.gov>

Ted -

Attached:

- Appendix A (Legal, Planning, and Policy Guidance) from the 2015 [Arctic National Wildlife Refuge Comprehensive Conservation Plan](#). The International PCH Agreement is described briefly on p. A-3.
- Agreement itself - I've highlighted a couple of pertinent sections.
- 1987 USFWS Press Release about the Agreement
- A 2017 ADFG report on the PCH. The Agreement is mentioned at the top of the last page.

Let me know if you need more.

Mark

~~~~~  
**Mark E. Miller, PhD | Deputy Director**  
**North Slope Science Initiative | <http://www.NorthSlopeScience.org>**  
Email: [memiller@blm.gov](mailto:memiller@blm.gov) | Office: 907-271-3212 | Mobile: 907-231-9427  
c/o Bureau of Land Management | Alaska State Office | State Director's Office  
222 West 7th Avenue, #13 | Anchorage, AK 99513  
~~~~~

"We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely."
-- E. O. Wilson, *Consilience*

--
Ted A Murphy
Alaska-Associate State Director
907-271-5076

Email Attachments

Appendix A

Legal, Policy, and Planning Guidance

A. Legal, Policy, and Planning Guidance

A.1 Legal Guidance

The U.S. Fish and Wildlife Service (Service) manages national wildlife refuges pursuant to various legal and administrative requirements. Management of Arctic National Wildlife Refuge (Arctic Refuge, Refuge) is dictated, in large part, by the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), which established Arctic Refuge, re-designated the Arctic National Wildlife Range as part of the new Refuge, and identified the purposes for which it was established. However, other laws, regulations and policies, and agreements with the State of Alaska also guide the management of Arctic Refuge. This section identifies the acts and policy guidance that are integral in the development of this Comprehensive Conservation Plan (Plan, Revised Plan). Among the most important are the National Wildlife Refuge Administration Act, as amended by the National Wildlife Refuge System Improvement Act; the Refuge Recreation Act; the Alaska Native Claims Settlement Act (ANCSA); and the Endangered Species Act. A brief description of these and other pertinent legal documents that influence management of Arctic Refuge is found in the following subsections.

A.1.1 *International Treaties*

Several treaties affect how the Service manages Arctic Refuge. Among these are migratory bird treaties with Canada, Mexico, Japan, and Russia and the Convention on Nature Protection and Wildlife Conservation in the Western Hemisphere. These treaties differ in emphasis and species of primary concern but collectively provide clear mandates for identifying and protecting important habitats and ecosystems and for protecting and managing individual species.

A.1.1.1 *Migratory Birds*

A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. Refuge and Service management of migratory birds must comply with the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended. Key amendments to the act include the Migratory Bird and Game Mammal Treaty with Mexico of 1936, the Migratory Bird Treaty with Japan of 1974, and the Migratory Bird Treaty with the Soviet Union of 1978 (USSR Treaty). Migratory bird management must also comply with the Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere of 1940 (Convention).

The Convention and the Migratory Bird Treaty Act and its amendments, provide a variety of management provisions, including:

- Unless permitted by regulations, a prohibition on “the pursuit, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird ... for the protection of migratory birds ... or any part, nest, or egg of any such bird” (16 U.S.C. 703).

- A prohibition on the disturbance of nesting colonies (USSR Treaty, Article II).
- An allowance for the Secretary of the Interior to establish seasons for the taking of birds and the collection of their eggs by “indigenous inhabitants” of Alaska for their own nutritional and other essential needs (16 U.S.C. 712).
- Direction for each nation to undertake, to the maximum extent possible, measures necessary to protect and enhance migratory bird environments and to prevent and abate pollution or detrimental alteration of their habitats (USSR Treaty, Article IV).
- A requirement that each nation provide immediate notification to the other when pollution or destruction of habitats occurs or is expected (USSR Treaty, Article IV).
- A stipulation that each nation shall, to the extent possible, establish preserves, refuges, protected areas, and facilities for migratory birds and their habitats and manage them to preserve and restore natural ecosystems (Convention).
- Stipulations that special habitats outside the jurisdictional boundaries (territorial limits) may be designated in which, to the maximum extent, persons under each nation’s jurisdiction shall act in accordance with the principles of the treaty (for instance, this stipulation might require U.S. oil tankers to avoid or prevent pollution of special seabird areas on the high seas).
- An allowance that protective measures under the treaty may be applied to species and subspecies not listed in the specific convention but that belong to one of the families containing listed species (USSR Treaty, Article VIII). All bird species that occur on Arctic Refuge, with the exception of grouse and ptarmigan, are covered by the Migratory Bird Treaty Act, as amended.



A.1.1.2 Agreement on the Conservation of Polar Bears

This is an agreement between the governments of Canada, Denmark, Norway, the former USSR, and the United States. It recognizes the responsibilities of circumpolar countries for coordinating actions to protect polar bears.

The agreement prohibits hunting, killing, and capturing polar bears except for bona fide scientific and conservation purposes, preventing serious disturbance to the management of other living resources, and by local people under traditional rights. This multilateral agreement also commits each associated country to sound conservation practices by protecting the ecosystem of polar bears, with special attention to denning areas, feeding sites, and migration corridors based on best available science through coordinated research.

The agreement was signed by the United States on November 15, 1973, in Oslo, Norway; ratified on September 30, 1976; and entered into force in this country on November 1, 1976 (IUCN 2009).

A.1.1.3 International Porcupine Caribou Herd Agreement

In 1987, the U.S. and Canadian governments signed the “Agreement between the Government of the United States of America and the Government of Canada on the Conservation of the Porcupine Caribou Herd.” This bilateral agreement recognizes that the Porcupine caribou herd regularly migrates across the international boundary between Canada and the United States and that the herd should be conserved according to ecological principles emphasizing the importance of conserving habitat, including calving, post-calving, migration, wintering, and insect relief habitat.

The main objectives of the agreement are to conserve the herd and its habitat through international cooperation and coordination so that the risk of irreversible damage or long-term adverse effects, including cumulative effects, as a result of use of caribou or their habitat is minimized, and to ensure opportunities for customary and traditional uses of the Porcupine caribou herd.

The agreement set up the International Porcupine Caribou Board, composed of delegated representatives from both countries that give advice and recommendations to the countries on the conservation and management of the herd. The International Porcupine Caribou Board, in turn, set up the Porcupine Caribou Technical Committee, composed of biologists from each country to advise them in their recommendations. Refuge staff participate on the Porcupine Caribou Technical Committee.

This agreement was signed by the United States on July 17, 1987, in Ottawa, Canada, and entered into force in this country upon signing (United Nations 2004).

A.1.1.4 Yukon River Salmon Agreement

On January 28, 1985, the United States and Canada signed the Pacific Salmon Treaty to prevent over-fishing, provide for optimum production, and ensure that both countries receive benefits equal to the production of salmon originating in their waters. The treaty was revised in 1999 to renew the parties’ long-term fishing agreements. The Yukon River Salmon Agreement was signed by delegations from the U.S. and Canada on March 2001 and was implemented by management agencies that same year. However, official recognition of the

agreement wasn't until December 4, 2002, when it was signed by the U.S. and Canadian governments and officially inserted into the Pacific Salmon Treated as Chapter 8 (Yukon River Drainage Fisheries Association and Yukon River Panel 2005)

Salmon that originate in the Canadian portion of the Yukon River drainage are a shared resource between the Yukon Territory (Canada) and Alaska (U.S.). Yukon River Chinook and chum salmon have some of the longest migratory journeys in the world and are prized for their size and oil content. The people along the river and its tributaries depend on this resource for food, as well as for social, ceremonial, recreational, and economic purposes. Due to sharp declines of Canadian-origin Yukon River salmon populations, the two countries negotiated a cooperative management arrangement for these resources. The agreement outlines steps to ensure the sustainability of Canadian-origin Yukon River salmon stocks and fisheries through conservation, management practices, stock rebuilding, harvest sharing, research, and habitat protection. In Arctic Refuge, salmon that occur in and/or migrate through the Porcupine River are subject to the terms of the agreement. Other Yukon River tributaries in Arctic Refuge with salmon include the Coleen and Sheenjek Rivers.

The agreement is implemented through the Yukon River Panel, an international body of 12 members, equal parts American and Canadian, which advises managers of Yukon River fisheries concerning restoration, conservation, and coordinated management.

A.1.2 National Guidance

A.1.2.1 National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee (Refuge Administration Act)

This act serves as the “organic act” for the National Wildlife Refuge System (Refuge System). The act, as amended, consolidated the various categories of lands administered by the Secretary of the Interior (Secretary) through the Service into a single, national system. The act establishes a unifying mission for the Refuge System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. This act states, first and foremost, that the mission of the Refuge System be focused singularly on wildlife conservation.

This act identifies six priority wildlife-dependent recreation uses, clarifies the Secretary's authority to accept donations of money for land acquisition, and places restrictions on the transfer, exchange, or other disposal of lands within the Refuge System. Most importantly, this act reinforces and expands the “compatibility standard” of the Refuge Recreation Act. The Refuge Administration Act authorizes the Secretary, under such regulations as he may prescribe, to “permit the use of any area within the [Refuge] System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he determines that such uses are compatible with the major purposes for which such areas were established.”

A.1.2.2 Refuge Recreation Act of 1962, as amended, 16 U.S.C. 460k-4

This act requires that any recreational use of areas in the Refuge System be “compatible” with the primary purpose(s) for which the area was acquired or established. It also requires that

sufficient funding be available for the development, operation, and maintenance of recreational uses that are not directly related to the area's primary purpose(s).

A.1.2.3 Alaska Native Claims Settlement Act of 1971

The Alaska Native Claims Settlement Act (ANCSA) provides for “a fair and just settlement of all claims by Natives and Native groups of Alaska, based on aboriginal land claims.” The law provided for grants of land and money and the establishment of Native corporations to maintain the economic affairs of Native organizations. In exchange for this settlement, all aboriginal titles and claims, including fishing and hunting rights, were extinguished. Section 17(d)(2)(A) provided the basis for the enactment of ANILCA. Under Section 22(g), refuge lands conveyed to village corporations remain subject to the laws and regulations governing use and development of the refuge. This section only applies to lands that were designated as refuge lands at the time ANCSA was passed. Section 17(b) of the Act provided for public easement across Native lands for access to Federal lands.

A.1.2.4 Alaska National Interest Lands Conservation Act of 1980, as amended, 16 U.S.C. 140hh-3233, 43 U.S.C. 1602-1784, Public Law 96-487

In addition to amending ANCSA, the Alaska Statehood Act, and the Wild and Scenic Rivers Act, and modifying portions of the Wilderness Act as it applies to lands in Alaska, the Alaska National Interest Lands Conservation Act (ANILCA) expanded the Federal conservation unit system throughout the State by adding or expanding national parks, refuges, forests, designated Wilderness areas, and designated wild and scenic rivers. ANILCA identifies the purposes of the Refuge, defines provisions for planning and management, and authorizes studies and programs related to wildlife and wildland resources, subsistence opportunities, and recreational and economic uses (such as oil and gas exploration and development, access, and transportation and utility systems). Section 1317 of ANILCA required that all refuge lands not designated as Wilderness be reviewed as to their suitability for Wilderness designation within five years of the enactment of ANILCA.

ANILCA Section 1002 provided for a comprehensive and continuing inventory and assessment of the fish and wildlife resources of the coastal plain of the Refuge, including an analysis of the impacts of oil and gas exploration, development, and production. Section 1002 authorized surface geological and seismic exploration of the coastal plain, provided it avoided significant adverse effects on fish and wildlife and other resources. Section 1002 also withdrew the public lands on the Refuge's coastal plain from all forms of entry, appropriation, and operation of mining laws and mineral leasing laws. Section 1003 of ANILCA prohibited the production of oil and gas from the Arctic Refuge and stated that “... no leasing or other development leading to production of oil and gas from the range shall be undertaken until authorized by an Act of Congress.”

Title VIII of ANILCA authorizes the State of Alaska to regulate subsistence uses on Federal public lands if several requirements are met. The State managed statewide subsistence harvests until late 1989, when the Alaska Supreme Court ruled that the rural residency preference required by Federal law violated the Alaska Constitution. Despite repeated efforts, the State has not amended its constitution to bring its regulatory framework back into compliance with ANILCA.

The Federal government began managing subsistence hunting, trapping, and fishing on Alaska's Federal public lands in July of 1990. For the purposes of Federal subsistence management, public lands include lands managed by the U.S. Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, and the U.S. Forest Service; non-navigable waters on these lands; and some navigable and marine waters. On October 1, 1999, management authority of the Federal Subsistence Board was extended to include navigable water within and adjacent to exterior boundaries of Federal conservation units in which the United States has an interest by virtue of the reserved water rights doctrine.

The board establishes regulations for the harvest of fish and wildlife for subsistence purposes by qualified rural residents on Federal public lands in Alaska. The Federal process involves substantial public input. Individuals and organizations submit proposals for regulations to the board that are reviewed by the Federal Subsistence Regional Advisory Councils (e.g., the North Slope Subsistence Regional Advisory Council, the Eastern Interior Alaska Subsistence Regional Advisory Council). The regional councils, which are composed of local citizens, make recommendations on proposals to the board. Federal subsistence staff also advise the board on regulatory proposals, providing data and analyses from local Federal managers and Alaska Department of Fish and Game (ADFG) biologists.

The State's recreational, commercial, personal use, and subsistence regulations continue to apply on all Federal lands unless superseded by Federal subsistence regulations. However, the board may establish Federal regulations to provide for use only by eligible rural residents in order to protect the ANILCA Title VIII preference for local rural users or to protect a wildlife population or fishery.

A.1.2.5 Wilderness Act of 1964

The Wilderness Act established the National Wilderness Preservation System. The act provides the framework for designation by Congress of new units to the system and prescribes policy for management of designated Wilderness areas. Section 702(3) designated approximately 7.16 million acres¹ of Wilderness in Arctic Refuge, and Section 707 says that, except as otherwise expressly provided for in ANILCA, Wilderness areas designated under ANILCA shall be administered in accordance with the Wilderness Act. Section 1317 of ANILCA required the "review, as to their suitability or non-suitability for preservation as wilderness, all land within ... units of the National Wildlife Refuge System in Alaska not designated as wilderness by this Act" This requirement was to be completed within five years of the enactment of ANILCA.

A.1.2.6 The Wild and Scenic Rivers Act (16 U.S.C. 1271-1287) Public Law 90-542, approved October 2, 1968, (82 Stat. 906)

This act establishes a National Wild and Scenic Rivers System (NWSRS) and prescribes the methods and standards through which additional rivers may be identified and added to the

¹ Acreages in this Plan are derived from many sources and may not agree with previously published values, including the draft Revised Plan. For more information, please refer to "A Note about Acreages" in the front pages of this volume.



system. Rivers in the NWSRS have outstanding, scenic, recreational, geologic, fish and wildlife, historic, cultural, or other values, and are managed in a way that protects these values for present and future generations. Rivers are classified as wild, scenic, or recreational, and hunting and fishing are permitted in components of the system under applicable Federal and State laws. Section 5(d)(1) requires that in all planning by Federal agencies for the use and development of water and related land resources, consideration be given to potential wild, scenic, and recreation rivers. This Revised Plan considers potential wild, scenic, and recreational rivers within Arctic Refuge, and ANILCA provides direction for management of designated rivers. Under ANILCA, portions of the Sheenjek, Ivishak, and Wind rivers in Arctic Refuge were designated as wild rivers and included in the NWSRS.

A.1.2.7 Marine Mammal Protection Act of 1972, as amended; (16 U.S.C. 1361-1421h; 50 CFR 13, 18, 216, and 229 as amended)

This act established a Federal responsibility for conservation of marine mammals. Management of walrus and polar bears is vested in the Department of the Interior (DOI). The act established a moratorium on the taking and importation of marine mammals and products made from them. Alaska Natives who take marine mammals for subsistence purposes, however, were exempt from the moratorium. This act has a direct effect on Refuge management decisions within our responsibility, such as managing visitor use effects upon individual animals. For example, for polar bears, Refuge responsibilities to satisfy the intent of both the Marine Mammal Protection Act and the Endangered Species Act are outlined in the Service's Polar Bear Interaction Guidelines (Service 2011) and Polar Bear Viewing Guidelines (Service 2010a).

A.1.2.8 Endangered Species Act of 1973, as amended; Public Law 93-205; (16 U.S.C. 1531-1544, et seq., as amended)

This act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of State programs. Among its provisions, the act authorizes the determination and listing of endangered and threatened species and habitat critical to those species; prohibits authorized taking, possession, sale, transport, etc., of endangered species; provides authority to acquire land for the conservation of listed species with land and water conservation funds; and authorizes the assessment of civil and criminal penalties for violating the act or implementing regulations.

Section 7 of the act requires Federal agencies to ensure that any action authorized, funded, or carried out by them does not jeopardize the continued existence of listed species or modify their critical habitat. Currently threatened or endangered species known to occur on Arctic Refuge include the polar bear, bowhead whale, Steller's eider, and spectacled eider. See Appendix B for Section 7 consultations.

A.1.2.9 Magnuson-Stevens Fishery Conservation and Management Act of 1996, Public Law 94-265, as amended by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act, Public Law 109-479 (16 U.S.C. 1801-1884)

The Magnuson-Stevens Fishery Conservation and Management Act is the primary law governing marine fisheries management in Federal waters of the United States. Among other things, it aids development of the domestic fishing industry by phasing out foreign fishing, managing the fisheries, and promoting conservation. The act was originally enacted as the Fishery Conservation and Management Act of 1976 and has been amended multiple times, most notably in 1996 and 2007. The 1996 amendments focused on rebuilding over-fished fisheries, protecting essential fish habitat, and reducing bycatch. The 2007 amendments mandate the use of annual catch limits and accountability measures to end over-fishing, provide for widespread market-based fishery management through limited access privilege programs, and call for increased international cooperation.

The Magnuson-Stevens Fishery Conservation and Management Act requires all Federal agencies to consult with the National Marine Fisheries Service on all actions, or proposed actions, permitted, funded, or undertaken by the agency, that may adversely affect essential fish habitat. See Appendix B for essential fish habitat consultation.

A.1.2.10 National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321-4347, and the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of NEPA, 40 CFR 1500-1508

The National Environmental Policy Act (NEPA) is the basic national charter for protection of the environment. The procedural provisions in Council on Environmental Quality (CEQ) regulations require Federal agencies to integrate the NEPA process with other planning at the earliest possible time whenever taking a major Federal action that may significantly affect the human environment, so as to provide a systematic interdisciplinary approach. NEPA also requires Federal agencies to identify and analyze the environmental effects of their actions; describe appropriate alternatives to the proposal; involve affected State and Federal agencies, tribal governments, and the affected public in the planning and decision-making process; and

fully integrate all proposals that might have an impact on the environment with the provisions of NEPA (40 CFR 1501.2). Implementation of any one of the alternatives in this Plan for managing Arctic Refuge is such an action. Therefore, this planning process is subject to NEPA requirements.

A.1.2.11 Federal Water Pollution Control Act of 1972, as amended by The Clean Water Act of 1977, Public Law 95-217; (33 U.S.C. 1251-1387, et seq., as amended; 33 CFR 320ff; 40 CFR 15, 100-400, 220-233, 400-471)

This act regulates the discharge of pollutants into waters of the United States. The act protects fish and wildlife, establishes operation permits for all major sources of water pollution, and limits the discharge of pollutants or toxins into water. The act makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit is obtained under the Clean Water Act.

A.1.2.12 Coastal Zone Management Act of 1972

The Federal Coastal Zone Management Act was passed in 1972 in recognition of the increasing and conflicting uses that were causing irreparable harm to biological and physical systems associated with coastal areas. The act directs states to complete comprehensive coastal management programs or plans. Once a State's plan receives Federal approval, this law mandates that Federal actions be consistent with that State's coastal management program. The Alaska Coastal Management Program was terminated on July 1, 2011, per AS 44.66.030.

A.1.2.13 Antiquities Act (16 U.S.C. 431-433); Archaeological Resources Protection Act of 1979, Public Law 96-95; (16 U.S.C. 470as, et seq., as amended; 43 CFR 50-58); and the National Historic Preservation Act of 1966, (Public Law 89-665; 16 U.S.C. 470 et seq., as amended)

These laws make reference to cultural resources or govern the management of cultural resources on Federal lands. The various historic preservation laws, in general, do the following:

- Vest ownership of historic and prehistoric properties and of materials collected from such sites with the State and Federal government.
- Protect archeological and historic sites from unauthorized disturbance and prescribe penalties for individuals who damage (or collect from) such sites.
- Provide for issuing permits to qualified individuals and institutions to conduct scientific research.
- Mandate the inventory and evaluation of all sites on government owned and managed lands. The inventory is the responsibility of the individual Federal agency involved.
- Require that all projects with State or Federal involvement be conducted in such a way as to protect any significant cultural resources that may be present. This includes, but is not limited to, the performance of archeological surveys, site evaluations, and, if necessary, mitigation of adverse impacts to such resources.

A.2 Policy Guidance

Programmatic guidance and policy documents provide additional direction for the management of national wildlife refuges throughout the Refuge System. While it is not practical to provide information about all of these documents in this Plan, they are critical to management of the Refuge. This section summarizes key policies.

A.2.1 Wildlife Dependent Recreation Policy 605 FW 1-7

The National Wildlife Refuge System Improvement Act of 1997 states that “compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the [Refuge] System.” The overarching goal of the Service’s wildlife-dependent recreation policy is to enhance wildlife-dependent recreation opportunities and access to quality visitor experiences on refuges while managing refuges to conserve fish, wildlife, plants, and their habitats.

A.2.2 Biological Integrity, Diversity, and Environmental Health 601 FW 3

The biological integrity, diversity, and environmental health policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and the Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. It also provides refuge managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions and, where appropriate and in concert with refuge purposes and the Refuge System mission restore lost or severely degraded components.

A.2.3 Appropriate Refuge Uses 603 FW 1

The National Wildlife Refuge System Improvement Act of 1997 identified six priority wildlife-dependent recreation uses: hunting, fishing, wildlife observation and photography, environmental education, and interpretation. With the exception of these six uses, and with the exception of the taking of fish and wildlife under State regulations, the refuge manager follows the Service’s Appropriate Refuge Uses policy to decide if a new or existing use is an appropriate refuge use. If an existing use is not appropriate, the refuge manager will eliminate or modify the use. If a new use is not appropriate, the refuge manager will deny the use.

A.2.4 Compatibility 603 FW 2

A compatible use is a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the national wildlife refuge. The refuge manager will not initiate or permit a new use of a national wildlife refuge or expand, renew, or extend an existing use of a refuge unless the refuge manager has determined the use is a compatible use. A compatibility determination is not an action under NEPA. Deciding whether or not to allow the use is the action—not the compatibility determination. Actions such as developing or revising comprehensive conservation plans or step-down plans and issuing special use permits are about allowing or

not allowing refuge uses and therefore require NEPA compliance. For more on compatibility determinations, see Appendix G.

A.2.5 Wilderness Stewardship Policy 610 FW 1-5

The Service's Wilderness Stewardship Policy provides an overview and foundation for implementing the Wilderness Act and the National Wildlife Refuge System Administration Act of 1966, as amended. The policy covers land management planning for congressionally designated Wilderness and addresses how to administer Wilderness in Alaska in light of ANILCA.

A.2.6 Refuge Planning 602 FW 1

The Refuge Planning Policy provides guidance for refuge planning, including the comprehensive conservation planning process and step-down management planning.

A.2.7 Comprehensive Conservation Planning 602 FW 3

Comprehensive conservation planning is a systematic decision making process founded on principles of sound fish and wildlife management and available science, and consistent with legal mandates and other policies, guidelines, and planning documents. The Service's planning policy provides guidance and step-by-step direction, and establishes minimum requirements for all comprehensive conservation plans.

A.3 Programmatic Guidance

Programmatic guidance developed by the Alaska Region, the Service, or DOI provides additional direction for the management of the Refuge System. Much of the management direction described in Chapter 2, and throughout this Plan, is influenced by general guidance from the programs and policies described in the next sections.

Several of these documents provide guidance that directs the Service to use an ecosystem approach in which the integrity of the entire ecosystem and its processes are considered when managing refuges. This broad-scale approach requires close collaboration with others in the form of effective landscape-level partnerships and coordinated efforts to address climate change. We provide a brief description of ecosystem management in the context of partnering and summarize the influential programs, strategies, and national and regional management plans that were reviewed during the development of this Plan.

A.3.1 Ecosystem Management and Conservation Partnerships

An ecosystem approach to refuge management was initiated by the Refuge System Improvement Act. The Service recognizes the complex and interconnected relationships that are present within ecosystems and across landscapes and recognizes that ecosystems may not be confined within the boundaries of a refuge, a state, or even the nation. The Service also recognizes that people and their socio-cultural and economic systems are important components of ecosystems. Therefore, working with people in conservation partnerships and other collaborative efforts is necessary in applying ecosystem management.

Creating and maintaining conservation partnerships across entire landscapes is crucial for reaching the goal of ecosystem management because fish, wildlife, and their habitats are not constrained by the administrative boundaries of specific protected areas. Without physical barriers, and with available habitat, fish and wildlife will freely move through ownerships and management jurisdictions. In the face of accelerating climate change and other environmental stressors, some species may shift their ranges into different ecosystems and political or administrative jurisdictions.

Conservation of biological diversity on refuge lands and outside refuge boundaries is an ambitious but fundamental goal of the Service's ecosystem approach to management. Through



its refuge-specific, regional, national, and international programs, the Service contributes to the conservation of biological diversity by directly protecting habitats and managing for the recovery of fish and wildlife populations that are threatened or endangered. The Service also restores habitats, conducts environmental clean ups, monitors ecological integrity, and provides technical assistance to private landowners. The Service has learned that it cannot work alone to accomplish these efforts because conservation of biological diversity requires coordination among many public agencies, private organizations, landowners, and citizens across different landscapes, societies, and cultures.

A.3.2 Landscape Conservation Cooperatives

Two decades of ecosystem management, combined with the realities of accelerating climate change, have made it clear to the Service that conservation must be coordinated on a landscape-level basis. In September 2009, DOI issued Secretarial Order No. 3289 (amended February 2010) to address the impacts of climate change on the nation's waters, lands, and other natural and cultural resources. Section 3(c) of the order states: "Interior bureaus and agencies, guided by the Energy and Climate Change Council, will work to stimulate the development of a network of collaborative 'Landscape Conservation Cooperatives.' These cooperatives ... will work interactively with the relevant DOI Climate Science Center(s) and help coordinate adaptation efforts [in response to climate change] in the region."

A Landscape Conservation Cooperative (LCC) is an applied conservation partnership that provides scientific and technical support for conservation at a landscape scale. The fundamental role of the LCC is to help address conservation science needs within a broad geographic area such as the entire range of a species, population, or groups of species of fish or wildlife. Although the LCC concept was initially motivated by climate change, the role of these partnerships is to help improve the collective ability of the conservation community to address a wide variety of environmental stressors and conservation challenges within entire landscapes, including management response to climate change.

Implementing the LCC concept includes bringing partners together to identify what they can collectively agree on in terms of conservation interests and science needs. The partners will then work toward collectively addressing those interests and needs. The intent of LCC partnerships is to accomplish a conservation mission that no single agency or organization could accomplish alone.

A.3.3 National Management Plans

Nature is not constrained by the administrative boundaries that are used to determine ownership or management of specific areas of land. Without physical barriers, and with available habitat, fish and wildlife will freely roam through lands and waters regardless of ownership or management. To ensure the conservation of the many species that migrate over political and administrative lines, there are several national efforts designed to monitor and protect these species. These plans were reviewed during the revision of the Refuge Plan to ensure that the revised management direction is consistent with these national conservation plans.

A.3.3.1 Strategic Habitat Conservation

The Strategic Habitat Conservation report (U.S. Geological Survey and Service 2006) and technical implementation handbook (Service 2008) combine to create a framework rooted in the principles of adaptive natural resource management. Adaptive management incorporates new information learned from research and monitoring into future management actions. Strategic Habitat Conservation provides a guiding tool for setting and achieving conservation objectives at multiple scales based on the best available information, data, and ecological models.

Implementation of Strategic Habitat Conservation involves the integration of four elements that occur in an adaptive management feedback loop. These are biological planning, conservation design, delivery of conservation actions, and monitoring and research. Information learned from implementing Strategic Habitat Conservation is used to help a refuge determine what contribution(s) it can make for meeting conservation priorities at the landscape level. Project leaders and planning teams consider Strategic Habitat Conservation together with other Federal policies and guidance when developing goals and objectives for refuge comprehensive conservation plans.

A.3.3.2 Strategic Plan for Responding to Accelerating Climate Change

In 2010, the Service completed a strategic plan for responding to the effects of accelerating climate change (Service 2010b). The primary purpose of the Service's strategic plan is to provide a vision and direction for the agency by defining its role within the context of the larger conservation community as both the Service and the larger community respond to global climate change on a landscape-level basis. Another key component of the Service's strategic plan is close coordination with the regional Climate Science Centers that are being established by the U.S. Geological Survey and other DOI agencies as they implement Secretarial Order No. 3289, as amended.

Rooted in the mission of the Service, the strategic plan outlines goals, objectives, and actions organized under three major strategies: adaptation, mitigation, and engagement. Adaptation is helping fish, wildlife, and their habitats adapt to climate change. The Service's strategic plan establishes applied science partnerships for conservation (i.e., LCCs) through the adaptation section of the document. Mitigation is reducing levels of greenhouse gasses in the earth's atmosphere. Engagement is reaching out to and communicating with existing partners and others to join forces with them in seeking solutions to the challenges and threats to fish and wildlife conservation posed by climate change. Project leaders and planning teams consider these strategies, together with other Federal policies and guidance, when developing goals and objectives for refuge comprehensive conservation plans.

A.3.3.3 Centennial Legacy

Between 2000 and 2003, in preparation for the 100th anniversary of the Refuge System, the Service planned numerous events and developed a number of publications to mark the centennial. The planning was in response to the National Wildlife Refuge Centennial Act of November 1, 2000. The celebration was intended to serve as a vision to provide resources for the Refuge System over the next 100 years. Materials developed for the centennial and beyond prioritized and addressed the Refuge System's most pressing needs in three main categories: essential staff, mission-critical projects, and major maintenance.

A.3.3.4 North American Waterfowl Management Plan

The North American Waterfowl Management Plan is dedicated to the recovery of waterfowl populations through the restoration and management of wetland ecosystems (NAWMP Committee 2004). The North American Waterfowl Management Plan seeks to conserve biological diversity in the Western Hemisphere, integrate wildlife conservation with sustainable economic development, and promote partnerships of public and private agencies, organizations, and individuals for conservation. Canada, the United States, and Mexico are committed to this ongoing continental effort and have formed an international partnership to identify priority waterfowl habitats and to establish goals and objectives for the management of waterfowl populations and habitats. Arctic Refuge provides important breeding and migration habitat for a variety of waterfowl from throughout North America.

A.3.3.5 Partners in Flight Bird Conservation Plans

Partners in Flight is a cooperative effort among Federal, State, and local government agencies; philanthropic foundations; professional organizations; conservation groups; industry; universities; and private individuals. Partners in Flight was created in 1990 in response to growing concerns about declines in the populations of many landbird species and to emphasize the conservation of birds not covered by existing conservation initiatives. Bird conservation plans are developed in each region to identify species and habitats most in need of conservation, to establish objectives and strategies to meet those needs, and to implement plans and monitor progress on them.

A.3.3.6 U.S. Shorebird Conservation Plan

The U.S. Shorebird Conservation Plan (Brown et al. 2001) seeks to stabilize populations of all shorebirds that are in decline because of factors affecting habitat in the United States. At a regional level, the plan's goal is to ensure that shorebird habitat is available in adequate quantity and quality to support shorebird populations in each region. Ultimately, the goal of the Shorebird Conservation Plan is to restore and maintain shorebird populations throughout the Western Hemisphere through an international partnership. Arctic Refuge provides important breeding and staging habitats for a variety of shorebirds.



A.3.3.7 North American Waterbird Conservation Plan

The North American Waterbird Conservation Plan (Kushlan et al. 2002) is the product of an independent partnership of individuals and institutions having interest and responsibility for conservation of waterbirds and their habitats in the Americas. The partnership, called Waterbirds of the Americas, was created to “support a vision in which the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and non-breeding waterbirds are sustained or restored throughout the lands and waters of North America, Central America, and the Caribbean.” Their plan “provides a continental-scale framework for the conservation and management of 210 species of waterbirds ... in 29 nations throughout North America” Over 30 species of migratory waterbirds have been recorded on Arctic Refuge, and 18 of these species are regular breeders. Included are such diverse groups as loons, gulls, seabirds, and cranes.

A.3.4 Regional Management Plans

In addition to considering national conservation plans, this Revised Plan must consider the management of neighboring lands by reviewing regional conservation plans and other land management goals of the region. Regional plans, goals, and objectives from other programs were reviewed to understand how the Refuge can contribute to the goals for conservation within the State or local region. This list is not intended to be comprehensive, but it demonstrates some of the major regional plans that were reviewed during the development of this Plan.

A.3.4.1 Alaska Interagency Wildland Fire Management Plan

Interagency fire management plans for 13 geographic areas of the State were prepared between 1982 and 1988 to provide a coordinated and cost-effective approach to fire management on all lands in Alaska. In 1998, an amendment was produced called the Alaska Interagency Wildland Fire Management Plan (AIWFMP). This amendment consolidated the original 13 plans into a single document and provided land managers, land owners, and fire suppression organizations a single reference for interagency fire management operational information. The amended plan also incorporated operational changes that occurred since the inception of the statewide fire management planning effort. In 2010, the AIWFMP was updated again in response to public requests for more information regarding Alaskan fire management practices (Bureau of Land Management 2010). The 2010 revision clarifies interagency guidelines, policies, and operational direction for responses to wildland fires, and brings terminology up to date. The purpose of the plan is to be the interagency reference for wildland fire operational information and to promote a cooperative, consistent, cost-effective, interagency approach to wildland fire management in Alaska. While the plan does not supersede individual agency policies and requirements, it is intended that unit-specific fire management plans (such as the Arctic Refuge Fire Management Plan) be used in conjunction with the interagency plan.

A.3.4.2 Landbird Conservation Plan for Alaska Biogeographic Regions

Continental and local declines in numerous bird populations have led to concern for the future of migratory and resident bird species. The Landbird Conservation Plan for Alaska

Biogeographic Regions (Boreal Partners in Flight Working Group 1999) was developed through the Partners in Flight national initiative in recognition of the need for a coordinated, cooperative conservation initiative focusing on nongame landbirds. It provides conservation priorities and objectives for landbirds in each region of Alaska. Arctic Refuge contributes to this plan through a variety of inventory and monitoring studies of landbirds within the Refuge.

A.3.4.3 Alaska Shorebird Conservation Plan

Over 70 species of shorebirds have been recorded in Alaska, representing one-third of the world's shorebird species (Alaska Shorebird Group 2008). Shorebirds worldwide have suffered dramatic population declines in the past decade. The Alaska Shorebird Conservation Plan (Alaska Plan) is one of 11 regional plans associated with the U.S. Shorebird Conservation Plan. The Alaska Plan identifies shorebird species of concern in Alaska and provides goals, objectives, and conservation priorities for shorebird conservation throughout the State. The Alaska Plan also provides a new framework for building a conservation strategy in a landscape context. The four major components to the conservation strategy are research, population monitoring, habitat management, and education and outreach. The overall goal of the plan is to keep shorebirds and their habitats well distributed — not only across the Alaska landscape, but also throughout regions used by these populations during other phases of their annual cycle. Additionally, the “Program for Regional and International Shorebird Monitoring” Boreal Committee is presently investigating techniques for monitoring shorebirds in the boreal forest. Arctic Refuge supports several species that are showing declines throughout the North American continent, including American golden plover, buff-breasted sandpiper, solitary sandpiper, dunlin, and upland sandpiper. The Boreal Program for Regional and International Shorebird Monitoring program is presently in its development phase and has yet to be implemented in Alaska.

A.3.4.4 Utility Corridor Resource Management Plan

The Utility Corridor Resource Management Plan is a long-range comprehensive plan that directs management of the approximately 6.1 million acres of Bureau of Land Management (BLM) lands through which the Dalton Highway and Trans-Alaska Pipeline pass. The utility corridor, which was established by Public Land Order (PLO) 5150 on December 30, 1971, is an essential component of the national oil and gas transportation system (BLM 1989). The plan identifies special management areas and development nodes in the utility corridor, and describes provisions for appropriate uses and protections for valuable resources. Included in the plan is the Galbraith Lake Area of Critical Environmental Concern that is directly adjacent to the western boundary of Arctic Refuge. The 1989 plan, which provided management guidance for 20 years, is scheduled to be revised by BLM; however, a timeline for the revision has not yet been set.

A.3.4.5 Dalton Highway Recreation Management Plan

The Dalton Highway Recreation Management Area includes those public lands adjacent to the Dalton Highway from the Yukon River, north to a point near the confluence of the Sagavanirktok and Ivishak rivers, approximately 60 miles south of Prudhoe Bay, Alaska. The 1989 Utility Corridor Resource Management Plan (see Section A.3.4.4) established the

boundaries of the plan area, which includes lands adjacent to the western boundary of Arctic Refuge.

BLM completed the Dalton Highway Recreation Area Management Plan (1991) because of increasing public interest and use of the Dalton Highway after the highway was opened to the public in 1981. The plan divides the recreation management area into zones according to the recreation opportunity spectrum, and it establishes recreation management objectives for the zones within the utility corridor. Issues addressed in the plan include information and interpretive services, facility development, resource manipulation and rehabilitation, and Dalton Highway Recreation Management Area administration.

A.3.4.6 Dalton Highway Scenic Byway Corridor Partnership Plan

The Dalton Highway Scenic Byway Corridor Partnership Plan (ADNR 2010) provides a comprehensive evaluation of the intrinsic qualities of the byway and intends to guide management, protection, and enhancement of those qualities over time. The plan is directed toward discussing the primary concerns and challenges associated with living and operating in the corridor. The plan also acknowledges issues and concerns associated with managing the byway; provides a descriptive overview of the route; summarizes road and transportation characteristics, such as traffic volumes, accident statistics, and signage; assesses current and future visitation; and provides a framework that will help local byway organizations succeed in reaching their stated vision, goals, and objectives. Arctic Refuge staff participated on the advisory committee for the Byway Corridor Partnership Plan.

A.3.4.7 Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources

The Alaska Department of Fish and Game (ADFG) published a strategic plan for Alaska fish and wildlife in 2006 (ADFG 2006). It serves as the State's comprehensive wildlife conservation strategy and focuses on nongame species. The goal of the strategy is to conserve the diversity of Alaska's wildlife and fish resources, focusing on species with the largest need for conservation interventions. The strategy was designed with the intent to integrate new conservation actions and strategies with existing State wildlife management and research programs to build upon earlier successes. The strategy outlines the conservation needs of hundreds of species and many species assemblages, highlighting a growing need in the State for initial inventorying studies for lesser known species. The strategy also provides detailed natural history information and specific and measurable objectives for species conservation in Alaska.

A.3.4.8 Alaska Natural Heritage Program

This program was established in 1989 by The Nature Conservancy; in 1993, it became part of the University of Alaska Anchorage, residing in the College of Arts and Sciences. The Alaska Natural Heritage Program is Alaska's clearinghouse for information on plant and animal species of conservation concern, natural communities of conservation concern, and invasive non-native plant species. The information is collected, validated, and distributed, and assistance is provided to natural resource managers and others in applying it effectively. The program has developed a biological conservation database that is linked to similar programs in all 50 states, most Canadian provinces, and many Latin American countries.

A.4 References

- Alaska Department of Fish and Game [ADFG]. 2006. Our wealth maintained: A strategy for conserving Alaska's diverse wildlife and fish resources. Alaska Department of Fish and Game, Juneau, Alaska, USA.
- Alaska Department of Natural Resources [ADNR]. 2010. Dalton Highway scenic byway corridor partnership plan. Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, Interpretation and Education Unit, Anchorage, Alaska, USA.
- Alaska Shorebird Working Group. 2008. Alaska shorebird conservation plan. Version II. Alaska Shorebird Group, Anchorage, Alaska, USA.
- Bureau of Land Management [BLM]. 1989. Proposed resource management plan and final environmental impact statement for the utility corridor planning area, Arctic Area, Alaska. BLM-AK-PT90-002-1610-060, Arctic District Office, Fairbanks, Alaska, USA.
- Bureau of Land Management [BLM]. 1991. Recreation area management plan: Dalton Highway. BLM-AK-PT92-003A-1610-060, Arctic District Office, Fairbanks, Alaska, USA.
- Bureau of Land Management [BLM]. 2010. Alaska interagency wildland fire management plan. Bureau of Land Management, Alaska Fire Service, Fort Wainwright, Alaska, USA.
- Boreal Partners in Flight Working Group. 1999. Landbird conservation plan for Alaska biogeographic regions. Version I. U.S. Fish and Wildlife Service, Anchorage, Alaska, USA.
- Brown, S., C. Hickey, B. Harrington, and R. Gill, editors. 2001. The U.S. Shorebird Conservation Plan, Second edition. Manomet Center for Conservation Sciences, Manomet, Massachusetts, USA.
- International Union for the Conservation of Nature, Species Survival Commission, Polar Bear Specialist Group [IUCN]. 2009. Agreement on the conservation of polar bears. <<http://pbsg.npolar.no/en/agreements/agreement1973.html>>. Accessed 1 February 2011.
- Kushlan, J. A., M. J. Steinkamp, K. C. Parsons, J. Capp, M. Acosta Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan. Version I. Waterbird Conservation for the Americas, Washington, D.C., USA.
- North American Waterfowl Management Plan, Plan Committee [NAWMP Committee]. 2004. North American Waterfowl Management Plan 2004. Strategic Guidance: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, and Secretaria de Medio Ambiente y Recursos Naturales.
- Yukon River Drainage Fisheries Association and Yukon River Panel. 2005. Yukon River salmon agreement handbook: Information and reference materials pertaining to the Yukon River salmon agreement. Yukon River Drainage Fisheries Association, Anchorage, Alaska, USA.

- U.S. Fish and Wildlife Service [Service]. 2008. Strategic habitat conservation handbook: A guide to implementing the technical elements of strategic habitat conservation. Version I. Report from the National Technical Assessment Team, February 11, 2008.
- U.S. Fish and Wildlife Service [Service]. 2010a. Arctic National Wildlife Refuge polar bear interaction guidelines. Unpublished material, U.S. Fish and Wildlife Service, Anchorage, Alaska, USA. <http://arctic.fws.gov/pdf/pbguidelines2011.pdf>. Accessed August 23, 2012.
- U.S. Fish and Wildlife Service [Service]. 2010b. Rising to the challenge: Strategic plan for responding to accelerating climate change. U.S. Fish and Wildlife Service, Washington, D.C., USA
- U.S. Fish and Wildlife Service [Service]. 2011. Polar bear viewing information. Revision June 2011. U.S. Fish and Wildlife Service, Anchorage, Alaska, USA.
- U.S. Geological Survey and U.S. Fish and Wildlife Service [Service]. 2006. Strategic habitat conservation: Final report from the National Ecological Assessment Team.
- United Nations. 2004. Agreement between the Government of the United States of America and the Government of Canada on the conservation of the Porcupine caribou herd. Pages 267-271 *in* Treaty Series: Treaties and International Agreements Registered or Filed and Recorded with the Secretariat of the United Nations. Volume 2174, I-38202.

Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd

E100687 - CTS 1987 No. 31

The Government of Canada and the Government of the United States of America, hereinafter called the “Parties”:

RECOGNIZING that the Porcupine Caribou Herd regularly migrates across the international boundary between Canada and the United States of America and that caribou in their large free-roaming herds comprise a unique and irreplaceable natural resource of great value which each generation should maintain and make use of so as to conserve them for future generations;

ACKNOWLEDGING that there are various human uses of caribou and that for generations certain people of Yukon Territory and the Northwest Territories in Canada have customarily and traditionally harvested Porcupine Caribou to meet their nutritional, cultural and other essential needs and will continue to do so in the future, and that certain rural residents of the State of Alaska in the United States of America have harvested Porcupine Caribou for customary and traditional uses and will continue to do so in the future; and that these people should participate in the conservation of the Porcupine Caribou Herd and its habitat;

RECOGNIZING the importance of conserving the habitat of the Porcupine Caribou Herd, including such areas as calving, post-calving, migration, wintering and insect relief habitat;

UNDERSTANDING that the conservation of the Porcupine Caribou Herd and its habitat requires goodwill among landowners, wildlife managers, users of the caribou and other users of the area;

RECOGNIZING that the Porcupine Caribou Herd should be conserved according to ecological principles and that actions for the conservation of the Porcupine Caribou Herd that result in the long-term detriment of other indigenous species of wild fauna and flora should be avoided;

RECOGNIZING that the Parties wish to establish co-operative bilateral mechanisms to co-ordinate their activities for the long-term conservation of the Porcupine Caribou Herd and its habitat;

RECOGNIZING that co-operation and co-ordination under this Agreement should not alter domestic authorities regarding management of the Porcupine Caribou Herd and its habitat and should be implemented by existing rather than new management structures;

HAVE AGREED as follows:

1. Definitions

For the purpose of this Agreement only:

1. "Porcupine Caribou Herd" means those migratory barren ground caribou found north of 64°, 30' north latitude and north of the Yukon River which usually share common and traditional calving and post-calving aggregation grounds between the Canning River in the State of Alaska and the Babbage River in Yukon Territory and which historically migrate within the State of Alaska, Yukon Territory, and the Northwest Territories.
2. "Conservation" means the management and use of the Porcupine Caribou Herd and its habitat utilizing methods and procedures which ensure the long-term productivity and usefulness of the Porcupine Caribou Herd. Such methods and procedures include, but are not limited to, activities associated with scientific resources management such as research, law enforcement, census taking, habitat maintenance, monitoring and public information and education.
3. "Habitat" means the whole or any part of the ecosystem, including summer, winter and migration range, used by the Porcupine Caribou Herd during the course of its long-term movement patterns, as generally outlined on the map attached as an Annex.

2. Objectives

The objectives of the Parties are:

1. To conserve the Porcupine Caribou Herd and its habitat through international co-operation and co-ordination so that the risk of irreversible damage or long-term adverse effects as a result of use of caribou or their habitat is minimized;

2. To ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd by:
 1. in Alaska, rural Alaska residents in accordance with 16 U.S.C. 3113 and 3114, AS 16.05.940(23), (28) and (32), and AS 16.05.258(c); and
 2. in Yukon and the Northwest Territories, Native users as defined by sections A8 and A9 of the Porcupine Caribou Management Agreement (signed on October 26, 1985) and those other users identified pursuant to the process described in section E2(e) of the said Agreement;
 3. To enable users of Porcupine Caribou to participate in the international co-ordination of the conservation of the Porcupine Caribou Herd and its habitat;
 4. To encourage co-operation and communication among governments, users of Porcupine Caribou and others to achieve these objectives.
3. Conservation
1. The Parties will take appropriate action to conserve the Porcupine Caribou Herd and its habitat.
 2. The Parties will ensure that the Porcupine Caribou Herd, its habitat and the interests of users of Porcupine Caribou are given effective consideration in evaluating proposed activities within the range of the Herd.
 3. Activities requiring a Party's approval having a potential impact on the conservation of the Porcupine Caribou Herd or its habitat will be subject to impact assessment and review consistent with domestic laws, regulations and processes.
 4. Where an activity in one country is determined to be likely to cause significant long-term adverse impact on the Porcupine Caribou Herd or its habitat, the other Party will be notified and given an opportunity to consult prior to final decision.
 5. Activities requiring a Party's approval having a potential significant impact on the conservation or use of the Porcupine Caribou Herd or its habitat may require mitigation.
 6. The Parties should avoid or minimize activities that would significantly disrupt migration or other important behavior patterns of the Porcupine Caribou Herd or that would otherwise lessen the ability of users of Porcupine Caribou to use the Herd.
 7. When evaluating the environmental consequences of a proposed activity, the Parties will consider and analyze potential impacts, including cumulative impacts, to the Porcupine Caribou Herd, its habitat and affected users of Porcupine Caribou.

8. The Parties will prohibit the commercial sale of meat from the Porcupine Caribou Herd.
4. International Porcupine Caribou Board
 1. The Parties will establish an advisory board to be known as the International Porcupine Caribou Board, hereinafter called the Board.
 2. The Parties will each appoint four members of the Board within a reasonable period following the entry into force of the present Agreement.
 3. The Board will:
 1. adopt rules and procedures for its operation, including those related to the chairmanship of the Board; and
 2. give advice or make recommendations to the Parties, subject to concurrence by a majority of each Party's appointees.
 4. The Board, seeking, where appropriate, information available from management agencies, local communities, users of Porcupine Caribou, scientific and other interests, will make recommendations and provide advice on those aspects of the conservation of the Porcupine Caribou Herd and its habitat that require international co-ordination, including but not limited to the following:
 1. the sharing of information and consideration of actions to further the objectives of this Agreement at the international level;
 2. the actions that are necessary or advisable to conserve the Porcupine Caribou Herd and its habitat;
 3. co-operative conservation planning for the Porcupine Caribou Herd throughout its range;
 4. when advisable to conserve the Porcupine Caribou Herd, recommendations on overall harvest and appropriate harvest limits for each of Canada and the United States of America taking into account the Board's review of available data, patterns of customary and traditional uses and other factors the Board deems appropriate;
 5. the identification of sensitive habitat deserving special consideration; and
 6. recommendations, where necessary, through the Parties as required, to other boards and agencies in Canada and the United States of America on matters affecting the Porcupine Caribou Herd or its habitat.
 5. It is understood that the advice and recommendations of the Board are not binding on the Parties; however, by virtue of this Agreement, it has been accepted that the Parties will support and participate in the operation of the Board. In particular they will:

1. provide the Board with information regarding the conservation and use of the Porcupine Caribou Herd and its habitat;
 2. promptly notify the Board of proposed activities that could significantly affect the conservation of the Porcupine Caribou Herd or its habitat and provide an opportunity to the Board to make recommendations;
 3. consider the advice and respond to the recommendations of the Board; and
 4. provide written reasons for the rejection in whole or in part of conservation recommendations made by the Board.
5. International Responsibility

The Parties will consult promptly to consider appropriate action in the event of:

1. significant damage to the Porcupine Caribou Herd or its habitat for which there is responsibility, if any, under international law; or
 2. significant disruption of migration or other important behavior patterns of the Porcupine Caribou Herd that would significantly lessen the ability of users of Porcupine Caribou to use the Herd.
6. Implementation

Co-operation and co-ordination under and other implementation of this Agreement shall be consistent with the laws, regulations and other national policies of the Parties and is subject to the availability of funding.

7. Interpretation and Application

All questions related to the interpretation or application of the Agreement will be settled by consultation between the Parties.

8. Entry into force - Amendments

1. This Agreement which is authentic in English and French shall enter into force on signature and shall remain in force until terminated by either Party upon twelve months written notice to the other.
2. At the request of either Party, consultations will be held with a view to convening a meeting of the representatives of the Parties to amend this Agreement.

IN WITNESS WHEREOF, the undersigned, being duly authorized by their respective Governments, have signed this Agreement.

DONE at Ottawa, in duplicate, this 17th day of July, 1987 in the English and French languages, both texts being equally authentic.

Thomas M. McMillan
FOR THE GOVERNMENT OF CANADA

Donald Paul Hodel
FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA



DEPARTMENT of the INTERIOR

news release

U.S. FISH AND WILDLIFE SERVICE

For Release July 17, 1987

Craig L. Rieben 343-5634

UNITED STATES AND CANADA SIGN CARIBOU CONSERVATION AGREEMENT

Secretary of the Interior Don Hodel and Canadian Minister of the Environment Thomas McMillan today signed an agreement calling for international conservation of the Porcupine caribou herd that migrates between Alaska and Canada.

In comments following the signing ceremony, Secretary Hodel said, "The Porcupine caribou herd is a wildlife resource of great value to both countries. This agreement lays the foundation for a coordinated approach to future conservation of the Porcupine caribou herd and demonstrates our commitment to perpetuation of this very important herd."

The agreement is aimed at conserving the herd through international cooperation and coordination so that long-term adverse effects from the use of the herd or its habitat are minimized. It also calls for the establishment of an International Porcupine Caribou Board consisting of four representatives from each country. The Board will evaluate information concerning the herd and its habitat in order to make recommendations and provide advice on conservation measures requiring international coordination.

The agreement also recognizes the importance of the herd to customary and traditional human uses, including subsistence harvest, that have been practiced by generations of rural residents in Alaska, the Yukon Territory, and the Northwest Territories. The interests of these and other users are given consideration as part of the agreement.

The Porcupine caribou herd is named after the Porcupine River, which drains a significant portion of the herd's 96,100-square-mile range in northeast Alaska and northwest Canada. The herd generally winters in Canada and undertakes a spring migration to calving grounds located in the foothills of the Brooks Range and the coastal plain bordering the Beaufort Sea from the Canning River in Alaska to the Babbage River in Canada. The calving areas in Alaska are encompassed by the nearly 20-million-acre Arctic National Wildlife Refuge.

In concluding his remarks, Secretary Hodel noted that his recommendations to Congress regarding oil and gas leasing on the coastal plain of the Arctic National Wildlife Refuge have taken into consideration measures needed to safeguard the Porcupine caribou herd. "This agreement will provide additional assurance that the herd is conserved and managed wisely," Hodel said.

(over)

Today's signing culminates an effort begun in 1983 when the U.S. Fish and Wildlife Service and the State of Alaska agreed to seek international cooperation in management of the herd. Since then, the process has involved extensive communication with other State and Federal agencies, Canadian counterparts, representatives of rural communities, and non-government entities. During that period, the herd grew from 110,000 animals to the current estimate of 180,000 caribou.

[http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/
porcupine_caribou_news/porcupine_caribou_news_summer_2017.pdf](http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/porcupine_caribou_news/porcupine_caribou_news_summer_2017.pdf)

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:776 (219 conversations)

Created: 08-07-2018 at 17:01 PM

Conversation Contents

Fwd: Engagement with tribes and ANCs on 10-02 lease sale

"Murphy, Ted" <t75murph@blm.gov>

From: "Murphy, Ted" <t75murph@blm.gov>
Sent: Mon Mar 26 2018 09:51:38 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: Engagement with tribes and ANCs on 10-02 lease sale

----- Forwarded message -----

From: **Wackowski, Stephen** <stephen_wackowski@ios.doi.gov>
Date: Mon, Mar 19, 2018 at 9:32 AM
Subject: Engagement with tribes and ANCs on 10-02 lease sale
To: Karen Mouritsen <kmourits@blm.gov>, Ted Murphy <t75murph@blm.gov>, Karen Clark <karen_clark@fws.gov>, Greg Siekaniec <greg_siekaniec@fws.gov>, Lesia Monson <lesia_monson@ios.doi.gov>, Joseph Hayes <joseph.hayes@boem.gov>
Cc: Joseph Balash <joseph_balash@ios.doi.gov>, Jason Larrabee <jason_larrabee@ios.doi.gov>

To avoid getting wires crossed on engagement with Alaska Native stakeholder groups on the 10-02 lease sale, Lesia will set up a shared calendar for your teams to populate with scheduled calls, trips, G2Gs, etc.

As you know ASLM and I have some long standing relationships with various stakeholders up there, and we would rather not hear after the fact about DOI engagement with folks from Kaktovik, Utqiagvik, Arctic Village and surrounding villages/gov't entities.

We will add in our own formal meetings or calls into the calendar for your visibility.

Greg/Karen- I realize you have a lot of day-to-day business in the Arctic Refuge not related to the lease sale--no need to add that to the calendar. However, it would be good for us to understand what the usual order business is with tribes, ANCs, and NGOs in/around the refuge is. Perhaps we should do a call or a visit to the Arctic Refuge office in Fairbanks sooner than later.

Steve Wackowski
Senior Adviser for Alaskan Affairs

Department of the Interior
4230 University Drive, Suite 300
Anchorage, AK 99508
907-271-5485

--

Ted A Murphy
Alaska-Associate State Director
907-271-5076

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Mon Mar 26 2018 19:35:59 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: Engagement with tribes and ANCs on 10-02 lease sale

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Monson, Lesia** <lesia_monson@ios.doi.gov>
Date: Tue, Mar 20, 2018 at 10:26 AM
Subject: Re: Engagement with tribes and ANCs on 10-02 lease sale
To: Joseph Hayes <joseph.hayes@boem.gov>, Greg Siekaniec <greg_siekaniec@fws.gov>, Ted Murphy <t75murph@blm.gov>, Karen Clark <karen_clark@fws.gov>, Karen Mouritsen <kmourits@blm.gov>, Jason Larrabee <jason_larrabee@ios.doi.gov>, Joseph Balash <joseph_balash@ios.doi.gov>
Cc: "Wackowski, Stephen" <stephen_wackowski@ios.doi.gov>

Hi Everyone,

I created and shared a calendar with you. It should appear in your list of calendars as "10-02 Engagement". You have sharing privileges, in case you have staff who will be entering the information on your behalf.

Let me know if you have any questions, or are having trouble accessing or sharing it.

Thank you,
Lesia

Lesia Monson

Department of the Interior
Office of the Secretary
[4230 University Drive, Suite 300](#)
[Anchorage, AK 99508](#)
[907-271-5485](#)

On Mon, Mar 19, 2018 at 9:32 AM, Wackowski, Stephen <stephen_wackowski@ios.doi.gov> wrote:

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Steve Wackowski
Senior Adviser for Alaskan Affairs
Department of the Interior
[4230 University Drive, Suite 300](#)
[Anchorage, AK 99508](#)
[907-271-5485](#)

Label: "_Coastal Plain"

Created by: mnhayes@blm.gov

Total Messages in label: 776 (219 conversations)

Created: 08-07-2018 at 17:01 PM

Conversation Contents

Fwd: Airborne snow mapping in 1002 area next month

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Mon Mar 26 2018 19:26:44 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, Serena Sweet <ssweet@blm.gov>, Marlo Draper <mdraper@blm.gov>, Ted Murphy <t75murph@blm.gov>, "Nichelle (Shelly) Jones" <njones@blm.gov>
Subject: Fwd: Airborne snow mapping in 1002 area next month

we should discuss tomorrow. Though I think this is a FWS issue

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Devaris, Aimee** <adevaris@usgs.gov>
Date: Fri, Mar 23, 2018 at 9:36 AM
Subject: Fwd: Airborne snow mapping in 1002 area next month
To: Gregory Siekaniec <greg_siekaniec@fws.gov>, Karen Mouritsen <kmourits@blm.gov>

Hi Greg and Karen,

This is the kind of thing I'm hoping we can discuss next week. This is new work apparently being undertaken by USGS, and it's not clear to me what the relative priority is or how useful it will be. Thus far, I understood the need for snow depth information to be related to water availability in terms of the EIS. Is this snow drift modeling for polar bear den habitat needed for the IHA? I hadn't heard of this requirement before.

Thanks,
Aimee

----- Forwarded message -----

From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Thu, Mar 22, 2018 at 2:56 PM
Subject: Airborne snow mapping in 1002 area next month
To: Todd Atwood <tatwood@usgs.gov>, George Durner <gdurner@usgs.gov>, Patrick Lemons <patrick_lemons@fws.gov>, Craig Perham <craig.perham@boem.gov>

Cc: Drew Crane <drew_crane@fws.gov>, Paul Leonard <paul_leonard@fws.gov>, John Pearce <jpearce@usgs.gov>, Matthew Sturm <msturm1@alaska.edu>

Dear Beaufort Sea Polar Bear Researchers,

Please share with others as needed...

The FWS Arctic LCC has been working with Matthew Sturm (UAF) and Frank Urban (USGS) to identify a preliminary study to gather information on snow depth in the Arctic National Wildlife Refuge 1002 area. Matthew was able to secure funding to fly LiDAR and Structure for Motion imagery over a select area of the coastal plain, and now we are looking for feedback on areas of interest. We see this as an opportunity to have data at three scales for a point in time (April 10-19, 2018): ground measurements, aircraft based imagery and satellite remote sensing data, to give us some quantitative information to inform further discussions. Our goals are two-fold:

1) To work with you all to determine if we can refine existing models or work with to create new models that annually identify snow drifts with highest probability to create potential polar bear denning habitat; and 2) to establish how to monitor for minimum snow required for winter tundra travel to protect taller stature vegetation (tussocks and shrubs) in the 1002 area during exploration and development.

Frank Urban would lead the ground survey team by snowmachine while Matthew and Chris Larson fly. Frank has three remote snow/temperature monitoring stations on the 1002 Coastal Plain, including Camden Bay, March Creek and Niguanik. They have proposed the following for the snow survey, but are looking for feedback on what areas would be of interest:

*Are there any priority areas in the 1002 area that you would want to see mapped for snow depth? with the budget we have, and time, we can cover two **15 by 4 km swaths**. Our current plan is to lay these over areas that we measured in 2014 with some measurements in 2015. One swath would be from Camden Bay south to Marsh Creek; the other from just south of Kaktovik SE to Niguanik. If there is some other location that has high priority please let us know.*

Our field protocols emphasize the collection of a large number of snow depth values, which allow us to proof the structure from motion snow depth maps. we will also collect some snow stratigraphy and density, which will allow us to convert depths to water and to think about over-snow trafficability issues. Other aspects of the snow of interest?

I would be grateful for your feedback based on your knowledge and experience with polar bear denning to identify the what might be useful. I understand that early winter snow depth is potentially more relevant to polar bear denning habitat selection, but I do hope that this information will help us understand general snow depth/redistribution patterns associated with topography. I will also be consulting the Arctic National Wildlife Refuge staff for other insights into terrain variation that could

affect snow depth for winter tundra travel.

Thank you in advance for your time. I know that those of you from USGS are out in the field looking for bears, but I hope you'll have a chance to share your thoughts early next week or let me know what additional information you may need and when you might be able to reply.

Thank you,

Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--

Aimee M. Devaris
Regional Director
U.S. Geological Survey
[4210 University Drive](#)
[Anchorage, Alaska](#)
[907-786-7055](#)

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Tue Mar 27 2018 10:08:50 GMT-0600 (MDT)
To: "Mouritsen, Karen" <kmourits@blm.gov>
Serena Sweet <ssweet@blm.gov>, Marlo Draper
<mdraper@blm.gov>, Ted Murphy <t75murph@blm.gov>,
CC: "Nichelle (Shelly) Jones" <njones@blm.gov>
Subject: Re: Airborne snow mapping in 1002 area next month

Yes, I agree it is a FWS issue.

Nicole Hayes

Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Mon, Mar 26, 2018 at 5:26 PM, Mouritsen, Karen <kmourits@blm.gov> wrote:
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Karen E. Mouritsen
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Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

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Aimee M. Devaris

Regional Director

U.S. Geological Survey

[4210 University Drive](#)

[Anchorage, Alaska](#)

[907-786-7055](#)

Label: "_Coastal Plain"

Created by: mnhayes@blm.gov

Total Messages in label: 776 (219 conversations)

Created: 08-07-2018 at 17:02 PM

Conversation Contents

Info regarding communities in and near the Arctic Refuge from CCP

Attachments:

/101. Info regarding communities in and near the Arctic Refuge from CCP/1.1 image003.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/2.1 image003.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/3.1 image003.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/4.1 image002.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/4.2 image006.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/4.3 image007.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/4.4 Griffithetal2002ANWRPCHstory.pdf
/101. Info regarding communities in and near the Arctic Refuge from CCP/5.1 image002.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/5.2 image006.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/5.3 image007.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/6.1 image002.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/6.2 image007.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/6.3 image006.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/7.1 image006.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/7.2 image007.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/7.3 image002.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/8.1 image007.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/8.2 image006.jpg
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/101. Info regarding communities in and near the Arctic Refuge from CCP/9.1 image006.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/9.2 image002.jpg
/101. Info regarding communities in and near the Arctic Refuge from CCP/9.3 image007.jpg

Wendy Loya <Wendy_loya@fws.gov>

From: Wendy Loya <Wendy_loya@fws.gov>
Sent: Fri Mar 16 2018 13:58:49 GMT-0600 (MDT)
To: Nicole Hayes <mnhayes@blm.gov>
CC: Stephanie Brady <stephanie_brady@fws.gov>
Subject: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image003.jpg

Hi Nicole,

The information in our CCP might be the best summary of the relationship of the communities consulted in the CCP process to subsistence on the Refuge, including the Porcupine Herd. From Page 4-174:

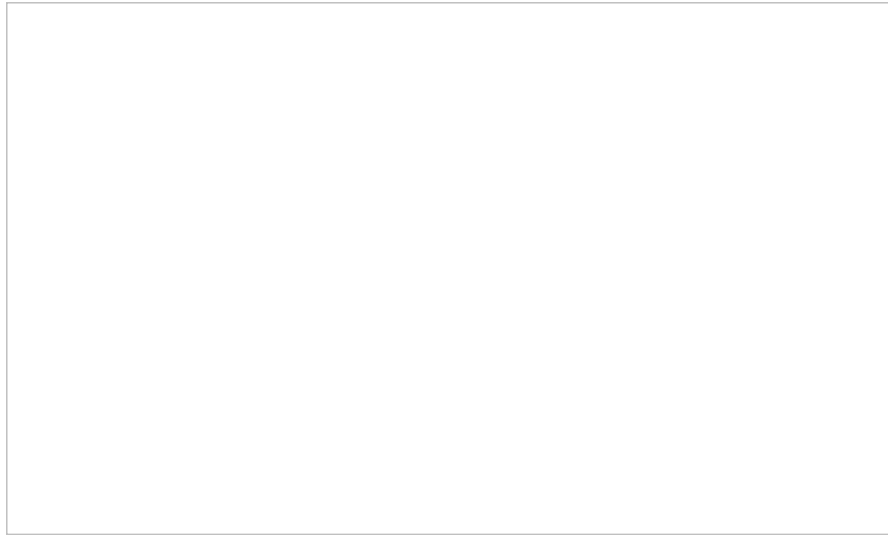
Presently, six communities (Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman) are in or relatively close to Arctic Refuge and use the Refuge for subsistence purposes. Residents of Arctic Village and Kaktovik utilize the Refuge most frequently due to their close proximity in or adjacent to the Refuge. Residents of Fort Yukon, Venetie, Chalkyitsik, and Wiseman use Refuge lands to a lesser extent (Service 1988a). In addition, the following communities have geographic or cultural ties to Arctic Refuge and its subsistence resources: Beaver, Circle, Birch Creek, and Stevens Village in Alaska, and Old Crow in Canada. In general, communities harvest the subsistence resources most available to them, concentrating their efforts along rivers or coastlines or in the mountains, depending on the season and availability of resources at particularly productive sites (HDR 2011).

The HDR 2011 citation is for the Pt. Thompson EIS. In looking at that document, approximately page 3-216 onward, I see they considered the North Slope Borough population in their assessment (volume 1, FEIS), but I do not know if they did consultation.

In looking at harvest reporting from ADFG, I found this in the PCH 2017 newsletter:

http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/porcupine_caribou_news/porcupine_caribou_news_summer_2017.pdf

Harvest reporting ensures your community gets the caribou they need! Porcupine herd harvest is thought to be between 1 to 2% of the herd annually. Canada's Harvest Management Plan requires that all hunters accurately report harvest each year. In 2013–2014, about 2,920 Porcupine caribou were harvested in Canada, with more than 95% of the harvest by Gwich'in or Inuvialuit hunters. In Alaska, harvest is primarily by local hunters in Arctic Village, Venetie, and Kaktovik. Reported harvest by these communities is estimated to be 200 to 500 caribou each year, but harvest reporting is usually low. Reported harvest by nonlocal Alaska resident or nonresident hunters is usually less than 175 caribou.



Wendy

Dr. Wendy M. Loya,
Arctic Program Coordinator, Office of Science Applications
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.227.2942 (mobile)

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Fri Mar 16 2018 14:19:20 GMT-0600 (MDT)
To: "Murphy, Ted" <t75murph@blm.gov>
Subject: Fwd: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image003.jpg

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

----- Forwarded message -----

From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Fri, Mar 16, 2018 at 11:58 AM
Subject: Info regarding communities in and near the Arctic Refuge from CCP
To: Nicole Hayes <mnhayes@blm.gov>
Cc: Stephanie Brady <stephanie_brady@fws.gov>

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"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

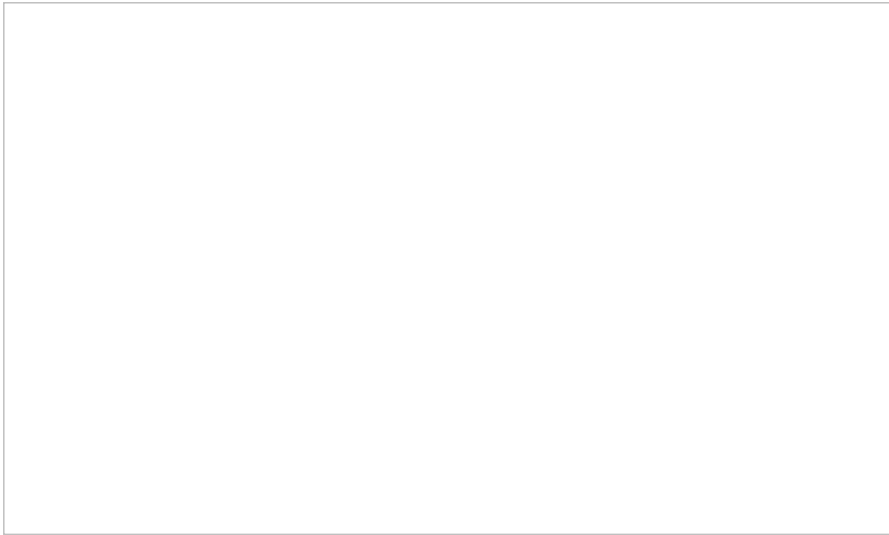
From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Thu Mar 22 2018 15:00:41 GMT-0600 (MDT)
To: Wendy Loya <Wendy_loya@fws.gov>, John Pearce <jpearce@usgs.gov>
Subject: Re: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image003.jpg

Hi Wendy and John,

I do have a question regarding this map that was provided in the ADFG PCH 2017 newsletter (http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/porcupine_caribou_news/porcupine_caribou_news_summer_2017.pdf) - any idea of where the data may have come from? We asked our GIS team to put together a map with some of the caribou range information in relation to the Refuge and Coastal Plain boundaries but when they contacted ADFG, ADFG was not sure where the source of the data came from for this map (?). We have some caribou herd data sets but they may be a little dated (definitely don't match this map). Would your departments have any recent data regarding the range of Porcupine and Central Herds that could be shared?

Thanks!
Nicole

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354



Wendy Loya <Wendy_loya@fws.gov>

From: Wendy Loya <Wendy_loya@fws.gov>
Sent: Thu Mar 22 2018 15:27:20 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>
Subject: RE: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image002.jpg image006.jpg image007.jpg Griffithetal2002ANWRPCHstory.pdf

Hi Nicole,

That is very strange. I am copying the CCP map below, from page 4-103. This would expand the communities to include Chalkyitsik, Circle, Wiseman/Coldfoot, with Ft. Yukon just outside the range, but recommended to be included.

Griffiths et al. 2002 has a similar map, so I would imagine that Griffiths et al. 2002 is the source of these data, I will attempt to confirm.

CCP Map:



Griffiths et al. 2002map



Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From: Hayes, Miriam (Nicole) [mailto:mnhayes@blm.gov]
Sent: Thursday, March 22, 2018 1:01 PM
To: Wendy Loya <Wendy_loya@fws.gov>; John Pearce <jpearce@usgs.gov>
Subject: Re: Info regarding communities in and near the Arctic Refuge from CCP

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Nicole

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Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Thu Mar 22 2018 15:33:41 GMT-0600 (MDT)
To: Wendy Loya <Wendy_loya@fws.gov>
CC: John Pearce <jpearce@usgs.gov>
Subject: Re: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image002.jpg image006.jpg image007.jpg

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CCP Map:



Griffiths et al. 2002map



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"Pearce, John" <jpearce@usgs.gov>

From: "Pearce, John" <jpearce@usgs.gov>
Sent: Thu Mar 22 2018 16:00:06 GMT-0600 (MDT)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
CC: Wendy Loya <Wendy_loya@fws.gov>
Subject: Re: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image002.jpg image007.jpg image006.jpg

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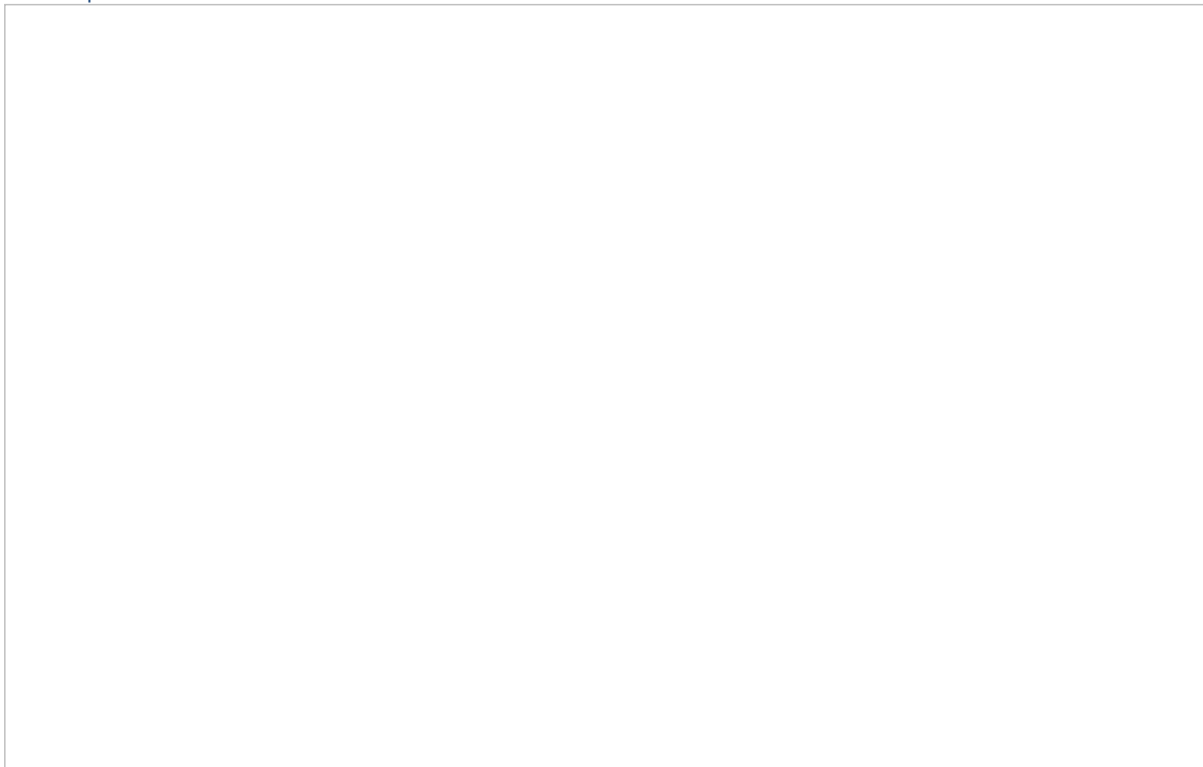
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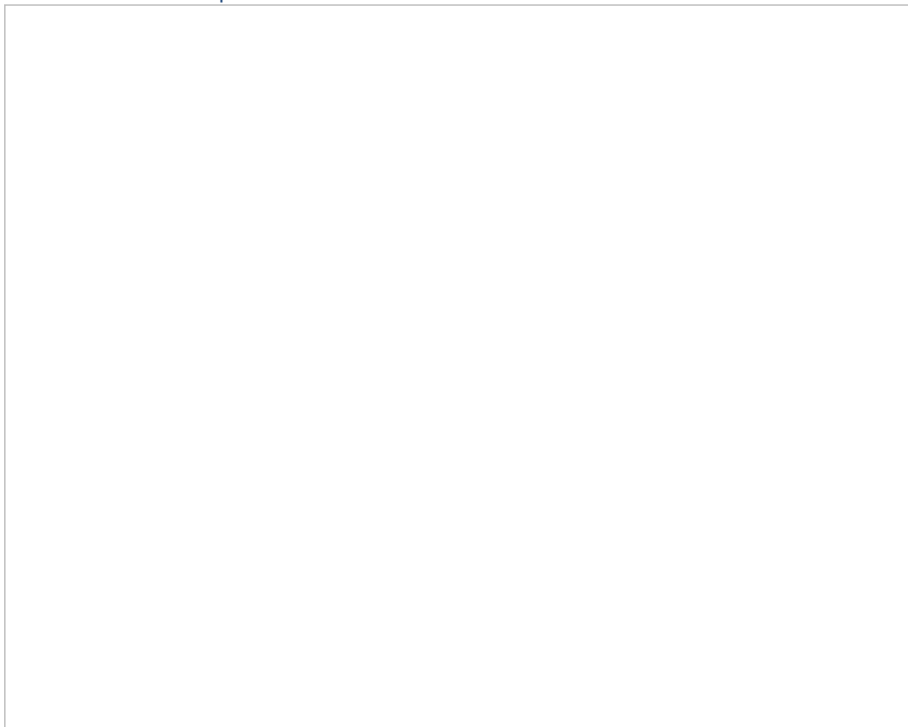
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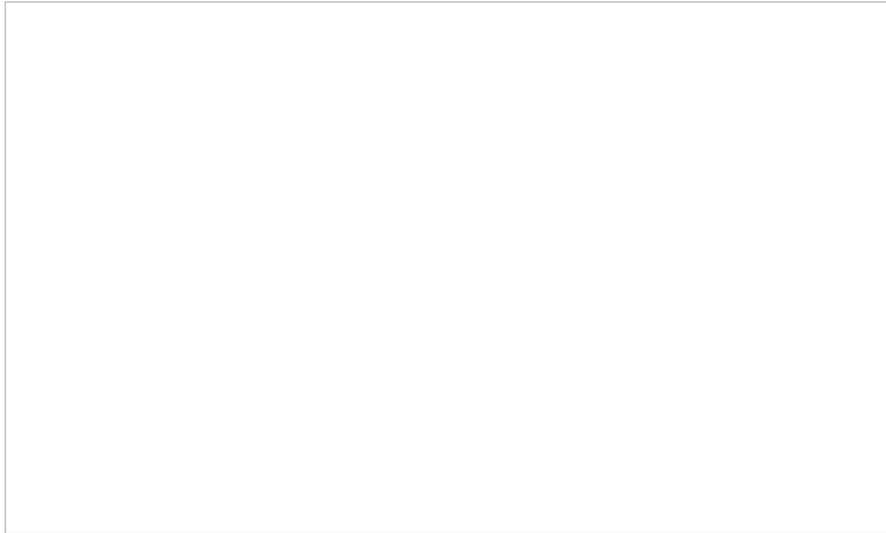
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From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Thu Mar 22 2018 16:02:14 GMT-0600 (MDT)
To: "Pearce, John" <jpearce@usgs.gov>
Subject: Re: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image006.jpg image007.jpg image002.jpg

John,
Thank you for the lead!
Nicole

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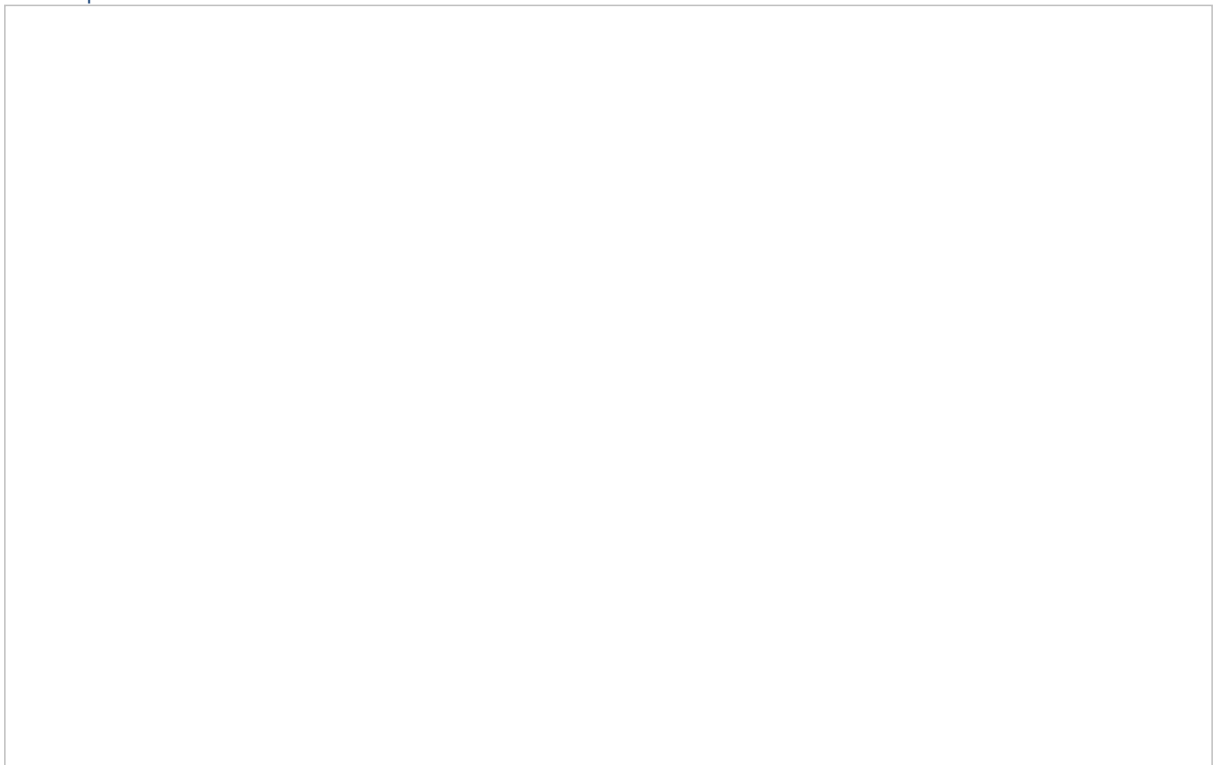
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From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Thu Mar 22 2018 16:02:43 GMT-0600 (MDT)
To: Catherine Hillis <chillis@blm.gov>
Subject: Fwd: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image007.jpg image006.jpg image002.jpg

Another POC at ADFG?

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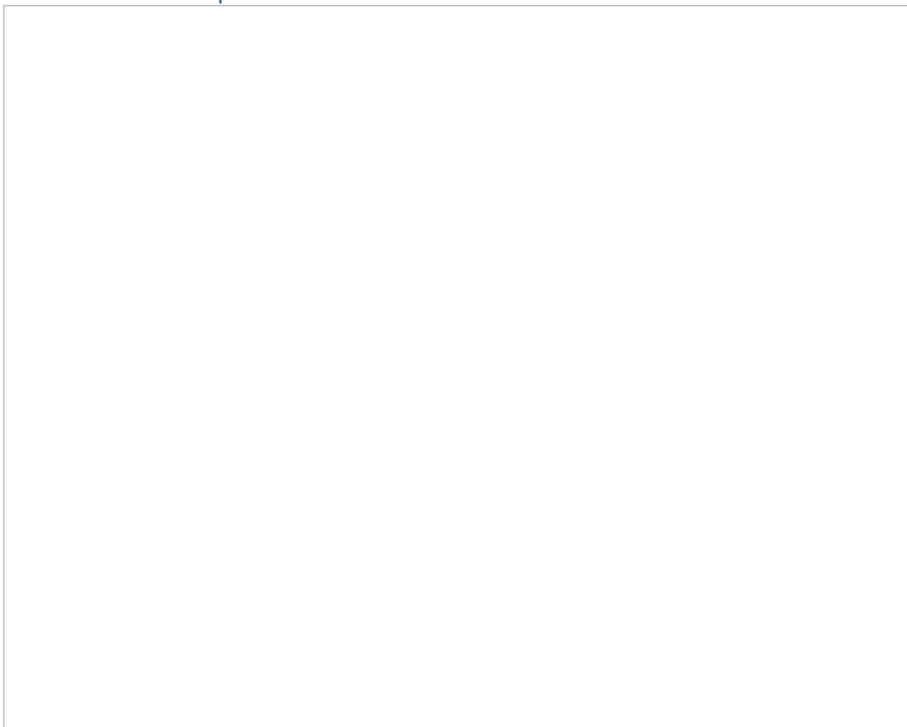
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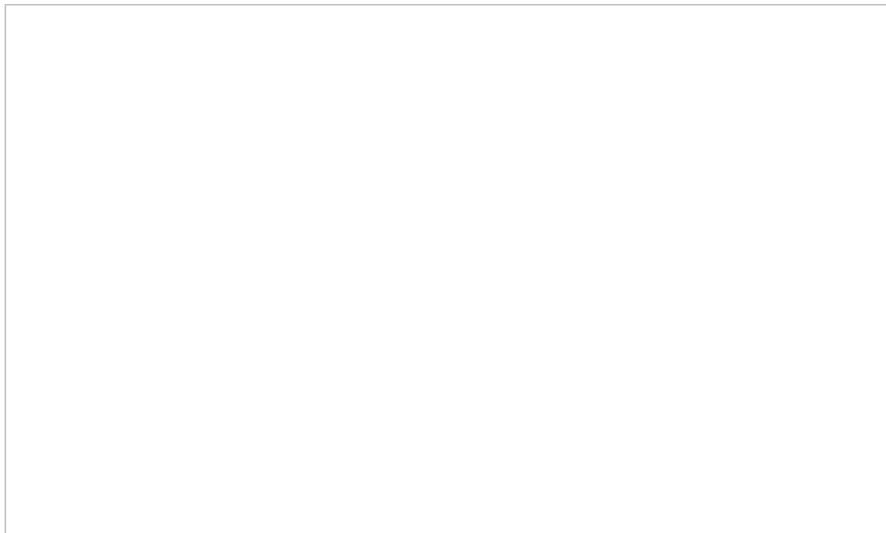
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"Hillis, Catherine" <chillis@blm.gov>

From: "Hillis, Catherine" <chillis@blm.gov>
Sent: Mon Mar 26 2018 12:52:23 GMT-0600 (MDT)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Subject: Re: Info regarding communities in and near the Arctic Refuge from CCP
Attachments: image006.jpg image002.jpg image007.jpg

Nicole, I still haven't received the information from Beth Lenart or Jason Caikoski.

Cathy Hillis, Geospatial Manager
Alaska State Office
907-271-3273

On Thu, Mar 22, 2018 at 2:02 PM, Hayes, Miriam (Nicole) <mnhayes@blm.gov> wrote:

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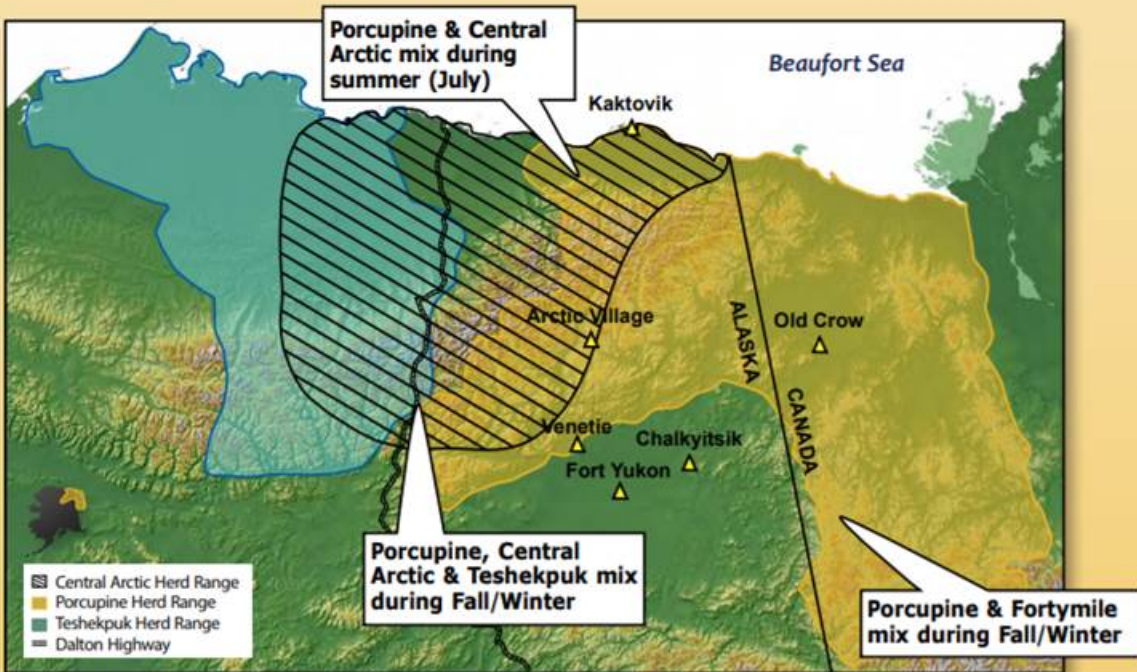
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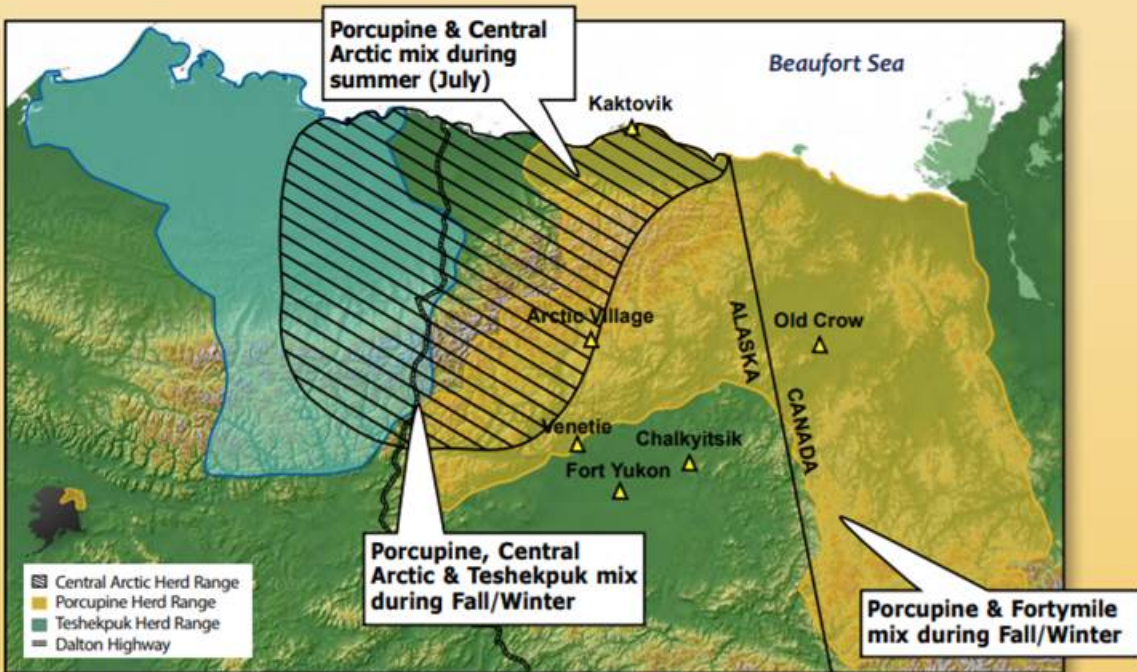
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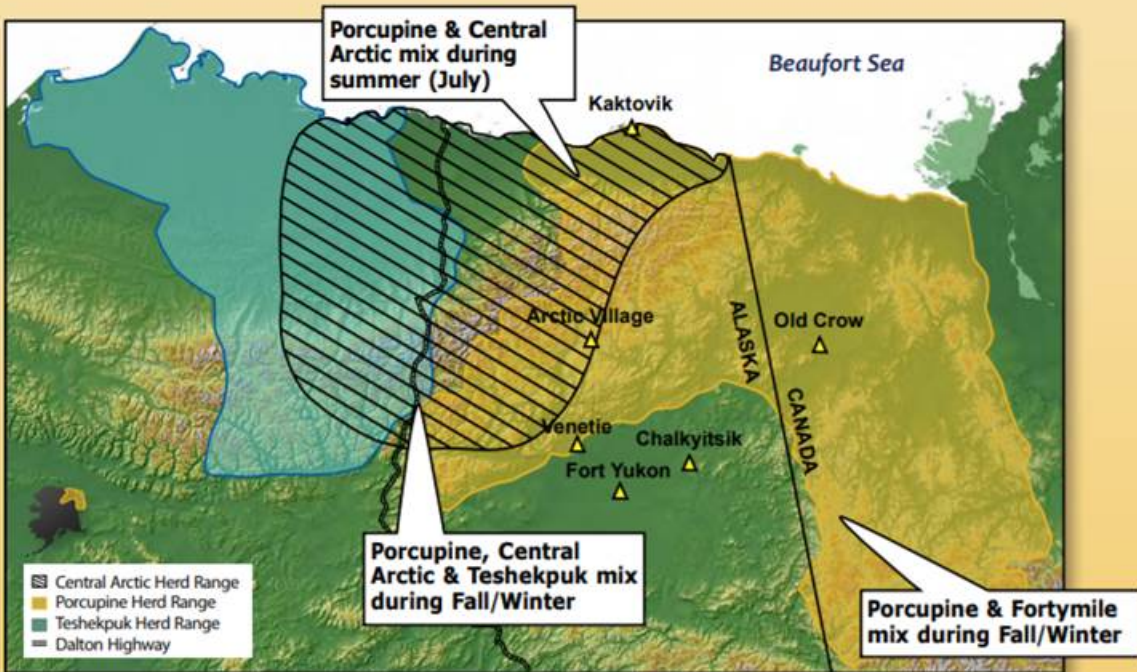
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Email Attachments









Map 4-8

Arctic National Wildlife Refuge

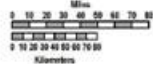
Range of the Central Arctic and Porcupine Caribou Herds

Caribou Ranges

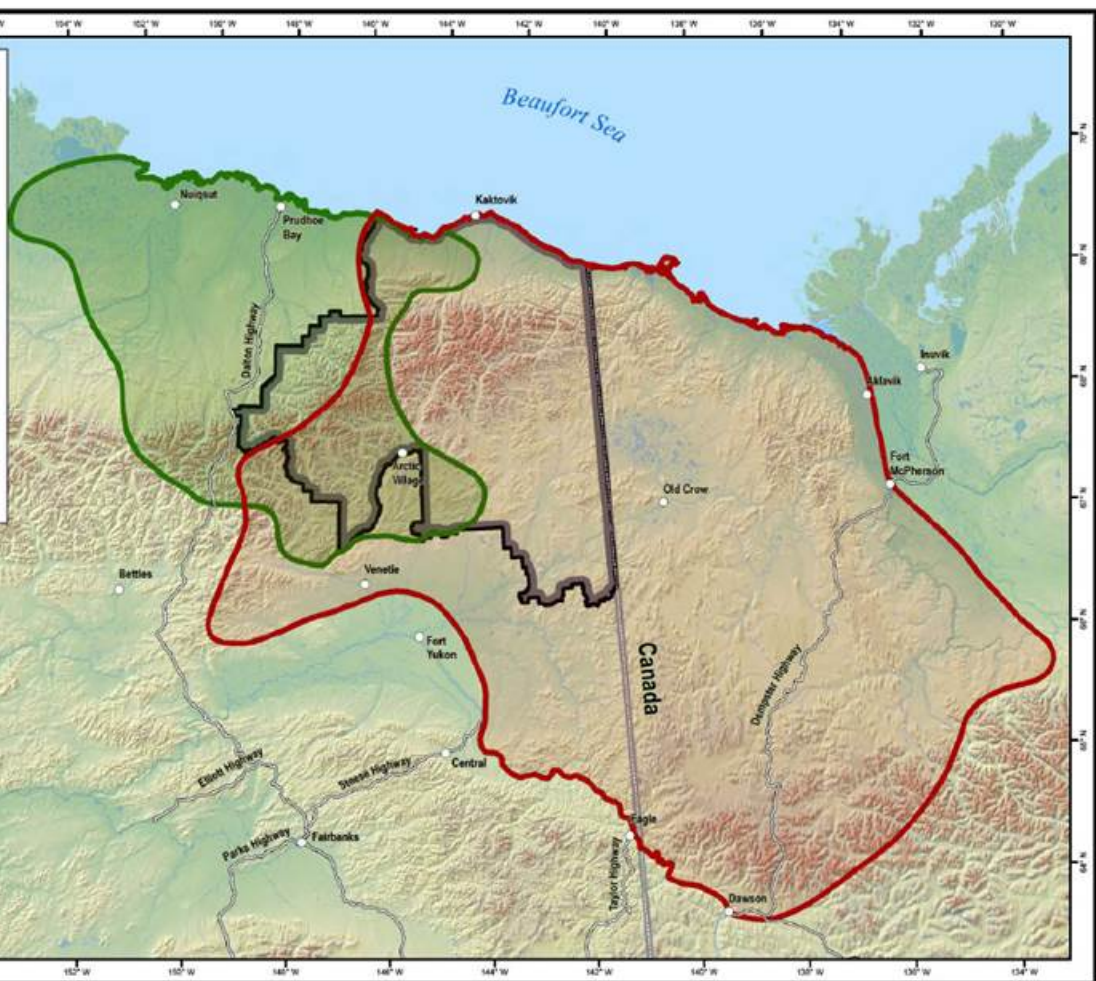
- Porcupine Caribou Herd Range
- Central Arctic Caribou Herd Range

Other Features

- Arctic Refuge Boundary
- U.S. - Canada Border



Alaska Albers Equal Area Cyclic Projection, 1983 North American Datum.



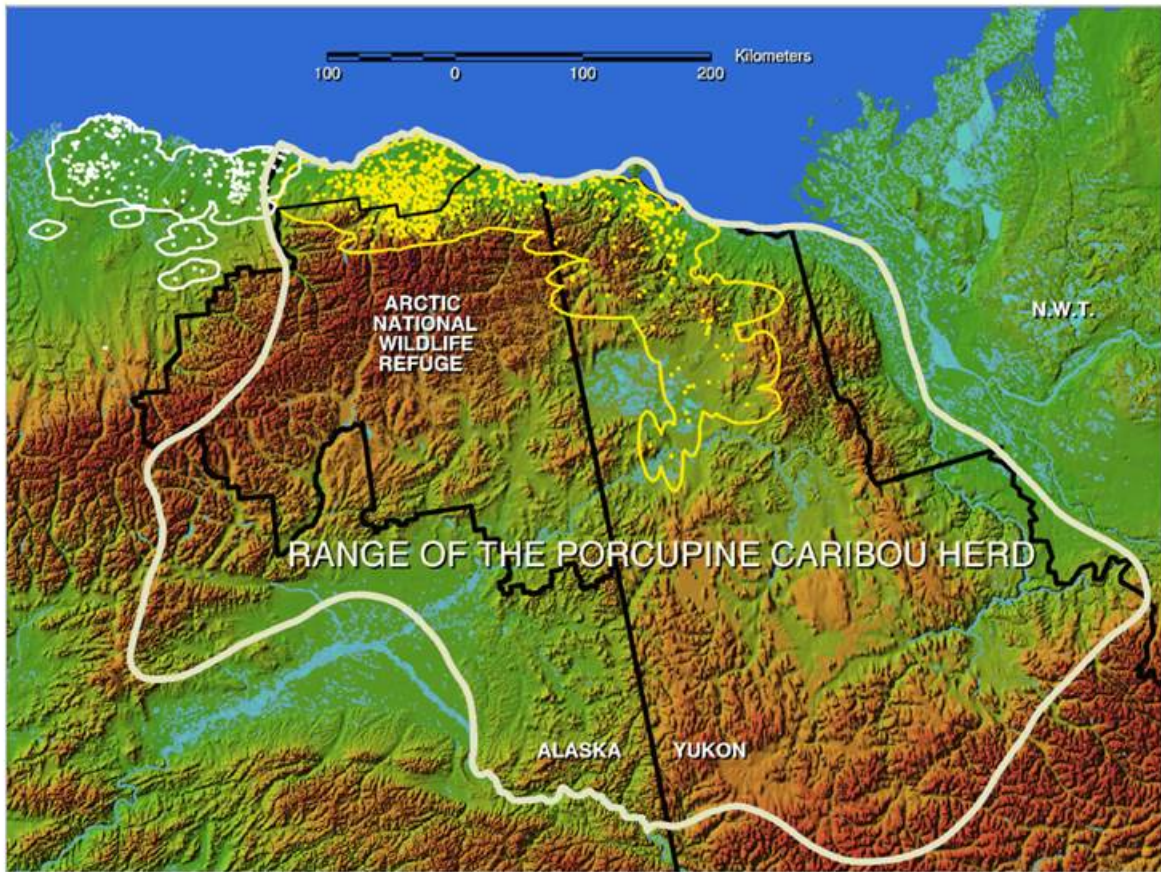
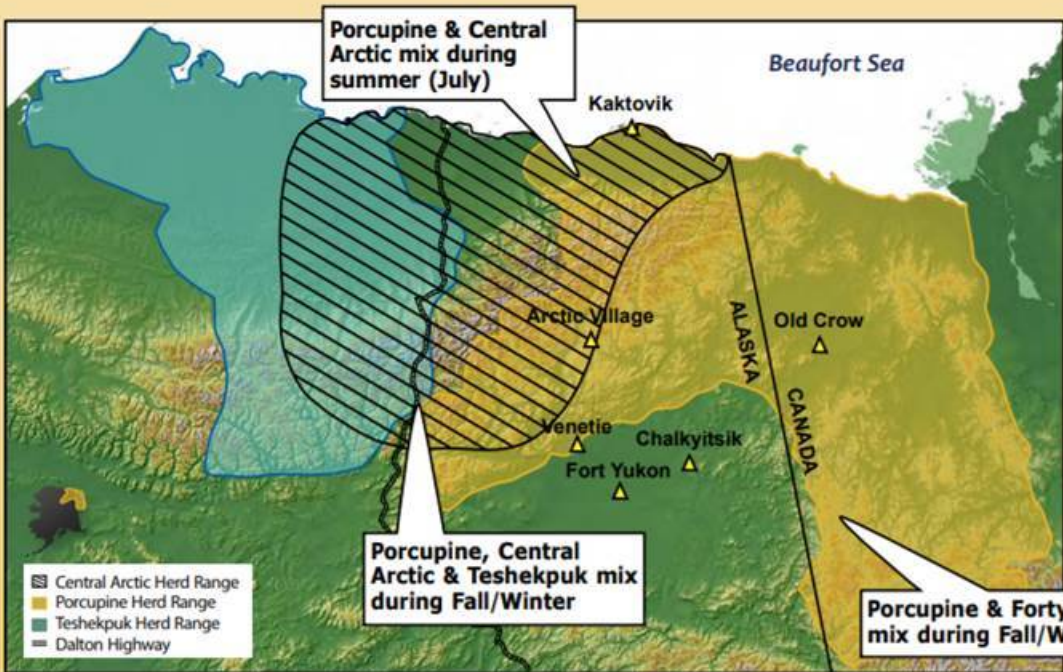


Figure 3.2. For the Porcupine caribou herd: annual range (wide white solid line), calving sites (yellow points), and aggregate extent of calving (thin solid yellow line), 1983-2001. For the Central Arctic caribou herd: aggregate extent of calving (thin solid white line) and calving sites (white points), 1980-1995. (Adapted from Wolfe 2000).



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Section 3: The Porcupine Caribou Herd

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Section 3: The Porcupine Caribou Herd

Brad Griffith, David C. Douglas, Noreen E. Walsh, Donald D. Young, Thomas R. McCabe, Donald E. Russell, Robert G. White, Raymond D. Cameron, and Kenneth R. Whitten

Documentation of the natural range of variation in ecological, life history, and physiological characteristics of caribou (*Rangifer tarandus*) of the Porcupine Caribou herd is a necessary base for detecting or predicting any potential effects of industrial development on the performance (e.g., distribution, demography, weight-gain of individuals) of the herd. To demonstrate an effect of development, post-development performance must differ from pre-development performance while accounting for any natural environmental trends.

We had 2 working hypotheses for our investigations: 1) performance of the Porcupine Caribou herd was associated with environmental patterns and habitat quality, and 2) access to important habitats was a key influence on demography.

We sought to document the range of natural variation in habitat conditions, herd size, demography (defined here as survival and reproduction), sources and magnitude of mortality, distribution, habitat use, and weight gain and loss; and to develop an understanding of the interactions of these characteristics of the herd.

In addition, we investigated ways that we could use this background information, combined with auxiliary information from the adjacent Central Arctic caribou herd, to predict the direction and magnitude of any potential effects of industrial oil development in the 1002 Area of the Arctic National Wildlife Refuge on Porcupine Caribou herd calf survival on the herd's calving grounds during June.

Data, Methods and Assumptions

This work focused on the calving and post-calving seasons of the Porcupine Caribou herd. The *calving season* was defined as the 3-week period that began with the birth of calves (spring). *Post-calving* was defined as the 3-week period that followed the calving season (early summer).

Porcupine caribou herd size was estimated by the Alaska Department of Fish and Game (ADF&G) from aerial photo-censuses during post-calving aggregations. Only censuses considered reliable by ADF&G were used. Variance in annual censuses due to multiple observers counting portions of the photo sets was relatively small when compared with each census ($\pm 2\%$) and was ignored in the display of annual censuses to the nearest 1,000 animals.

Demography and calf weight-gain were estimated from repeated locations and/or recaptures of radio-

collared animals. Calving distributions were estimated from 767 calving sites of adult (≥ 3 year old) radio-collared female caribou obtained during 1983-2001 (average of 40 sites per year; fixed-kernel analyses using Least Squares Cross Validation (Silverman 1986, Seaman et al. 1996, 1998, 1999)). *Concentrated calving areas* were defined as the annual kernel contour that included calving sites with greater than average density (Seaman et al. 1998). *Annual calving grounds* were defined as the 99% kernel utilization distributions obtained from annual calving sites. *Extent of calving* was defined as the aggregate extent of all annual calving grounds.

Vegetation types were mapped from Landsat-Thematic Mapper satellite imagery (Fig. 2.1; Jorgensen et al. 1994) and reduced from 17 to 7 classes for caribou habitat analyses (Fig. 3.1). We estimated the *Normalized Difference Vegetation Index* (NDVI) (Tucker 1979, Tucker et al. 1986) and snowcover from Advanced Very High Resolution Radiometer (AVHRR) data from National Oceanic and Atmospheric Administration (NOAA) polar orbiting satellites. Snowcover was estimated using a linear regression that we derived by correlating AVHRR infrared reflectance with estimates of snowcover extracted from aerial photographs collected in the 1002 Area during the snowmelt periods of 1987 and 1988 ($r^2 = 0.87$, $n = 80$). Cloud contaminated areas in the AVHRR images were identified (Baglio and Holroyd 1989) and excluded from analyses, as were large water bodies. AVHRR and Thematic Mapper images were transformed to an Albers Equal Area projection and re-sampled to 1-km² pixel size.

NDVI indexes the disproportionate reflectance of near-infrared radiation from green vegetation (Tucker and Sellers 1986) in the canopy of plant communities. Thus, relationships between NDVI and *total green plant biomass* or leaf area index (LAI) would be expected to be strongest for plant communities with reduced vertical distribution of green biomass and leaf area (e.g., communities dominated by sedges, grasses, or short shrubs that are common in the Arctic). Due to the size of the pixels (~1 km²) AVHRR data are linked more to landscape processes than to individual plant communities (Malingreau and Belward 1992).

Relatively good correlations have been obtained between above ground net primary productivity (ANPP) and seasonally integrated NDVI ($r^2 = 0.89$; Paruelo et al. 1997), LAI and NDVI when integrated across physiognomic categories ($r^2 = 0.97$; Shippert et al. 1995), and photosynthetic biomass and NDVI in small plots ($r^2 = 0.51$; Hope et al. 1993). Because NDVI indexes total green biomass and caribou are selective feeders (White 1983), we assumed that the biomass of forages eaten by caribou was positively correlated with total green biomass at the landscape scale.

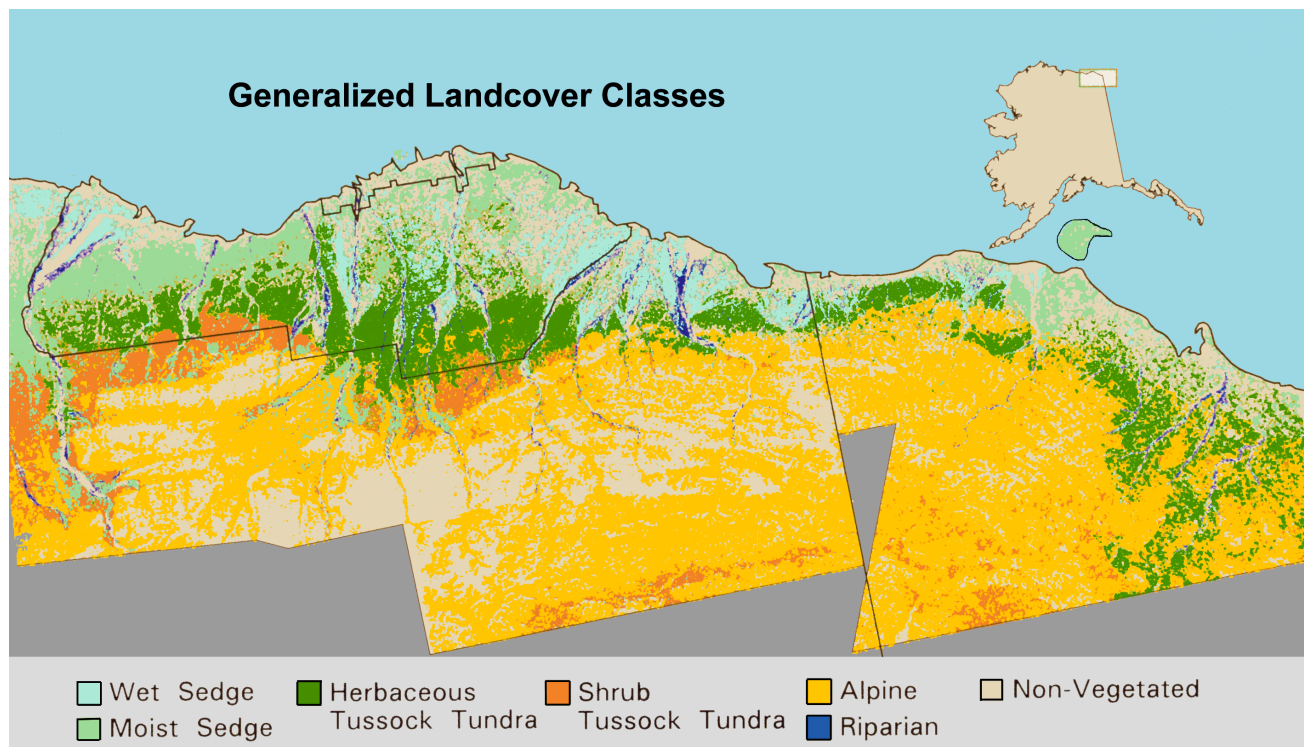


Figure 3.1. Land-cover classes on the coastal plain of the Arctic National Wildlife Refuge, Alaska, and eastward into the Yukon Territory, Canada, as generalized for studies of the Porcupine caribou herd. Classes are based on Jorgensen et al. (1994) as depicted in Fig. 2.1 and are expanded to include Canada using a Canadian Wildlife Service Landsat-derived vegetation map of the Northern Yukon. Classes on this map and their corresponding classes in Jorgensen et al. (1994) include: Wet Graminoid (WG, WGM, some PV), Moist Sedge (MSW, MS, MSD), Herbaceous Tussock Tundra (TT, SP), Shrub Tussock Tundra (STT), Alpine (ST, AT, some PV), Riparian (RS, DT, some PV), and Non-vegetated (BA, IC, WA, z SH).

We directly estimated NDVI at 3 times:

- 1) *NDVI_calving* composite (Holben 1986) images obtained as close as possible to median calving date each year (mean image date of 2 June, SE = 2.0 days). Snowcover was also estimated from these images. Negative NDVI values (areas with snowcover) were converted to zero NDVI.
- 2) *NDVI_mid-June* approximately 2 weeks after calving (mean image date of 16 June, SE = 2.6 days).
- 3) *NDVI_early-July* during the first week of July (mean image date of 3 July, SE = 2.4 days).

From these images we derived 2 additional estimates:

- 1) *NDVI_rate* the pixel-based daily rate of increase in NDVI from calving to mid-June.
- 2) *NDVI_621* NDVI on the fixed date of 21 June each year (approximately 3 weeks after calving, linearly interpolated from mid-June and early-July images).

In years when snowcover was substantial (i.e., 1986, 1988, 1989, 1992, 1997) and *NDVI_calving* was near zero, there may have been a small overestimate of *NDVI_rate*. In addition, cloud cover made it impossible to obtain a complete image on any fixed date. Thus,

NDVI_621 was the most robust NDVI estimate because it was interpolated to a fixed date from 2 snow-free images.

We assumed that *NDVI_calving* and *NDVI_621* represented relative green orange quantity while *NDVI_rate* reflected forage quality because it estimated the daily accumulation of new plant tissue which is highly digestible (Cameron and Whitten 1980). The quality implication of *NDVI_rate* was based on the assumption that caribou forage selectively for the most digestible food items (White 1983). Because energy and protein intake from milk by caribou calves remains high during the first 3 weeks of life and then declines as calves increase their intake of vegetation (White and Luick 1984, Parker et al. 1990), we assumed that *NDVI_621* estimated forage availability to lactating females during the 3-week period of peak lactation demand immediately after calving.

Predator distributions and relative densities were estimated from annual relocations of radio-collared grizzly bears (*Ursus arctos*), 1983-1994, and from aerial survey locations of golden eagle (*Aquila chrysaetos*) nest structures and wolf (*Canis lupus*) dens (Fig. 6.1).

satellite-collared caribou provided supplemental information on distribution throughout the herd's annual range. Estimates of minimum daily movement rates were

obtained from satellite-collared animals, 1985-1995, and from near-daily relocations of conventional radio-collared calves on the calving ground, 1992-1994.

Data were analyzed with contingency tables, linear and stepwise logistic regression, multi-response permutation procedures (MRPP, Mielke and Berry 1982), and analysis of variance. Akaike's Information Criteria (AIC; Akaike 1973, Akaike et al. 1986) were used for final model selection. Bonferroni procedures were used to provide overall experiment error protection as appropriate. GIS technology, remotely-sensed habitat data-layers, habitat-demography relationships, and simulation modeling were used to assess potential effects of displacement of calving grounds on calf survival each June.

Not all types of data were available throughout the entire primary study period of 1983-2001. Calf weights near birth were estimated from captured 1- and 2-day-old animals in 1983-1985, and again in 1992-1994. Calf weight-gains on the calving ground and cow weights in June and September were estimated in 1992-1994.

Caribou food habits were estimated during 1973 (Thompson and McCourt 1981), 1979-1981 (Russell et al. 1993), and for this study during 1993-94 from microhistological analyses of fecal pellets (Sparks and Malechek 1968) corrected for forage digestibility (Duquette 1984).

Annual adult caribou survival was estimated in 1983-1992 (Fancy et al. 1994, Walsh et al. 1995). Over-winter calf survival was estimated in 1983-1985 and 1988 (Fancy et al. 1994, Walsh et al. 1995). June calf survival (the proportion of parturient radio-collared females retaining live calves during the last week of June) was estimated in 1983-1992 (Fancy et al. 1994, Walsh et al. 1995) and for this study in 1993-2001.

Calving distributions and vegetation types on the calving grounds were available for all years 1983-2001, but satellite-based estimates of NDVI and snowcover were only available for the years 1985-2001.

The study area covered the annual range of the Porcupine caribou herd (Fig. 3.2), emphasizing the calving ground, and was described in the introduction of

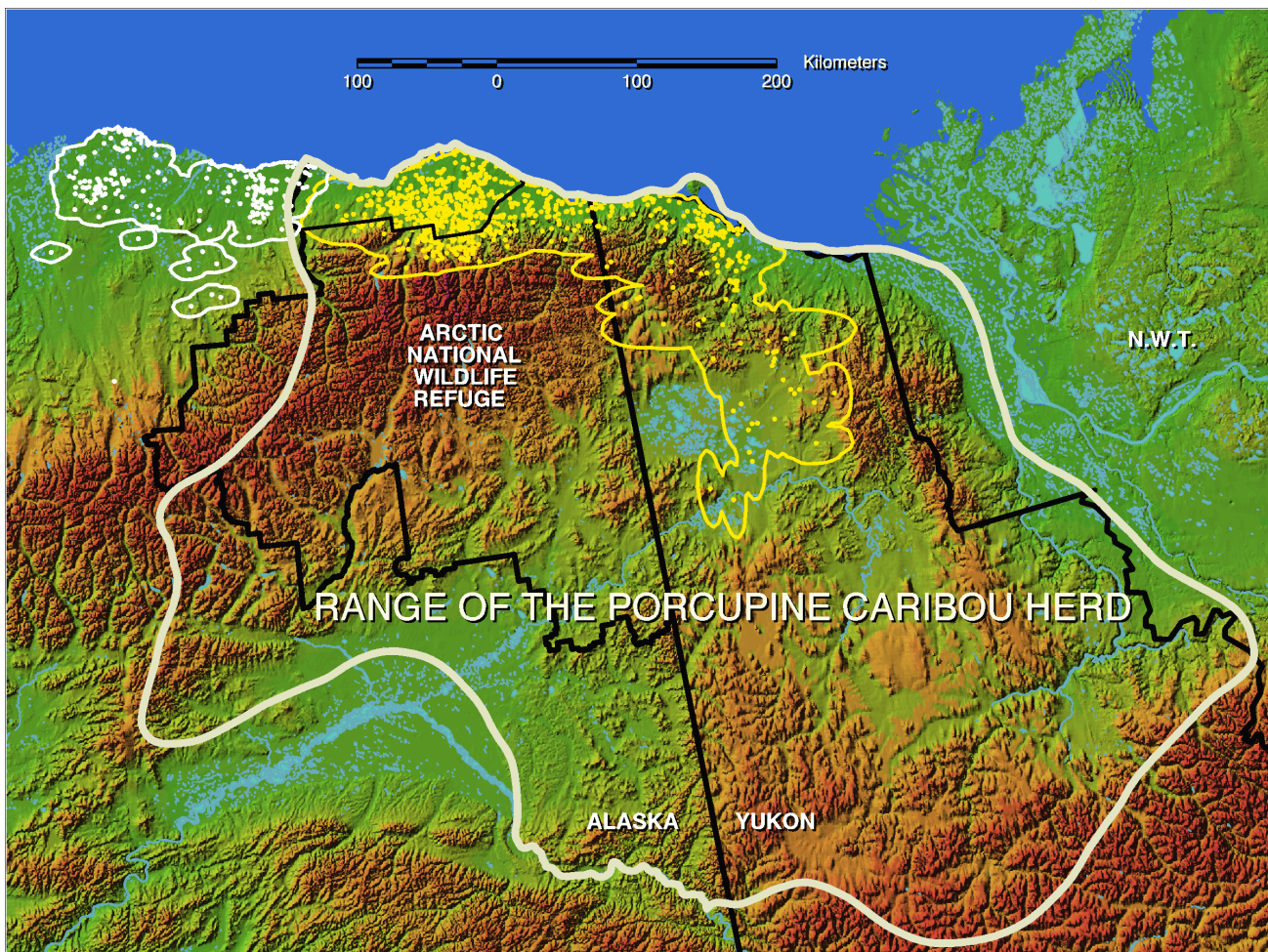


Figure 3.2. For the Porcupine caribou herd: annual range (wide white solid line), calving sites (yellow points), and aggregate extent of calvingz (thin solid yellow line), 1983-2001. For the Central Arctic caribou herd: aggregate extent of calving (thin solid white line) and calving sites (white points), 1980-1995. (Adapted from Wolfe 2000).

this report and in the 1987 Final Legislative Environmental Impact Statement (Clough et al. 1987).

Nutritional Importance of the Calving Ground

Spring arrival on the calving ground is the time of minimum body reserves for parturient females (those about to give birth or accompanied by very young calves) (Chan-McLeod et al. 1999). Thereafter, their energy and protein requirements reach the highest level of the year during peak lactation in the first 3 weeks of June (White and Euick 1984, Parker et al. 1990). The females' appetites are high and forage intake rates can match lactation demands only where primary production is high (White et al. 1975, 1981). Small changes in nutritional content and digestibility of forage, however, can have substantial multiplier effects on digestible energy and protein intake (White 1983), and thus may influence nutritional performance of Porcupine Caribou herd females on the calving ground.

Recent advances in identifying the basis of selection of food by ungulates demonstrate that forage intake is a function of ungulate morphology, plant architecture, and biomass of acceptable forage (White et al. 1975, Trudell and White 1981, Spalinger et al. 1988, Shipley and Spalinger 1992, Gross et al. 1993, Langvatn and Hanley 1993, Wilmshurst and Fryxell 1995). Because ungulates select forage with high digestible energy and high digestible protein (Langvatn and Hanley 1993, Wilmshurst and Fryxell 1995), these properties are the relevant measure of forage value of habitats at any spatial scale (White et al. 1975, White and Trudell 1980a,b). Thus, the forage currency for ungulates is primarily a function of digestibility of acceptable foods and is not simply plant biomass or gross energy (Fryxell 1991).

The source of protein for fetal growth comes almost exclusively from body protein of female caribou entering winter (Gerhart et al. 1996). Females with high body protein in late winter produce the largest calves (Allayef-Chan 1991). Early weaning of calves occurs when habitat conditions do not support a protein intake sufficient to meet a minimal rate of body protein deposition; milk synthesis then ceases (Russell and White 1998). The protein:energy ratio of forage consumed during lactation increases the milk protein intake by calves (Chan-McLeod et al. 1994), the most important milk nutrient affecting calf growth rate at all calf ages (White 1992).

When forage biomass is low at calving, Porcupine caribou herd females might be expected to use microhabitats of highest biomass of acceptable foods and to select the most digestible forages from within them, as has been documented for caribou of the Central Arctic herd (White et al. 1975) and the Western Arctic herd (White and Trudell 1980). This change in the basis of selection, from forage biomass to forage digestibility,

constitutes scale-dependent selection (cf. Wiens 1989, O'Neil and King 1998). We pursued this issue of scale dependency in habitat selection by the Porcupine caribou herd at the larger scales of the annual calving grounds and concentrated calving areas.

Because the inability to meet lactation demands may lower the performance (i.e., weight-gain, survival) of calves, calving ground habitats may be important. They may be important because they can contribute substantially to the female and calf protein budgets during the calving season, when maternal protein reserves can be low (Gerhart et al. 1996, Chan-McLeod et al. 1999).

Habitat Trends During the Study Period

The climate of the Arctic has been warming in both summer and winter during recent decades (Chapman and Walsh 1993, Groisman et al. 1994, Houghton et al. 1995). Temperature increases have been greatest in winter. The warming has been heterogeneous across the Arctic (Chapman and Walsh 1993, Serreze 2000), but was evident in spring (Fig. 3.3a) and winter (Fig. 3.3f) temperatures within the northern part of the annual range of the Porcupine Caribou herd.

An earlier greening and later senescence of green plant biomass in areas north of 40°N (Myneni et al. 1997, 1998; Zhou et al. 2001) have been detected with NDVI and associated with the warming trend. The earlier greening was evident locally within the extent of calving (Fig. 3.2) of the Porcupine Caribou herd in the form of an increasing relative amount of green plant biomass on 21 June (NDVI_621, $r^2 = 0.50$, $P = 0.002$) during 1985-1999 (Fig. 3.4).

A very low value for NDVI_621 was observed in 1992, the year that stratospheric aerosols from the 1991 eruption of Mount Pinatubo in the Philippines reached the Arctic in spring (Minnis et al. 1993). Both 2001 and 2000 were substantial outliers (RS student = -2.49, -2.86, respectively) from the relationship between NDVI_621 and year, 1985-1999 (Fig. 3.4). Both 2001 and 2000 had exceptionally late springs with high snowcover at calving. We do not yet know if these outliers indicate a change in the trend observed during 1985-1999.

The Arctic Oscillation (Fig. 3.5) is centered over the high Arctic and is one of a number of correlated indices of large-scale atmospheric pressure differentials (e.g., North Atlantic Oscillation, Northern Hemispheric Annular Mode) (Thompson and Wallace 1998, 2001). The Arctic Oscillation is the height of the level of one-half atmosphere of pressure above the surface of the Earth and is weakly correlated with surface temperatures (Thompson and Wallace 1998). The Arctic Oscillation has a warm positive phase when surface pressures are low and warm North Atlantic water enters the Arctic Ocean,

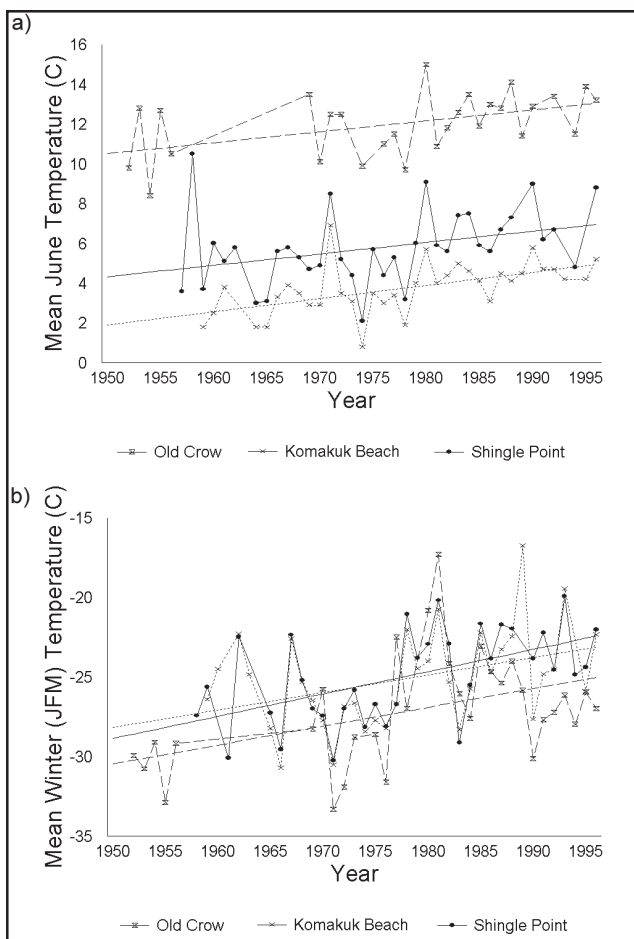


Figure 3.3. Mean temperatures for 2 stations within the Porcupine caribou herd's aggregate extent of calving (Komakuk Beach and Shingle Point, Yukon Territory, Canada) and 1 station within its winter range (Old Crow, Yukon Territory) for a) June, and b) winter (January, February, March), 1950-1995.

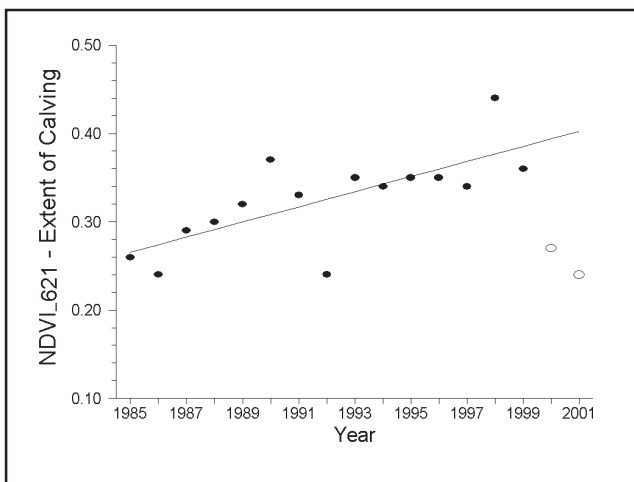


Figure 3.4. Median Normalized Difference Vegetation Index (NDVI) on June 21 within the aggregate extent of calving for the Porcupine caribou herd, 1983-2001. Values for 2000 and 2001 were outliers ($R_{Student} = -2.49, -2.86$, respectively) and excluded from the displayed regression line, $r^2 = 0.496, P = 0.002$.

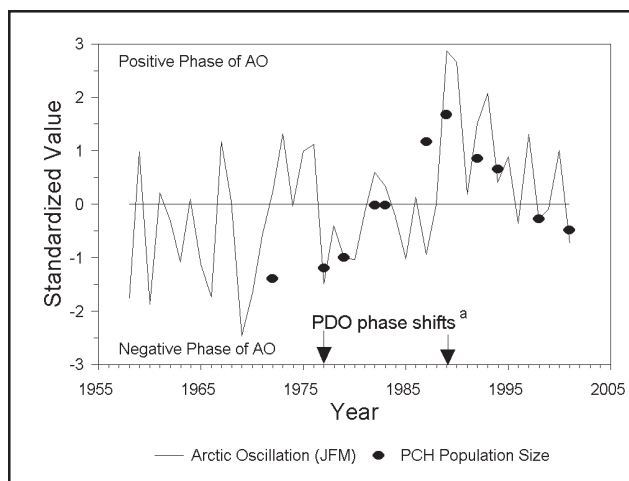


Figure 3.5. Standardized values of the Arctic Oscillation (AO) for winter (January, February, March) and population size of the Porcupine caribou herd, 1958-2001. Mean value indicated by solid horizontal line. ^a PDO is the Pacific Decadal Oscillation (Hare and Matuna, 2000).

and a cool negative phase when surface pressures are relatively high.

Initiation of increasing and decreasing trends in the Arctic Oscillation has been coincident with phase shifts in the Pacific Decadal Oscillation in 1977 and 1989 (Hare and Matuna, 2000) (Fig. 3.5). Correlations between the closely related North Atlantic Oscillation and a number of vegetative and ungulate population characteristics have been reported for Northern Europe (Post et al. 1997, Post and tensteth 1999).

Median annual NDVI at calving (NDVI_calving) within the extent of calving of the Porcupine caribou herd was positively correlated with the Arctic Oscillation from the winter (January, February, March) of the previous calendar year (~15 month lag, $F^2 = 0.32, P = 0.011$) (Fig. 3.6). This suggested that early forage availability for lactating females was influenced by weather patterns on a hemispheric scale.

Further, the suspected phase shift in the Arctic Oscillation at the end of the 1980s (Fig. 3.5) was coincident with an increase in the frequency of daily temperature excursions above freezing in both the spring (Fig. 3.7a) and fall (Fig. 3.7f) on the transitional ranges of the Porcupine caribou herd during the 1990s. There has been a decrease in the depth and extent of snowcover in Northwestern Canada near the wintering grounds of the Porcupine caribou herd during this latter period as well (Brown and Braaten 1998).

Thus, forage biomass during peak lactation demand (NDVI_621) increased during the period of study, 1985-1999 (Fig. 3.4), and this positive trend was coincident with summer warming on the calving ground (Fig. 3.3a). In addition, forage availability at calving (NDVI_calving) has been positively correlated with hemispheric-scale

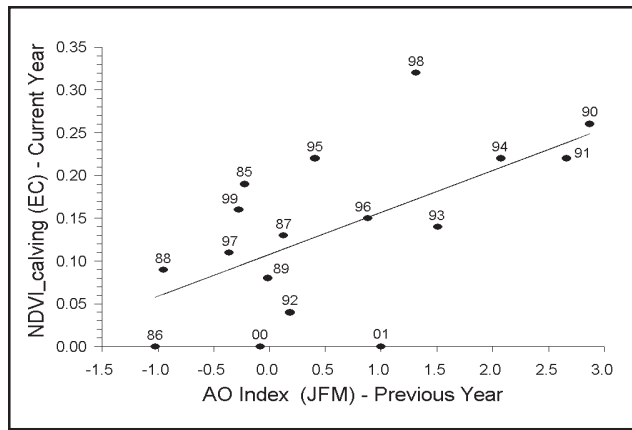


Figure 3.6. Median Normalized Difference Vegetation Index at calving (NDVI_calving) within the aggregate extent of calving (EC) of the Porcupine caribou herd for the current year, and winter Arctic Oscillation index (AO, January, February, March) for the previous calendar year, 1985-2001.

atmospheric conditions (Fig. 3.6). Counteracting the positive trend in forage abundance during peak lactation has been a tendency toward more freeze-thaw cycles on spring and fall transitional ranges of the Porcupine caribou herd (Fig. 3.7a,f) coincident with a suspected phase shift in the Arctic Oscillation.

These freeze-thaw cycles on transitional and winter ranges may have influenced snow properties, reduced access to forage, increased travel costs, and/or decreased the ability of caribou to escape their predators. These climate-influenced conditions on transitional/winter ranges may have contributed to the decline in size of the Porcupine caribou herd (Fig. 3.5) in spite of favorable conditions on the calving ground. Local and large-scale climate patterns as well as catastrophic events in the Southern Hemisphere (e.g., eruption of Mount Pinatubo) apparently have had major influences on Porcupine caribou herd habitats during the period of study and have set the stage for all observations of Porcupine caribou herd distribution and demographic processes during the past 2 decades.

Herd Dynamics and Demography

The growth curve of the Porcupine caribou herd suggested an approximate 30- to 40-year cycle of increase and decrease in abundance (Fig. 3.8). The herd numbered 100,000 in 1972, increased at about 4.9% per year from 1979 through 1989 when it reached 178,000 animals, then declined at about 3.6% per year from 1989 to 1998 (Fig. 3.8). The decline from 1998 to 2001 was only about 1.5% per year, and the herd now totals ~123,000 animals. If the current decline continues, the herd would be expected to again reach the lowest levels ever recorded during 2005-2010. If the herd continues to decline below ~100,000 animals, then the length of a complete herd cycle may exceed 30 years.

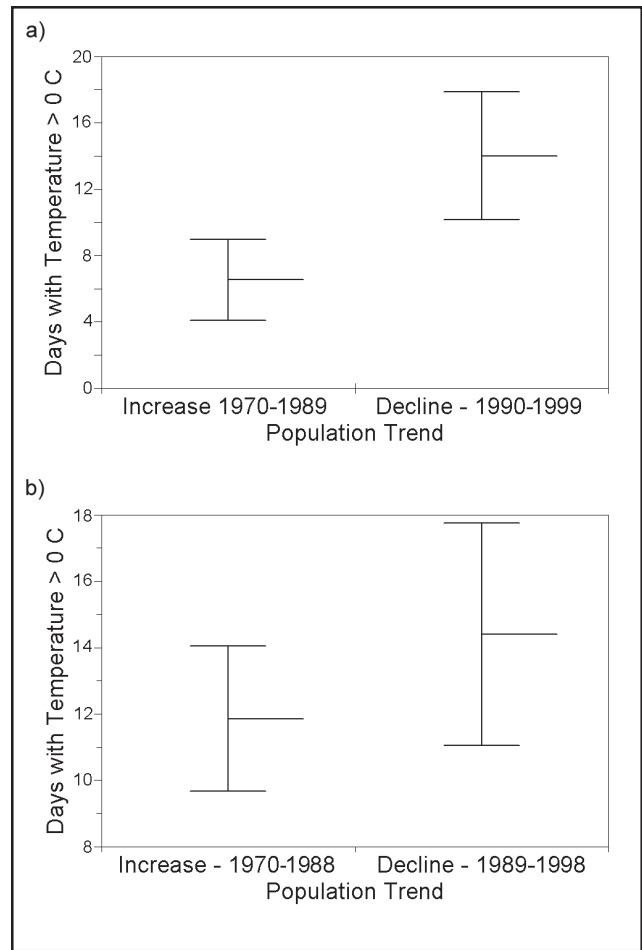


Figure 3.7. Frequency of days with daytime temperatures above freezing in a) spring (21 March - 30 April) and b) fall (21 September - 20 October) on transitional ranges of the Porcupine caribou herd during the herd increase phase, 1970-1988, and the herd decrease phase, 1989-1998. Brackets indicate 95% confidence intervals on mean values.

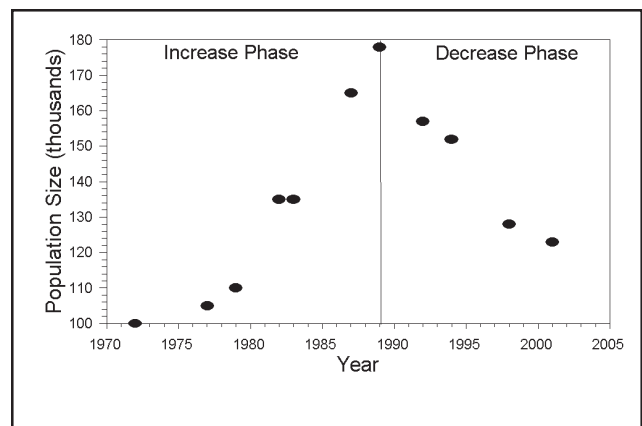


Figure 3.8. Population size of the Porcupine caribou herd, 1972-2001, estimated from aerial photo-censuses by the Alaska Department of Fish and Game.

Porcupine caribou herd size appeared correlated with Arctic Oscillation although there were too few data to conduct a proper time series analysis (Fig. 3.5). In contrast to the Porcupine caribou herd, other Alaska barren-ground caribou herds (Western Arctic, Teshekpuk Lake, Central Arctic), generally continued to increase during the downward trend in the Arctic Oscillation that was evident during the 1990s (Fig. 3.5).

Capacity for growth (defined as the maximum realized long-term growth rate) of the Porcupine caribou herd appeared substantially less than for other Alaska herds. Capacity for growth among herds of dramatically different sizes is best visualized by plotting relative herd sizes (Fig. 3.9). Maximum long-term growth rate (~4.9%, assumed linear, 1979-1989) (Fig. 3.8) of the Porcupine caribou herd was never more than about half the rate observed for other Alaska barren-ground caribou herds [Western Arctic herd (1976-1996, 9.5%), Teshekpuk Lake herd (1978-1993, 13%), Central Arctic herd (1978-1992, 10.3%)] (Fig. 3.9).

The Porcupine caribou herd was the first Alaska barren-ground caribou herd to begin and maintain a prolonged decline in the last 2 decades (Fig. 3.9). Annual survival of Porcupine caribou herd adult females was only about 84% (Fancy et al. 1994, Walsh et al. 1995), which was lower than that generally observed in other caribou herds (Bergerud 1980); and adult female survival may have been responsible for the relatively low growth rate of the Porcupine caribou herd.

Annual calf survival averaged about 48% with about half (56%) of the annual mortality occurring on the calving ground (Whitten et al. 1992, Fancy et al. 1994, Walsh et al. 1995).

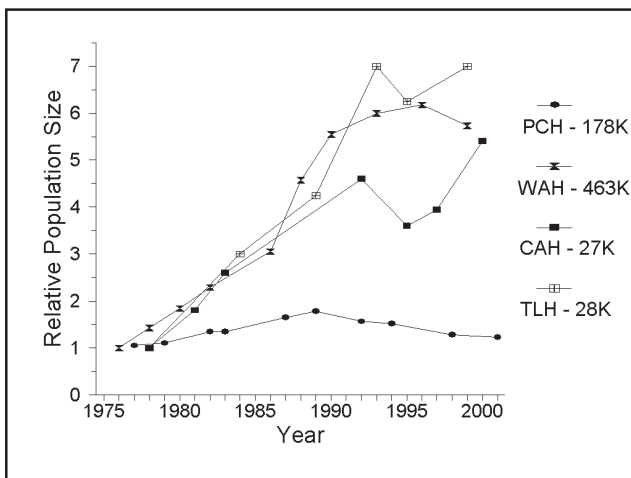


Figure 3.9. Relative post-calving herd sizes (minimum observed = 1.0) of the 4 Alaska barren-ground caribou herds (PCH = Porcupine caribou herd; WAH = Western Arctic herd; CAH = Central Arctic herd; TLH = Teshekpuk Lake herd), 1976-2001. Maximum observed population size for each herd is noted in the legend.

There were no significant differences in mean parturition, calf survival during June, or net calf production (defined as the product of parturition rate and June calf survival) (Fig. 3.10a-c) between the increase and decrease phases of the herd (Fig. 3.8). Parturition rate averaged 0.81 (range 0.71-0.92) during 1983-2001 (Fig.

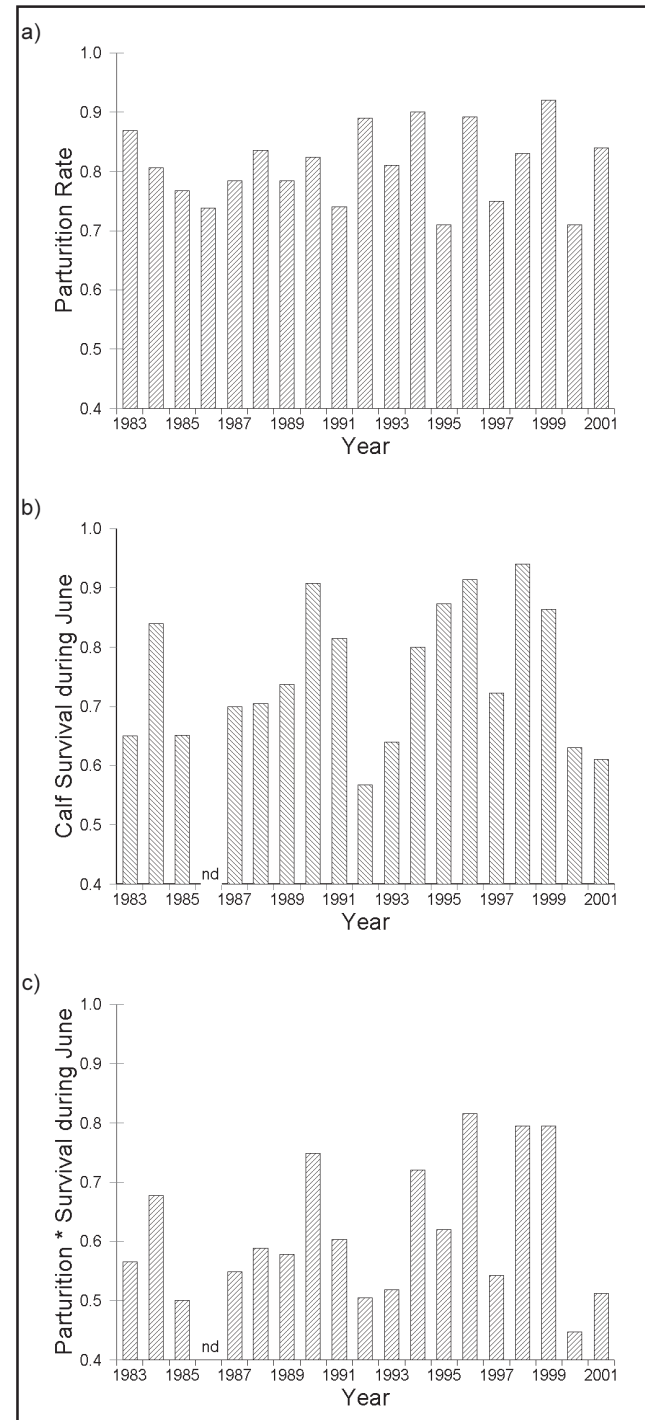


Figure 3.10. Reproductive estimates for the Porcupine caribou herd, 1983-2001: a) parturition rate of adult females, b) calf survival from birth through the last week of June, and c) net calf production [the product of parturition rate and calf survival].

3.10a) and did not differ between the increase phase (0.80, SE \pm 0.04, 1983-1989) and the decrease phase (0.82, SE \pm 0.08, 1990-2001).

Calf survival during June was quite high and averaged 0.75 (range 0.57-0.94) during 1983-2001 (Fig. 3.10f) but did not differ between the increase phase (0.71, SE \pm 0.07, 1983-1989) and the decrease phase (0.79, SE \pm 0.13, 1990-2001). Net calf production averaged 0.62f during 1983-2001 (range 0.50-0.82) (Fig. 3.10c) and did not differ between the increase phase (0.58, SE \pm 0.06, 1983-1989) and the decrease phase (0.63, SE \pm 0.13, 1990-2001). For all these demographic characteristics, variance tended to be greater during the decrease than during the increase phase of the herd.

Because average parturition, calf survival during June, and net calf production did not differ between the increase and decrease phases of the Porcupine Caribou herd, 1983-2001, a reduction in adult, sub-adult, and/or calf survival while animals were of the calving ground in late-summer through winter must have accompanied the herd decline. Emigration to the adjacent Central Arctic herd was an unlikely cause of the Porcupine Caribou herd decline because satellite-collared animals that occasionally (4 out of 167 collar-years) wintered with the Central Arctic herd, returned to the Porcupine Caribou herd the following summer.

Periodic lows in net calf production and calf survival during June (1992, 1993, 1997; Figs. 3.10b, c) were not sufficient to maintain the herd decline (S. A. Arthur, Alaska Department of Fish and Game, personal communication). Unfortunately, a complete record of adult, sub-adult, and calf survival estimates was not available for late-summer through winter during the decrease phase of the herd, 1989-2001.

Seasonal Distribution and Movements

The Porcupine Caribou herd Caribou wintered (15f November \pm 14 April) in Alaska south of the Brooks Range and in Canada in the Richardson and Ogilvie Mountains in the Yukon Territory (Fig. 3.11). Their annual range encompassed \sim 290,000 km² (Fig. 3.2). The extent of calving encompassed \sim 36,000 km². Spring migration to the annual calving grounds began in mid-April and continued through April and May (Fig. 3.11). Return to fall/winter ranges began with departure from the annual calving grounds in late-June and early-July (Fig. 3.11). In fall (15 September – 14 November), the Porcupine Caribou herd was distributed widely.

Minimum daily travel rates of parturient females were variable throughout the year (Fig. 3.12). Non-parturient females had similar movement rates. Minimum movement occurred during winter. Movement began increasing in mid-April with initiation of migration to the annual

calving ground and was directional toward the annual calving ground.

After their calves were born, the direction of movement of satellite-collared parturient females was random for 20 days (Fancy and Whitten 1991). Calf movement rate (minimum, straight line, estimated from conventional radio-collars) in the years 1992-1994 was about 2.5 km/day during the first week after birth. The rate increased gradually during the next week to about 5f km/day and then increased through the end of June to approximately 15-20 km/day. As females and calves departed the calving ground in late June and early July, some individual calves traveled as much as 90 km/day. Relatively high rate of movement continued throughout July. Because movement rates were low during the calving season and direction of movement was random for 20 days after birth (Fancy and Whitten 1991), the distribution of calving sites was assumed to be representative of habitat use by Caribou through 21 June.

Movement declined during August perhaps in response to harassment by Oestrid flies or to localized forage abundance. Movement increased during the pre-rut period in late-September and October and then reached a minimum again by mid-November. The average female of the Porcupine Caribou herd traveled approximately 4,355f km annually (Fancy et al. 1989).

During 1985-1992, median arrival of satellite-collared parturient females on the annual calving ground ranged from 17 May-4 June and median date of departure ranged from 3-26 July. Non-parturient females tended to lag slightly behind and south of the parturient females from early-May through calving (Whitten et al. 1992), but within 1 week after calving, parturient and non-parturient female distributions were essentially coincident.

Length of stay on the annual calving ground ranged from 34-67 days. Caribou have tended to depart the annual calving grounds earlier since 1995 (F. J. Mauer, U.S. Fish and Wildlife Service, personal communication). This trend may have been related to more advanced plant phenology within the extent of calving in late June during the late 1990s (Fig. 3.4).

Median calving date, 1983-1996, was 1 June (range 30f May-6 June) with 50% of annual calving occurring within 2 days of the annual median calving date. No temporal trends were evident in median calving date, and annual calf survival was not related to median calving date (P \geq 0.05).

Sizes and locations of annual calving distributions were quite variable. Annual calving grounds encompassed 3,672-16,667 km² during 1983-2001 (Fig. 3.13, Table 3.1). Similar distributions were observed during aerial surveys, 1972-1982 (Figs. II-5 in Clough et al. 1987). On average, concentrated calving areas occupied 12.3%f (range 0.7-25%) of the annual calving grounds (255-f

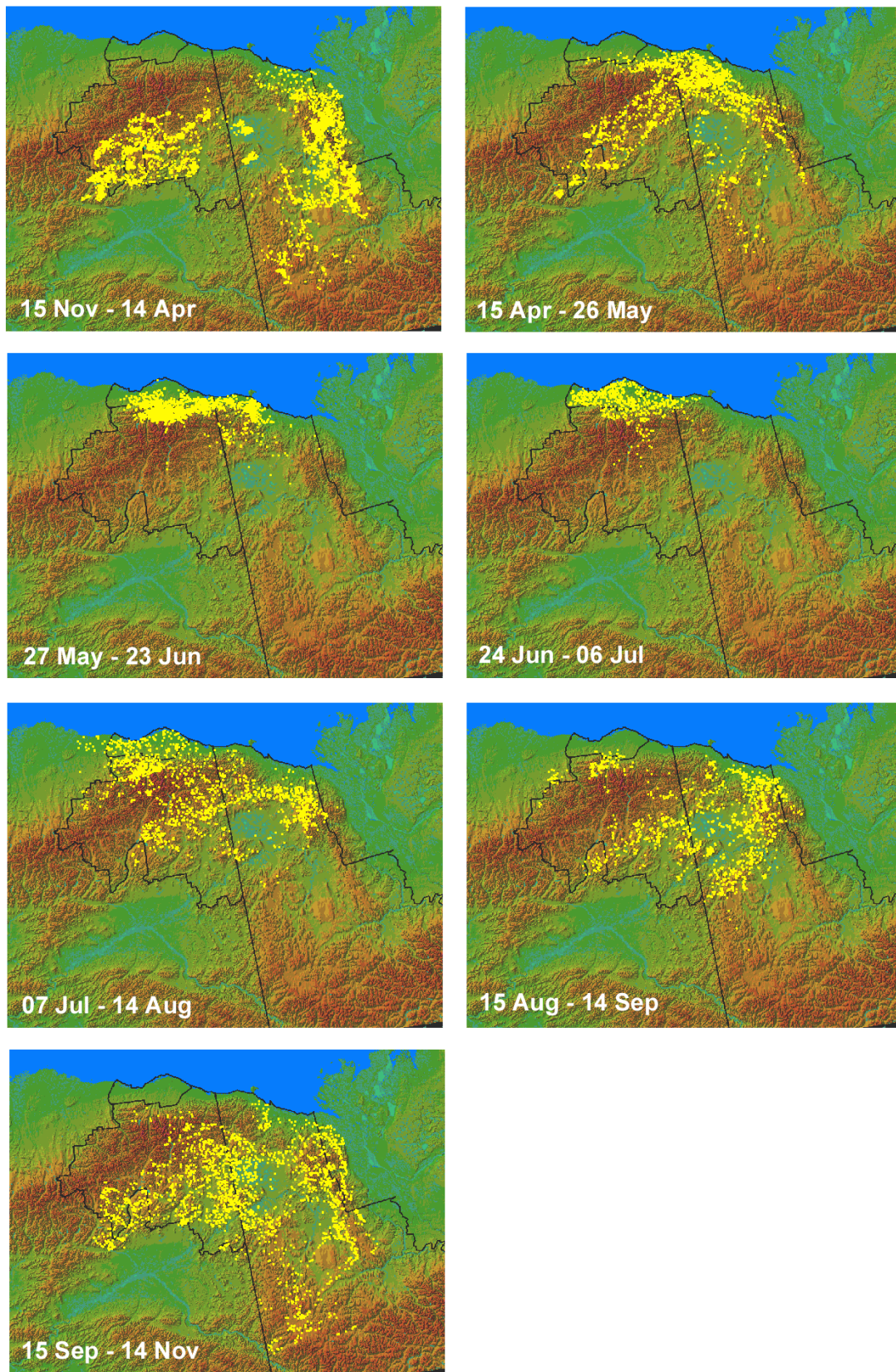


Figure 3.1 Distribution of satellite-collared female caribou of the Porcupine caribou herd during 7 time periods, 1985-1995. An average of 10 animals (range 4-17) were collared each year yielding 14,447 observations; 87% of these observations were obtained 1985-1990. Not included were the locations of 3 females that each spent one winter with the adjacent Central Arctic herd.

2,548 km²) and contained 47% (range 29-61%) of calving locations.

There was no concentrated calving area in 2001 when the spring was very late and the extent of calving was almost completely snow covered. Density of parturient females in the concentrated calving area ranged approximately 13-106/km² over the years and averaged 7.7 times (range 3.7-10.8) higher than outside the concentrated calving area each year (Table 3.1). None of these estimates differed between the increase and decrease phases of the herd ($P > 0.05$). Since 1972, there have been only 2 years (2000, 2001) when all calving occurred in Canada and 1 additional year (1982) when all concentrated calving occurred in Canada.

Neither the areas of annual calving grounds nor areas of concentrated calving areas were correlated ($P > 0.05$) with the number of calving sites, with the estimated number of parturient females in the herd, with the percent of the extent of calving that was snow free, or with any greenness (NDVI) estimate in either the extent of calving or the annual calving grounds. Thus, neither herd size nor habitat characteristics were clearly related to calving ground size. Factors affecting calving ground size remain unclear.

Distribution of calving sites differed (MRPP, $P < 0.05$) among all successive years, 1983-2001, except 1983-1984 when the number of calving sites obtained from radio-collared females was lowest and 2000-2001 when late springs restricted calving to Canada (Table 3.1). There was no uni-directional trend to shifts in location of annual calving grounds for concentrated calving areas (Rayleigh's Test, $P = 0.870$ and 0.740 , respectively). During 1983-1994, parturient females displayed no among-year fidelity to the concentrated calving area ($P = 0.951$) nor any habitat attribute for calving ($P > 0.135$), but females that calved in the 1002 Area returned there for calving in the following year more often than expected ($P = 0.024$).

The percent of females calving in the 1002 Area in the years 1983-2001 was quite variable, averaging 43% (range 0-92%) but not differing ($P = 0.128$) between the decrease (50%, SE \pm 3%) and the increase phase (30%, SE \pm 23%) of the herd (Fig. 3.14). The proportion of the concentrated calving area that was in the 1002 Area followed a similar trend. As the relative amount of green biomass at calving within the extent of calving (NDVI_calving) increased because of earlier springs, the percent of females calving in the 1002 Area increased ($r^2 = 0.68$, $P < 0.001$) (Fig. 3.15). Thus, the average proportion of Porcupine caribou herd females that calve in the 1002 Area may increase if the climate continues to warm.

The general location of calving in the years 1983-2001 was related to the winter Arctic Oscillation (January, February, March) during previous calendar year, approximately 15 months before calving. In years when

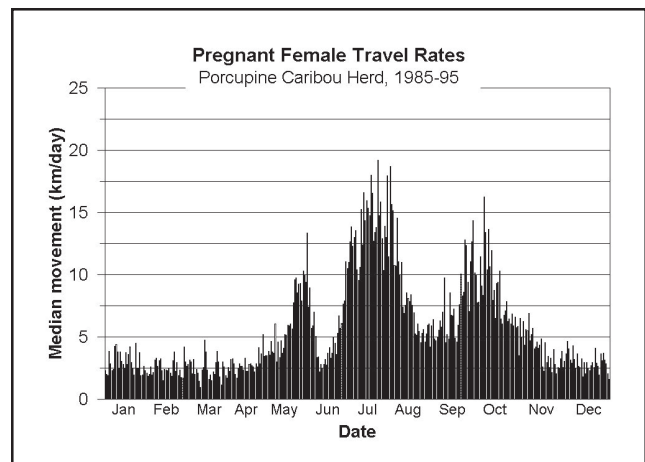


Figure 3.12. Minimum median daily movement rate of parturient satellite-collared females of the Porcupine caribou herd, 1985-1995. Values calculated from no more than one location per day. An average of 10 animals (range 4-17) were collared each year yielding 14,447 observations; 87% of these observations were obtained 1985-1990. Not included are the data for 3 females that each spent one winter with the adjacent Central Arctic herd.

the Arctic Oscillation was positive, more than half of the concentrated calving area was likely to be located on the Alaska portion of the coastal plain (83.3% of the years, Fisher's Exact Test, $P = 0.045$). Similarly, there was a tendency (66.7% of years, Fisher's Exact Test, $P = 0.057$) or more than half the females to calve in the 1002 Area when the Arctic Oscillation in the previous calendar winter was positive.

The time delay in correlation between the Arctic Oscillation and calving location and between the Arctic Oscillation and NDVI_calving (Fig. 3.6) may have been related to a 1-year delay between tiller formation and flower production for *Eriophorum vaginatum* (cottongrass) (Billings and Mooney 1968, Bliss 1971). Immature cottongrass flowers have been a dominant food item for Porcupine caribou herd when they have calved on the Arctic Refuge coastal plain. Cottongrass tiller formation is probably related to the availability of resources (moisture and soil nutrients).

Positive phases of the Arctic Oscillation may have enhanced resource availability, increased tiller production in the previous year, and resulted in increased flower production during the current spring. We would expect that the increased greenness at calving (NDVI_calving) might reflect leaf area of cottongrass tillers, rather than the pale green immature flowers.

During post-calving (>3 weeks after calf birth), Porcupine herd caribou (regardless of calving location) tended to move westward (Fig. 3.11). Even in exceptional years when calving occurred far to the east in Canada (e.g., 2000, 2001) (Fig. 3.13) caribou reached the Arctic Refuge coastal plain and portions of the 1002 Area by late-June or July (S. A. Arthur, Alaska Department of Fish

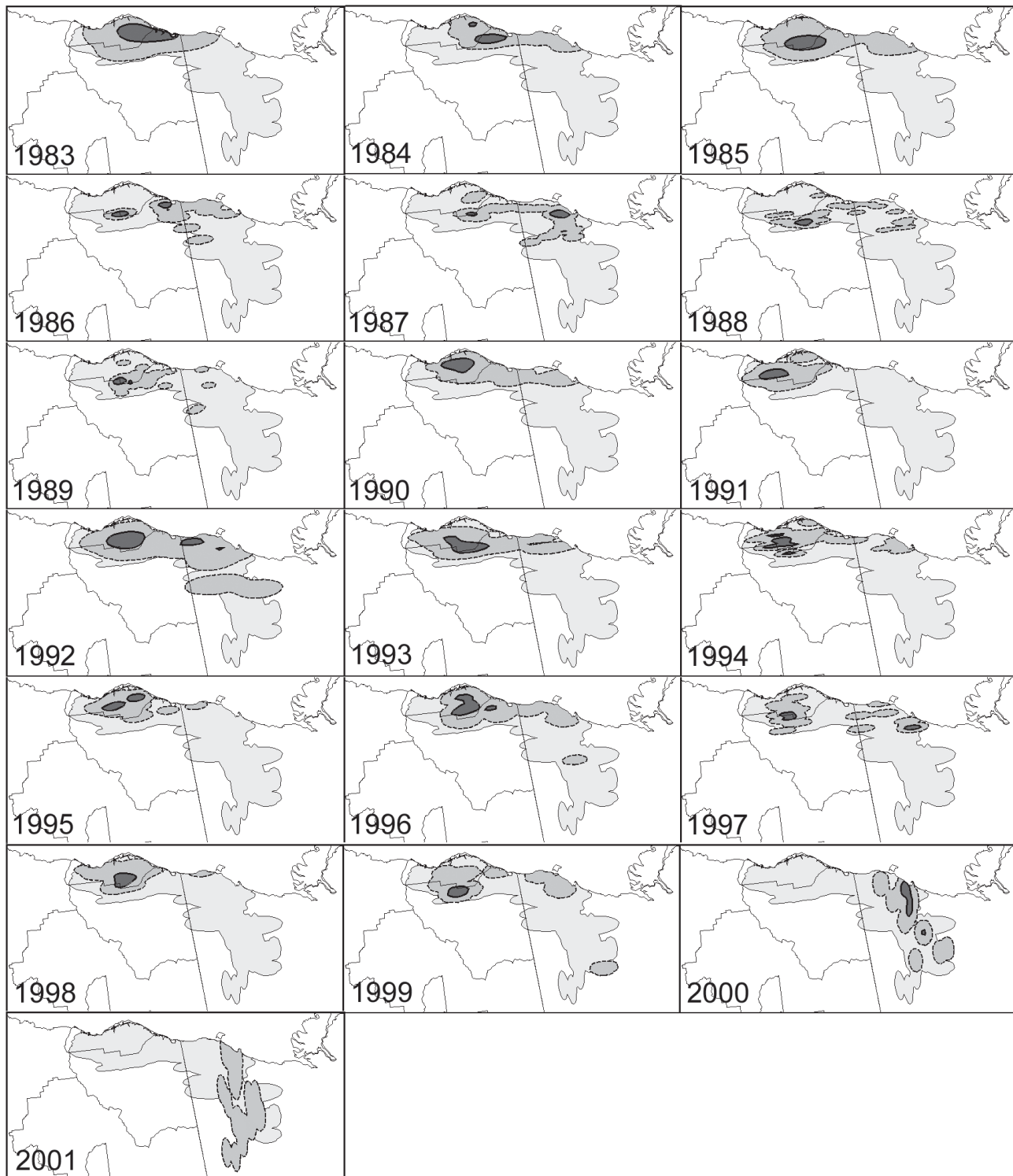


Figure 3.13. Calving distributions of the Porcupine caribou herd, 1983-2001, as estimated from fixed kernel analyses of the sites where radio-collared females were first observed with calves during repeated aerial surveys in May and June. There are 3 zones: 1) concentrated calving area (shown in dark gray), the contour enclosing calving sites with greater than average fixed kernel density, 2) annual calving ground (medium gray), the 99% fixed kernel utilization distribution for a year, and 3) aggregate extent of calving (light gray), the outer perimeter of all annual calving grounds. No concentrated calving was detected in 2001.

Table 3.1. Number of calving sites, number of calving sites in the concentrated calving area (CCA), area (km²) of CCA, area (km²) of annual calving ground (ACG), ratio of sizes of CCA to ACG, population size of the Porcupine caribou herd, percent of radio-collared female caribou that calved in the CCA, percent of radio-collared female caribou that calved in the 1002 Area, percent of the CCA within the 1002 Area, and percent of the ACG within the 1002 Area, 1983-2001, Alaska, USA, and Yukon Territory, Canada.

Year	Calving Sites	Sites in CCA	CCA Area	ACG Area	Ratio CCA/ACG	Population Size (K)	%females In CCA	%females In 1002	%CCA In 1002	%ACG In 1002
1983	18	11	2,584	10,064	0.25	135	55.6	61.1	62.4	42.8
1984	18	11	839	6,599	0.13		61.1	33.3	19.8	39.2
1985	34	16	1,585	10,784	0.15		47.1	55.9	69.2	36.8
1986	20	8	419	5,432	0.08		40.0	10.0	28.8	8.4
1987	36	15	479	6,048	0.08	165	44.4	13.9	14.2	15.7
1988	61	24	267	3,823	0.07		39.3	1.6	0.0	5.9
1989	51	15	255	3,672	0.07	178	29.4	33.3	59.3	30.1
1990	53	22	1,167	8,379	0.14		39.6	69.8	100.0	47.2
1991	43	21	731	5,767	0.13		48.8	88.4	92.5	68.6
1992	43	18	2,174	16,667	0.13	157	41.9	41.9	79.1	22.5
1993	35	18	1,401	9,098	0.15		51.4	57.1	70.2	40.3
1994	79	33	814	6,602	0.12	152	41.8	64.6	77.3	54.8
1995	60	31	827	5,141	0.16		51.7	91.7	100.0	71.2
1996	65	30	1,354	9,453	0.14		46.2	53.8	90.6	33.9
1997	29	15	530	5,661	0.09		51.7	31.0	33.7	31.8
1998	39	20	789	6,316	0.12	128	51.3	84.6	93.4	73.1
1999	20	9	601	7,820	0.08		45.0	20.0	9.3	30.4
2000	22	13	791	6,541	0.12		59.1	0.0	0.0	0.0
2001	41	a		10,602		123		0.0		0.0
average	40	18	976	7,604	0.12	148	47.0	42.7	55.5	34.3
minimum	18	8	255	3,672	0.07	123	29.4	0.0	0.0	0.0
maximum	79	33	2,548	16,667	0.25	178	61.1	91.7	100.0	73.1
SE	18	7	630	3,060	0.04	20	7.8	30.1	35.9	22.5

a No concentrated calving was detected in 2001

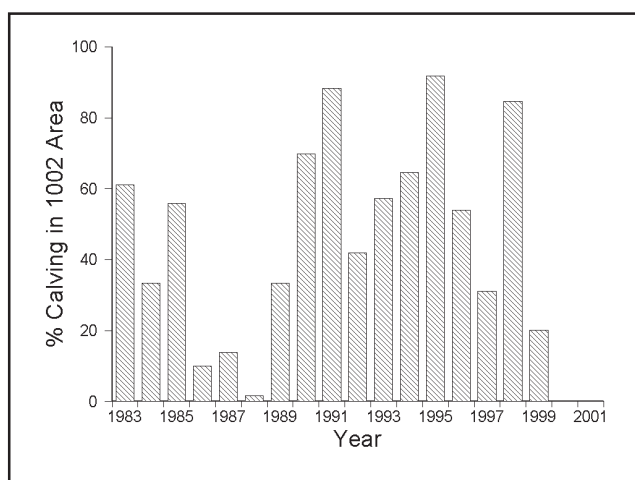


Figure 3.14. Percent of radio-collared Porcupine caribou herd females that calved in the 1002 Area of the Arctic National Wildlife Refuge, Alaska, 1983-2001.

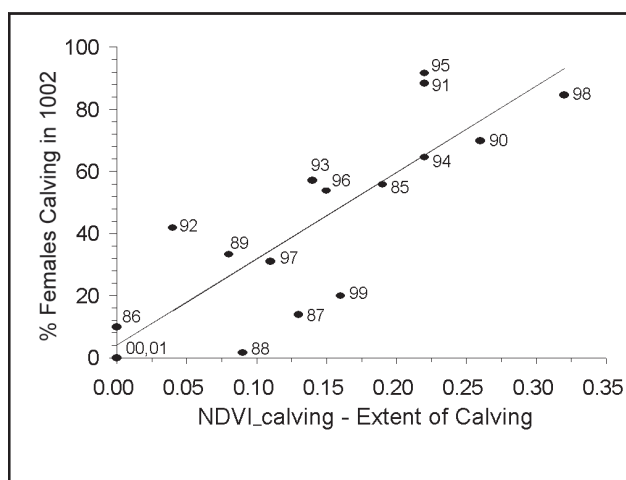


Figure 3.15. Percent of radio-collared Porcupine caribou herd females that calved within the 1002 Area of the Arctic National Wildlife Refuge, Alaska, in relation to the median Normalized Difference Vegetation Index at calving (NDVI_calving) within the aggregate extent of calving, 1985-2001. Point legends indicate the year of the estimates.

and Game, personal communication). As a result of these westward movements, essentially the entire 1002 Area was eventually used by late June or early July. Most of the time of the westernmost portion of the 1002 Area by satellite-collared females of the Porcupine Caribou herd occurred during 24 June-14 August (Fig. 3.11).

Foraging on the Calving Ground

The calving season diet of Porcupine herd caribou during 1993-1994, when concentrated calving was primarily in the 1002 Area (Fig. 3.13), was dominated (76-82%) by immature flowers of cottongrass from the time the caribou arrived on the calving ground until about 16-18 June (Figs. 3.16a, 3.17a). Similar diets were observed in 1973 (Thompson and McCourt 1981), but the location of concentrated calving in that year was not documented (Clough et al. 1987).

Diet was relatively consistent between years, but somewhat more variable in 1994, and not related to average daily weight-gain of calves in 1993 and 1994. Both cottongrass flowers and young willow (*Salix* spp.) leaves are easily digestible and are common forage of upland calving caribou when they are available (e.g.,

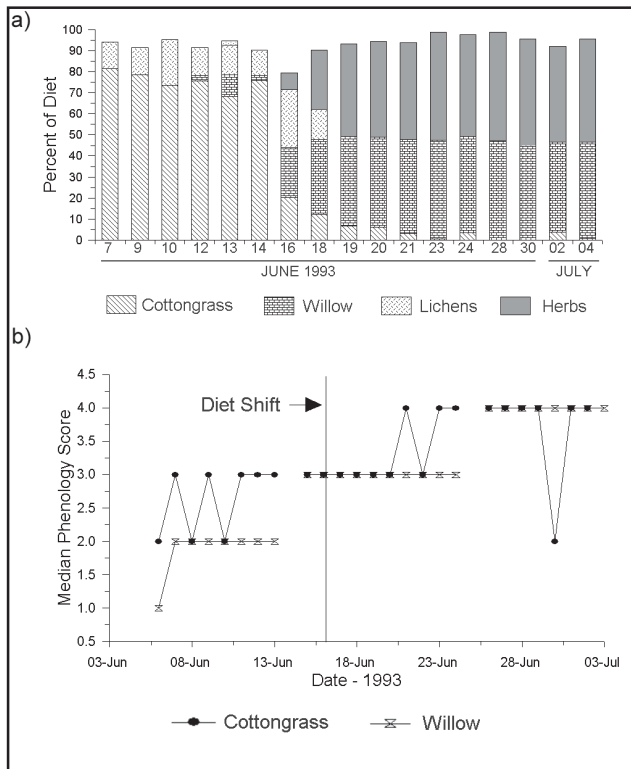


Figure 3.16. Porcupine caribou herd a) diet composition and b) median phenology of major forage items, 1993. Diet composition estimated from microhistological analysis of fecal pellets, corrected for digestibility. Phenology scores for cottongrass: 1 = leaves only, 2 = flowers in boot, 3 = early flower, 4 = full flower; and for willow: 1 = dormant, 2 = bud swelling, 3 = leaf unfolding, 4 = full leaf.

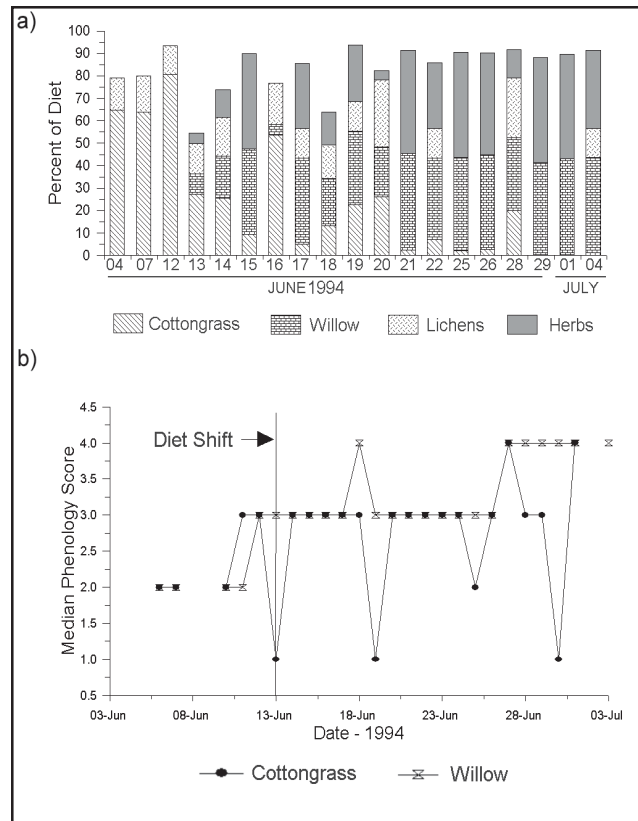


Figure 3.17. Porcupine caribou herd a) diet composition and b) median phenology of major forage items, 1994. Diet composition estimated from microhistological analysis of fecal pellets, corrected for digestibility. Phenology scores for cottongrass: 1 = leaves only, 2 = flowers in boot, 3 = early flower, 4 = full flower; and for willow: 1 = dormant, 2 = bud swelling, 3 = leaf unfolding, 4 = full leaf.

Thompson and McCourt 1981, Kuropat 1984, Russell et al. 1993). Cottongrass flowers were most common in the vegetation type herbaceous tussock tundra, and willow was most common in shrub tussock tundra and riparian shrub vegetation types (Jorgensen et al. 1994). Herbaceous plants were ubiquitous.

Dietary shifts within the 1993 and 1994 calving seasons apparently allowed caribou to increase nutrient concentration in their diet as the season progressed. By mid-June, 1993-1994, as cottongrass flowers matured, the leaves of willows unfolded (Figs. 3.16f, 3.17f). Then, within about 4 days (Figs. 3.16a, 3.17a), caribou diet shifted to an approximate 50:50 mix of willow and herbaceous plants.

The diet shift resulted in an increase of dietary nitrogen concentration (from 3% to 4%) and a decrease in Neutral Detergent Fiber (NDF) concentration (from 57% to 47%) based on nutritional analyses of cottongrass and willow of appropriate phenological stages from the calving ground. Available biomass of willow likely exceeded the biomass of cottongrass flowers during the diet shift and thereafter.

Caribou maintained the willow and herbaceous diet until they departed the calving ground near the end of June. Because climate warming and earlier greening may increase the carbon:nitrogen ratios of individual forage species and reduce their quality on fixed dates (Walsh et al. 1997), rapid shifting among forage species may allow caribou to accommodate time-specific reduction in nutritional quality of individual plant species that accompanies climate warming.

Diet of Porcupine herd caribou was substantially different when they used the Canadian portion of the extent of calving than when they used the Arctic Refuge coastal plain and the 1002 Area. Regardless of timing of snowmelt in Canada, calving diet there was dominated by mosses and evergreen shrubs (58.4-73.5%, Russell et al. 1993). These forage groups were much less digestible than the immature cottongrass flowers and willows (Russell et al. 1993) that dominated the calving diet of the Porcupine caribou herd in 1993 and 1994. This implied that diet quality during calving was reduced when the Porcupine caribou herd used the Canadian portion of the extent of calving rather than the Arctic Refuge coastal plain and the 1002 Area.

Habitat Selection

Habitat selection may be assessed at several orders (Johnson 1980); selection at each order implies disproportionate use of some component(s) of the habitats that are available. For migratory barren-ground caribou, selection orders might be defined as follows from highest to lowest order:

- First Order – the species distribution on earth.
- Second Order – area use by herds within the species range.
- Third Order – annual range use within herd ranges.
- Fourth Order – seasonal range use within annual ranges of herds.
- Fifth Order – annual use within the aggregate extent of all seasonal ranges.
- Sixth Order – annual concentrated use within an annual seasonal range.
- Seventh Order – patch use within a concentrated use area.
- Eighth Order – plant species use within habitat patches.
- Ninth Order – plant part use within plant species.

Higher order selection may constrain the choices at lower orders (Johnson 1980). The basis of selection may or may not be consistent among orders and, when the basis of selection changes among orders, habitat selection is considered to be scale-dependent (O'Neil and King 1998). In this work, we assessed habitat selection at fifth and sixth orders as defined above. Much discussion has focused on fourth order selection (cf. Bergerud and Pagef

1987; Fryxell 1991, 1995), but analysis of selection at the fourth order for the Porcupine caribou herd was beyond the scope of this report.

For the purposes of the material that follows, we define *fifth order selection* as the comparison of use within the annual calving grounds (ACG) to availability in the extent of calving (EC), written as ACG/EC (hereafter called *calving ground selection*). We define *sixth order selection* as the comparison of use within annual concentrated calving areas (CCA) to habitat availability within the annual calving grounds (CCA/ACG, hereafter called *concentrated calving selection*).

Because there was spatial dependency among habitats (vegetation, NDVI estimates, snowcover; all inventoried from the same 1-km² pixels) we present the results for each habitat attribute separately. Selection was assessed by comparing mean use/availability ratios among years with the null use/availability ratio of 1.0.

Habitat conditions within the extent of calving have been variable during 1985-2001. There was substantial snowcover throughout the extent of calving in 1986, 2000, and 2001, but greening was early in 1990, 1994, 1995, and 1998 (Fig. 3.18).

There was scale dependency in habitat selection by the Porcupine caribou herd during calving. Parturient females selected annual calving grounds with proportionately greater area of high (>median) rate of greening (NDVI_rate, 1.33x, $P < 0.005$) (Fig. 3.19a) and proportionately less area with high forage biomass both at calving (NDVI_calving, 0.60x, $P < 0.001$) (Fig. 3.19f) and during peak lactation (NDVI_621, 0.70x, $P < 0.002$) (Fig. 3.19c) than available in the extent of calving.

Parturient females also selected annual calving grounds with proportionately more area in the 26-50% (1.76x, $P < 0.001$) and 51-75% (1.71x, $P < 0.008$) snowcover classes and proportionately less area in the 0-25% (0.84x, $P < 0.008$) snowcover class than available in the extent of calving (Fig. 3.20).

Analysis of vegetation types in annual calving grounds showed that parturient females selected wet sedge (1.42x, $P < 0.004$), herbaceous tussock tundra (1.42x, $P < 0.001$), and riparian (1.37x, $P < 0.001$) vegetation types, avoided the alpine vegetation type (0.60x, $P < 0.001$), and did not respond ($P > 0.05$) to the shrub tussock tundra or moist sedge vegetation types (Fig. 3.21).

In contrast, at the next lower selection order (sixth), parturient females of the Porcupine caribou herd selected concentrated calving areas with proportionately greater area of high forage biomass both at calving (NDVI_calving, 2.35x, $P < 0.001$) (Fig. 3.19f) and during peak lactation demand (NDVI_621, 2.59x, $P < 0.001$) (Fig. 3.19c) than available in the annual calving grounds. The females were non-selective ($P > 0.05$) for rate of greening (NDVI_rate) (Fig. 3.19a) and all snowcover classes (Fig. 3.20), selected herbaceous tussock tundra

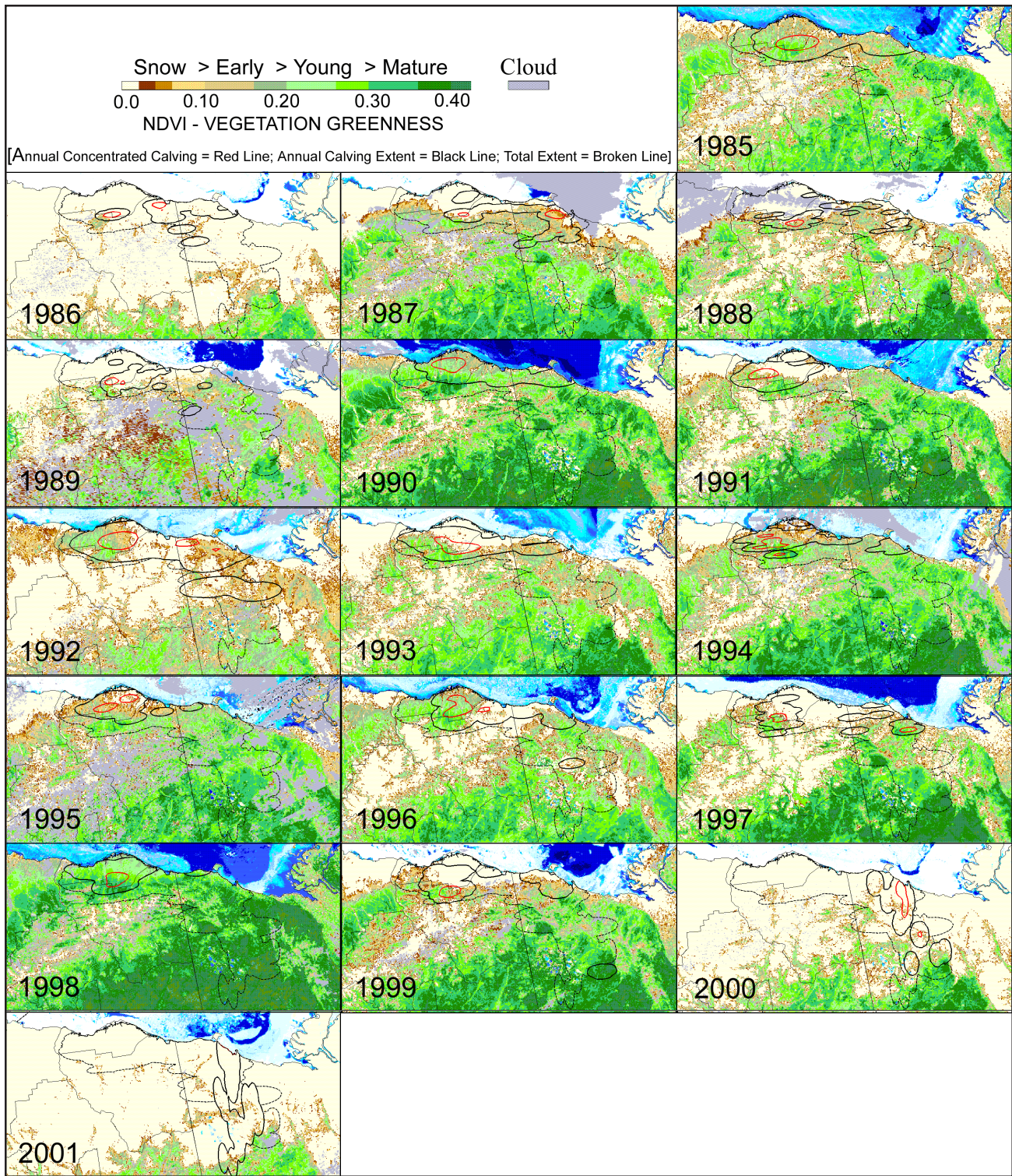


Figure 3.18. Annual conditions of snowcover and vegetation phenology derived from Advanced Very High Resolution Radiometer (AVHRR) satellite imagery during the calving period (30 May - 5 June), 1985-2001, for the Porcupine caribou herd. No concentrated calving was detected in 2001.

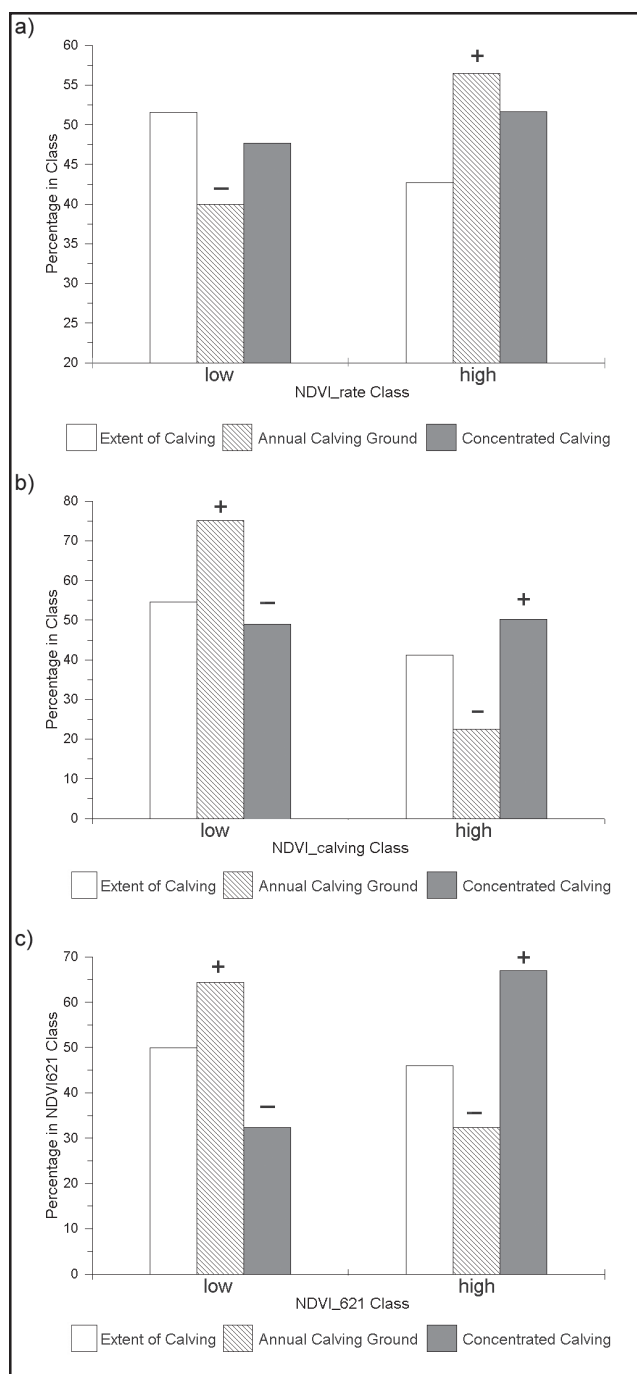


Figure 3.19. Azrage percent of area in low (\leq median) or high ($>$ median) classes of a) daily rate of increase in the Normalized Difference Vegetation Index (NDVI_rate) b) NDVI at calving (NDVI_calving), and c) NDVI on 21 June (NDVI_621) for the aggregate extent of calving, annual calving grounds, and concentrated calving areas of the Porcupine caribou herd, Alaska, 1985-2001. Statistically significant selection or avoidance ($P < 0.05$, overall experiment) in comparison with the category to the left is indicated by "+" or "-" above the bars. For example, female caribou on the annual calving ground avoided low NDVI_rate and selected high NDVI_rate in comparison with availability in the aggregate extent of calving. No significant selection of NDVI_rate for the concentrated calving area when compared with the annual calving ground was detected.

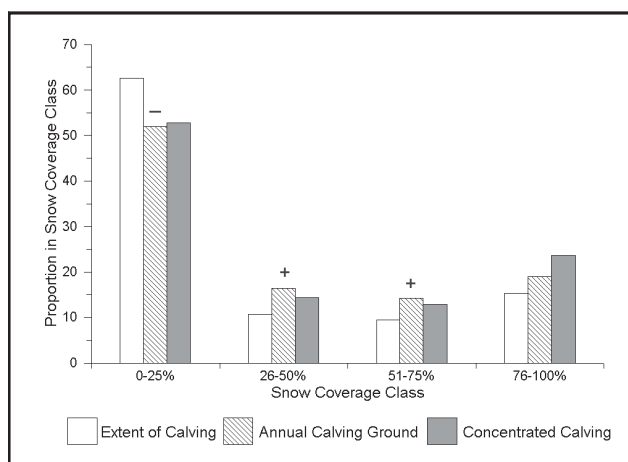


Figure 3.20. Azrage percent of area in 4 exclusive snowcover classes for the aggregate extent of calving, annual calving grounds, and concentrated calving areas of the Porcupine caribou herd, 1985-2001. Statistically significant selection or avoidance ($P < 0.05$, overall experiment) in comparison with the category to the left is indicated by "+" or "-" above the bars. For example, female caribou on the annual calving ground avoided areas of 0-25% snowcover and selected areas of 26-50% and 51-75% snowcover when compared with availability in the aggregate extent of calving. No significant selection of any snowcover class was detected for the concentrated calving area when compared with availability in the annual calving ground.

(1.68x, $P = 0.001$), avoided alpine vegetation (0.34x, $P = 0.001$), and were non-responsive ($P > 0.18$) to their remaining vegetation types (Fig. 3.21).

Although selection of vegetation types was scale-independent, there was scale dependency in the selection of forage quantity (NDVI_calving, NDVI_621) and quality (NDVI_rate). Parturient Porcupine caribou herd females selected annual calving grounds with a high proportion of easily digestible forage (NDVI_rate), then selected concentrated calving areas with relatively high plant biomass at calving (NDVI_calving) and on 21 June (NDVI_621).

The basis of habitat selection shifted from forage quality to forage quantity between the fifth (ACG/EC) and sixth (CCA/ACG) orders. The work of White et al. (1975) and White and Trudell (1980) at the levels of microhabitats (~seventh order, selection for biomass) and plant species within microhabitats (~eighth order, selection for digestibility) suggests that the basis of selection continues to be dynamic across successively smaller scales.

Forage quality appears to be the basis of selection at both relatively large (fifth order) and relatively small (eighth order) scales. Forage quantity appears to be the basis of selection at intermediate scales of analysis within this range. Specification of the scale of analysis is critical to developing an understanding of the basis of forage selection by ungulates, and Porcupine herd caribou demonstrated a variable functional response to forage (NDVI estimates) within the extent of calving.

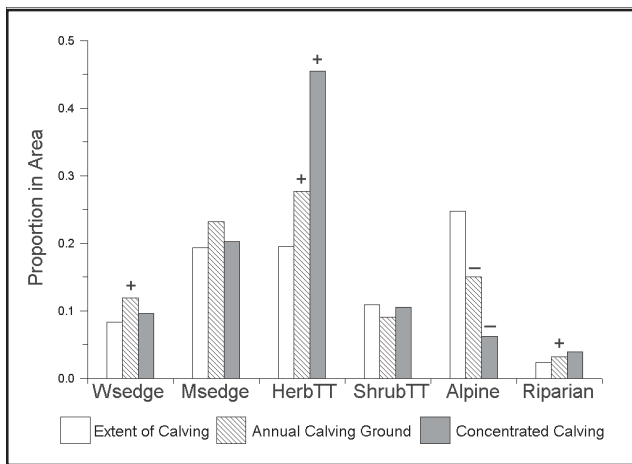


Figure 3.21. Azrage percent of area in 6 vetetation types for thez aggregate extent of calving, annual calving grounds, and concentratedz calving areas of the Porcupine caribou herd, 1985-2001. Vzgetationz types: Wsedge = wet sedge; Msedge = moist sedge; HerbTT =z herbaceous tussock tundra; ShrubTT = shrub tussock tundra, Alpine,z and Riparian. Statistically significant selection or avoidance ($P < 0.05$,z overall experiment) in comparison with the category to the left isz indicated by "+" or "-" above the bars. For exzample, the female caribouz on the annual calving ground avoided the Alpine vegetation type andz selected the HerbTT vegetation type when compared with availabilityz in the aggregate extent of calving, and on the concentrated calvingz area the caribou showed similar selection when compared withz availability in the annual calving ground.z

There were no clear differences in patterns of selection of any types of habitats between the increase and decrease phases of the herd. This observation is tempered by the fact that habitat selection was assessed for only the last 5 years (1985-1989) of the increase phase, but has been assessed for all 12 years of the current decline (1990-2001).

The shifting location of annual calving grounds within the extent of calving was apparently a functional response to annually variable landscape patterns in the quantity of easily digestible forage (NDVI_{rate}). The location of concentrated calving areas within annual calving grounds was an apparent functional response to forage biomass (NDVI_{calving}, NDVI₆₂₁).

This functional response to habitats allowed Porcupine caribou herd females to attain substantial intakes of nitrogen (Fig. 3.22) based on estimated diet composition (Figs. 3.16a, 3.17a), estimated nitrogen content of consumed forages, and consumption rates presented by White et al (1975), White and Trudell (1980a,b), and Trudell and White (1981). Thus, the Porcupine caribou herd calving ground was clearly important to the annual nitrogen budget of lactating females and was likely important to the annual energy budget.

The adjacent Central Arctic herd obtained only about one-quarter as much dietary nitrogen from its calving

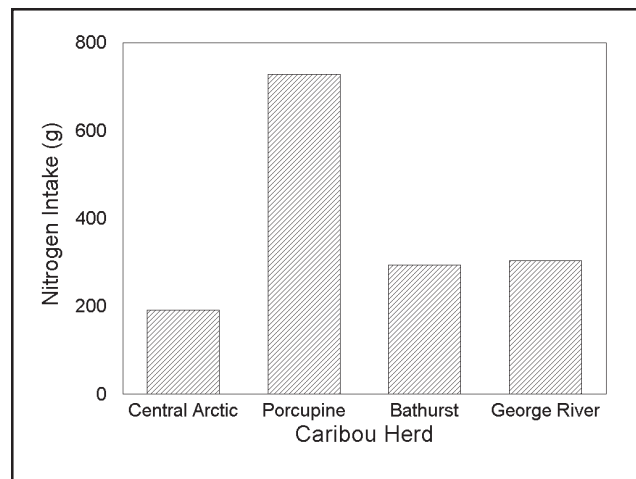


Figure 3.22. Estimated total intake of dietary nitrogen (g) from thez calving ground (25 May - 14 June) for 4 North American caribou herds.z Forage composition of diet and nutritional composition of forages werez estimated from locally collected samples. Intake rates were estimatedz from White et al. (1975).z

ground as did the Porcupine caribou herd (Fig. 3.22). It is likely that the proportion of the annual nitrogen budget obtained from a calving ground is positively correlated with the relative value of the calving ground to the nutrition of a herd within its annual range.

Effects of Insect Harassment on Habitat Use

Mosquitoes (*Cuculidae*) and flies of the family *Oestridae* are known to harass caribou, although harassment by Oestrid flies may occur primarily after Porcupine herd caribou leave the calving ground. Lactating females that are disturbed by insects may experience a negative energy balance due to increased movement rates when trying to escape harassment by insects (White et al. 1975, Russell et al. 1993). When harassment causes lactating females to substantially reduce foraging time, calf growth may be reduced (Helle and Tarvainen 1984, Fancy and White 1987, Russell et al. 1993).

During warm and calm days (mean temperature $\approx 13^{\circ}\text{C}$ and mean wind speed $\approx 6\text{m/sec}$) when conditions were such that caribou were likely harassed by insects (Nixon 1990), Porcupine herd caribou preferred dry prostrate shrub vegetation types on ridge tops in the foothills and mountains of the Brooks Range, elevated sites on the coastal plain, and areas adjacent to the Beaufort sea coast, apparently to gain relief from mosquitoes (Walsh et al. 1992).

Porcupine herd caribou did not display as strong a tendency to move to the coastline during potential insect harassment as has been seen for the adjacent Central Arctic herd. Observations of movements of marked animals during survey flights, however, indicate that

segments of the herd often follow the coastline while moving along the coastal plain of the Arctic Refuge in July (F.J. Mauer, U.S. Fish and Wildlife Service, personal communication).

Individual radio-collared caribou showed at least partial fidelity (i.e., caribou repeatedly returned to specific areas) to either the coastal plain, foothills, or mountain zones during the insect harassment season in different years (Walsh et al. 1992). The negative energetic consequences of insect harassment (Helle and Tarvainen 1984) suggest that free access to insect relief habitat is important to caribou (Walsh et al. 1992), but in some herds the energetic cost of insect harassment may be low (Toupin et al. 1996).

Calf Performance in Relation to Habitat Use

Mean calf weights within 1-2 days of birth were remarkably similar among years. On average, female calves caught during 1992-94 when the herd was declining weighed 6.2 kg, slightly less ($P=0.003$) than ≤ 2 -day-old female calves caught during 1983-85 (6.7 kg, Whitten et al. 1992) when the herd was increasing.

The increase/decrease classification, however, explained only about 9% of the variance in calf weights. The difference in female calf weights between the increase and decrease phases of the herd was due solely to a cohort of heavy calves in 1985 (7.2 kg). Female calves caught in 1983-84 weighed an average of 6.3 kgf (Whitten et al. 1992).

There was a significant interaction among years and periods (0-3 weeks and 4-5 weeks after birth) ($P < 0.001$) in daily weight-gain of female calves, 1992-94f (Fig. 3.23). Daily gain was particularly low during the fourth and fifth weeks of life for calves born in 1993 (Fig. 3.23).

Daily weight-gain of calves did not differ between calves born in the concentrated calving areas and in the peripheral calving areas ($P=0.214$). Much higher relative densities of caribou (7x on average) in the concentrated calving areas compared to peripheral calving areas may have reduced forage available to individual lactating females.

Even though concentrated calving areas had a greater proportion of area with high plant biomass (both NDVI_calving and NDVI_621) than did the annual calving grounds, the differential in forage abundance was evidently not sufficient to overcome the higher densities of caribou in the concentrated calving areas and to enhance the weight-gain of calves born there.

Patterns of habitat use by calves varied significantly ($P < 0.01$) between periods and among years, 1992-1994f (Fig. 3.24a-c), but were generally similar to use of sites for calving (Fig. 3.21). Weight-gain of calves during calving ground use was not associated with the percent of

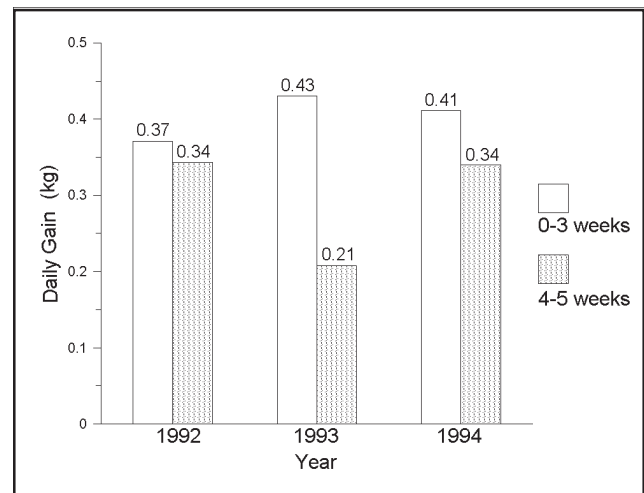


Figure 3.23. Daily gain (kg) of caribou calves of the Porcupine herd, 1992-1994, during 2 periods (0-3 weeks post-birth and 4-5 weeks post-birth). Gain was estimated from sequential weights of recaptured radio-collared animals. Means are listed above the appropriate bars.

time that calves spent in any particular vegetation type or in any class of forage at calving (NDVI_calving), rate of increase in forage during lactation (NDVI_rate), forage available at the peak of lactation (NDVI_621), or snowcover ($P > 0.05$).

Although individual calf weight-gain was not explained by within-annual-calving-ground habitat use, several characteristics of parturient females and calves were related to habitat conditions in the annual calving grounds, 1992-1994. The rank orders of 1) NDVI_621 in the annual calving ground, 2) average parturient female weights (Fig. 3.25), 3) parturient female body condition score, and 4) average calf weights, all at 3-weeks post-calving, were all the same (1993 > 1994 > 1992).

Lack of correlation between individual calf weight-gain and use of annual calving ground habitat suggests that the location of annual calving grounds may have maximized calf weight-gain, given the conditions of the annual habitat available within the extent of calving. Once the annual calving ground was located in an area that provided a high proportion of easily digestible forage (high NDVI_rate), then variation in caribou density and forage biomass (NDVI_calving, NDVI_621) may have interacted to reduce variation in performance among the individual study animals.

Factors Associated with Calf Survival on the Calving Ground

During 1983-1985, average mortality of calves during June was 29% (Whitten et al. 1992), slightly higher than the 1983-2001 average of 25%. In those early years, about 61% of mortality on the calving ground was due to predation and the remainder (39%) was due to nutritional

or physical characteristics of calves (Whitten et al. 1992, Rof e 1993). The interaction between nutritional status of the calves and predation mortality was not known.

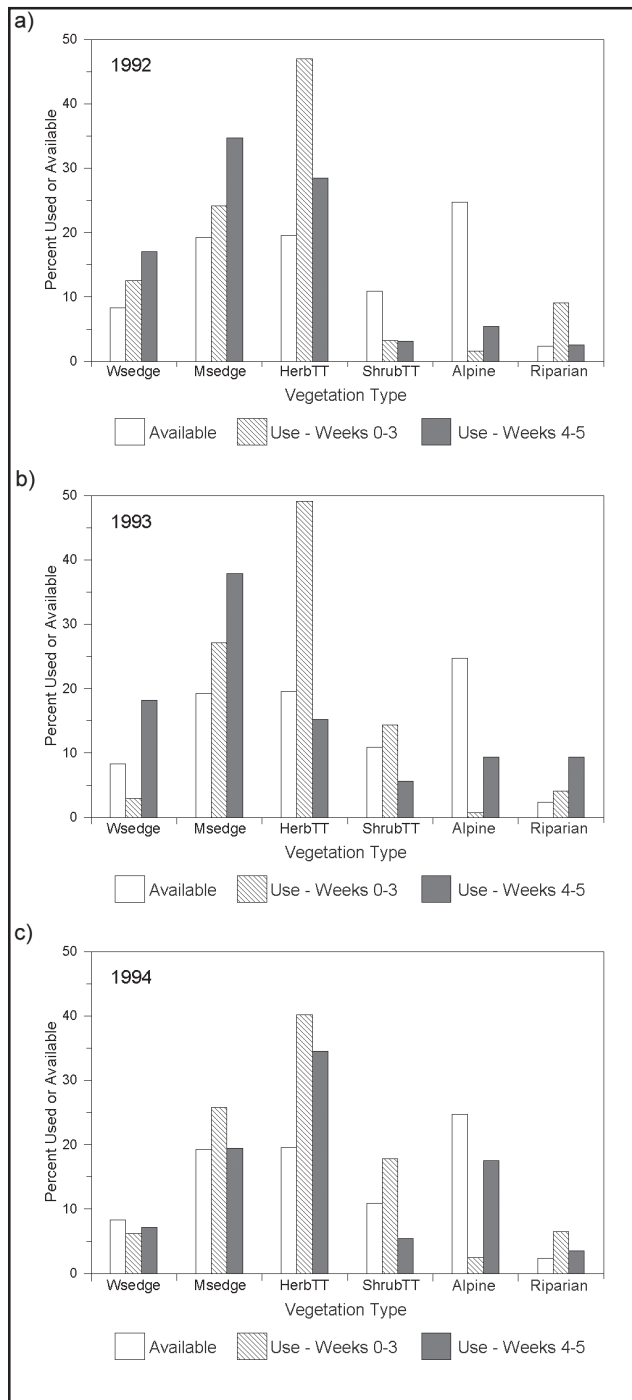


Figure 3.24. Availability of 6 vegetation types in the aggregate extent of calving for the Porcupine caribou herd and use by radio-collared calves during 2 periods (0-3 weeks post-birth and 4-5 weeks post-birth) for a) 1992, b) 1993, and c) 1994. Vegetation types: Wsedge = wet sedge; Msedge = moist sedge; HerbTT = herbaceous tussock tundra; ShrubTT = shrub tussock tundra, Alpine, and Riparian.

Predation occurred further south and at higher elevations near the foothills during 1983-1985 (Whitten et al. 1992).

During 1983-1985, golden eagles caused most predation mortality of calves in the annual calving grounds (~60%), grizzly bears ranked second (~24%), and wolves ranked third (~16%) (Whitten et al. 1992). Young and McCabe (1997) estimated that bears killed about 2% of calves during 1994, a year with relatively high overall calf survival (Fig. 3.10f).

Immature golden eagles ranged throughout the coastal plain and foothills (Clough et al. 1987), while golden eagle nests and wolf dens were primarily restricted to the foothills (see Fig. 6.1). Grizzly bear densities were moderate and their distributions were concentrated in the foothills (Young and McCabe 1997). In late summer through winter, the source and distribution of predation mortality of calves were unknown, but wolves were probably the dominant predator.

We used multiple scales to analyze factors associated with calf survival during June: 1) fate of individual calves within the population of calves; and 2) the proportion of the annual population of calves that survived until the end of June in relation to a) habitat characteristics within the extent of calving and b) habitat characteristics within each annual calving ground. These latter 2 classifications are conceptually equivalent to the fifth and sixth order habitat selection analyses.

Several factors were associated with enhanced survival of individual calves, 1983-1994 ($n=345$ calves). Survival was greater (10.8%, $P=0.004$) if the calf was born in a high density concentrated calving area rather than in the low density peripheral portion of the calving ground; greater (11.0%, $P=0.008$) if born near the median calving date rather than being born early or late in the calving season; greater (11.2%, $P=0.006$) if born on

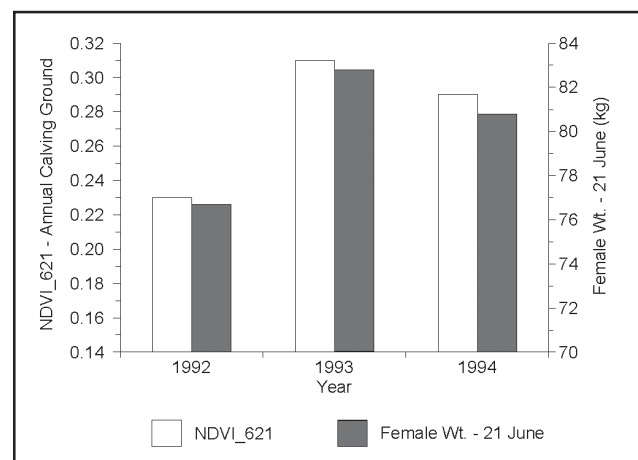


Figure 3.25. Median Normalized Difference Vegetation Index on 21 June (NDVI_621) within the annual calving grounds of the Porcupine caribou herd and weights of parturient female caribou when captured within the annual calving ground on 21 June, 1992-1994.

the coastal plain with lower suspected density of wolves, eagles and bears; and greater (8.3%, $P = 0.026$) if born in the 1002 Area.

The survival advantage of high density calving for individual calves tended to be greater when calves were born in the foothills and mountains than when they were born on the coastal plain (14.3% advantage vs. 7.9% advantage, respectively).

Individual calf survival was not related ($P = 0.160$) to the frequency of use of its birth site as a portion of the concentrated calving area, 1983-1994, but calf survival was lower (9.9%, $P = 0.026$) if the birth site was in an area never used as a concentrated calving area. In a stepwise logistic regression analysis that simultaneously considered calving density, time of birth, zone of birth (coastal plain or foothills), and in or out of the 1002 Area, only calving density ($P = 0.004$), time period of birth (early, middle, late; $P = 0.012$), and zone ($P = 0.008$) entered the model that predicted individual calf survival, 1983-1994.

The survival advantage of both high calving density and being born near the middle of the calving period may have been due to predator swamping where high spatial and temporal densities of calves may make it difficult for predators to capture individual calves (Hamilton 1971). Bears tended to be less successful at capturing calves in the concentrated calving areas of the Porcupine caribou herd (Young and McCabe 1997).

When assessing the proportion of the annual population of calves that survived during June, the timing of birth in relation to other calves was not applicable, but median calving date, 1983-1996, was available. In addition, we could consider the relative amount of food (NDVI_calving, NDVI_rate, and NDVI_621), winter range conditions prior to calf birth (snow properties), and the proportion of calves born in coastal plain or foothill zones.

Analyses of the proportion of calves surviving in relation to these independent variables were conducted separately at 2 scales: a) the extent of calving and b) the annual calving grounds.

Within the extent of calving, the relative amount of forage available to females during peak lactation (NDVI_621) provided the best model of calf survival during June ($r^2 = 0.85$, $P < 0.001$) (Fig. 3.26). No other independent variable that was considered added significant explanatory power.

This model (Fig. 3.26) (Percent June Calf Survival = $[0.107 + (2.05 \times \text{NDVI}_621 \text{ in the extent of calving})] \times 100$) was the best available estimate of survival of calves during June for the Porcupine caribou herd under undisturbed conditions during the past 2 decades. This model of calf survival was independent of annual calving ground location and, if the 1002 Area is developed, the

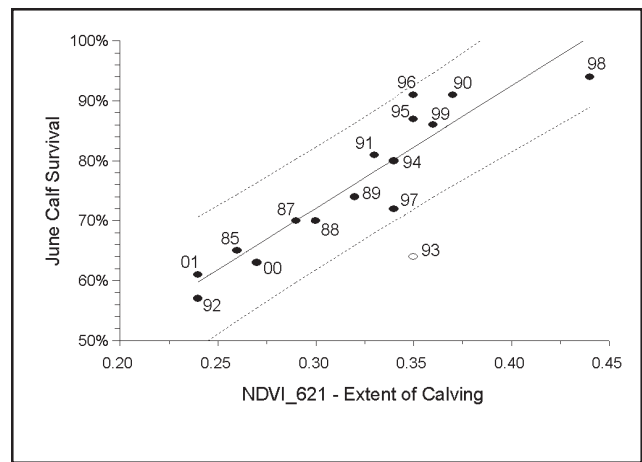


Figure 3.26. Calf survival through June for the Porcupine caribou herd, 1985-2001, in relation to median Normalized Difference Vegetation Index on 21 June (NDVI_621) within the aggregate extent of calving (EC). Legends identify the year of the estimate. Calf survival was not estimated in 1986 because inclement weather prevented a complete sample in late June. Calf survival for 1993 was a significant outlier (R Student = 3.84, see text for biological justification) and was excluded from the estimated regression line ($r^2 = 0.85$, $P < 0.0001$). Upper and lower dashed lines indicate 95% confidence intervals on the predicted observations.

model can be used to assess whether calf survival during June is affected by development.

Calf survival for 1993 was an outlier (R Student = 3.84) and excluded from the estimated relationship between NDVI_621 in the extent of calving and calf survival (Fig. 3.26) and from all subsequent models of calf survival. During 1992, atmospheric aerosols from the eruption of Mt. Pinatubo in the Philippines reached the Arctic in the spring (Stone et al. 1993). This resulted in a late spring, cool summer, early and heavy snow deposition in the fall, and near catastrophic conditions for caribou.

We surmise that the consistently bad weather conditions during 1992 and early 1993 resulted in a carry-over effect that reduced calf survival in 1993 to levels much lower than would have been expected on the basis of NDVI_621 alone. It was likely that this suspected additional mortality in 1993 affected calves within the first day or two of life; perhaps many calves were of very low birth weight. We draw this conclusion because 0- to 3-week weight-gain of calves that survived to be radio-collared in 1993 was as high as any other year (Fig. 3.23) and the weights of parturient females that were caught with their live calves on ~21 June in 1993 were as high as any weights we observed, 1992-1994 (Fig. 3.25).

At the smaller scale of the annual calving grounds, the proportion of Porcupine caribou herd calves that survived through June was positively related to both NDVI_621 in the annual calving grounds and to the proportion of calves that were born on the coastal plain (assumed lower

predation risk) ($r^2 = 0.70$, $P < 0.001$). No other variable added significant explanatory power. Median NDVI_621f in the annual calving grounds and the proportion of calves born on the coastal plain were not correlated ($P > 0.94$). Forage in the annual calving ground accounted for approximately 75% of the total variance explained by this model and assumed predation risk accounted for the remainder (Fig. 3.27).

Thus, in addition to scale dependency in the functional response of caribou to habitats (selection of NDVIs within the extent of calving and within the annual calving grounds), there was scale dependency in the numerical response of calf survival to calving ground location and habitat conditions. Only forage was related to calf survival at the largest spatial scale (extent of calving) that we analyzed.

At the intermediate scale (annual calving ground), forage dominated calf survival, but predation risk added substantial explanatory power. At the smallest scale (individuals within the population of calves), spatial and temporal variance in calf density (indirect predation risk) and direct predation risk most effectively explained calf survival.

This scale dependency in calf survival likely occurred because the annual variance in habitat conditions in both the extent of calving and in the annual calving grounds far exceeded the annual variance in predation risk within the extent of calving and within the annual calving grounds. The scale dependency in calf survival made it impossible to extrapolate across scales. Thus, to develop an understanding of the relative influence of forage and

predation on calf survival, it is imperative to specify the scale of analysis, and assess multiple scales simultaneously.

The temporal increase in forage during peak lactation (NDVI_621) (Fig. 3.4) was coincident with local climate warming (Fig. 3.3a). Forage at calving (NDVI_calving) was positively associated with the Arctic Oscillation (Fig. 3.6). There were also positive relationships between climate and NDVI_calving, between percent of females calving in the 1002 Area and NDVI_calving, and between calf survival and NDVI_calving [$r^2 = 0.33$, $P = 0.011$ (annual calving ground); $r^2 = 0.60$, $P < 0.001$ (extent of calving)]. As a result, June calf survival was weakly correlated ($r^2 = 0.22$, $P = 0.029$) with the proportion of cows that calved in the 1002 Area. Further, because climate affected calving ground location (e.g., Porcupine caribou herd females were more likely to use the western portion of the extent of calving following winters with a positive Arctic Oscillation), both forage availability and predation risk were implicitly related to climate.

In years with substantial snowcover on the coastal plain (Fig. 3.18) and relatively low NDVI_621 in the extent of calving, average calf survival (66%, $SE = 7$, $SE = 6$) was 19% less ($P = 0.008$) than when there was little snowcover at calving and NDVI_621 was high (85%, $SE = 6$, $SE = 11$). Thus, climate was an important influence on habitat conditions, on the likely use of the Alaska coastal plain and 1002 Area for calving, and on calf survival during June, 1983-2001, under undisturbed conditions.

Potential Effects of Development on June Calf Survival

In order to assess the potential effects of development of the 1002 Area on the Porcupine caribou herd during calving, we needed a model of caribou behavioral response to oil field infrastructures. The adjacent Central Arctic herd (Fig. 3.2), which calved in the vicinity of Prudhoe Bay - Kuparuk complex of petroleum development areas, provided the only available model of caribou behavioral response to petroleum development during calving.

Parturient female caribou (i.e., those about to give birth or accompanied by very young calves) of the Central Arctic herd repeatedly demonstrated their sensitivity to disturbance during the first few weeks of life of their calves (Smith and Cameron 1983, Whitten and Cameron 1983, Dau and Cameron 1986; Cameron et al. 1992; Nellemann and Cameron 1996, 1998).

Parturient females avoided, or were less likely to cross, *infrastructures* (roads and pipelines) during the calving season (Cameron and Whitten 1979, Dau and Cameron 1986, Murphy and Curatolo 1987, Lawhead 1988, Cameron et al. 1992). In addition, densities of

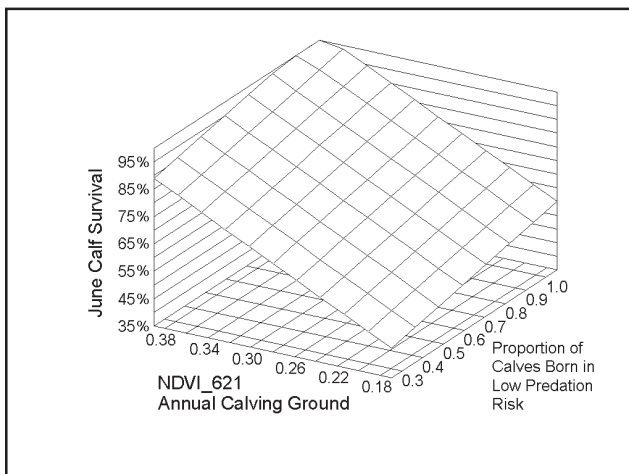


Figure 3.27. Predicted calf survival for the Porcupine caribou herd, 1985-2001, in relation to median Normalized Difference Vegetation Index on 21 June (NDVI_621) within the annual calving ground and to the proportion of calves born on the Arctic National Wildlife Refuge coastal plain physiographic zone where predator density was lower than in the foothill-mountain physiographic zone ($r^2 = 0.696$, $P < 0.001$). Calf survival was not estimated in 1986 because inclement weather prevented a complete sample in late June.

caribou during calving (June) were greater than expected beyond 4 km from roads and pipelines (Cameron et al. 1992).

Central Arctic herd caribou may make substantial use of areas in the vicinity of oil field infrastructures during periods of moderate to high insect abundance during post-calving in July (Pollard et al. 1994). That observation is not relevant, however, to the distribution of the Central Arctic herd during calving in June nor to the assessment of Porcupine Caribou herd distribution during calving in relation to potential oil development: Caribou of the Porcupine herd generally depart the calving ground during early July.

Historically, 2 zones of concentrated calving of the Central Arctic herd have been recognized (Murphy and Lawhead 2000). The zones were physically divided by the Sagavanirktok River and the Trans-Alaska Oil Pipeline. There was an eastern *reference* zone where development infrastructure was historically absent through 1995, and a western *developed* zone that included the Prudhoe Bay, Milne Point, and Kuparuk petroleum development areas. In 1996, the developed versus reference zone study design was compromised by the completion of pipelines leading to the Badami petroleum development area, east of the Trans-Alaska Oil Pipeline and into the reference zone.

During the late 1980s, concentrated calving in the developed zone shifted from the vicinity of the Kuparuk-Milne Point petroleum development areas to undeveloped areas to the south-southwest of the oil fields (Lawhead et al. 1993, Murphy and Lawhead 2000). Low density calving continued to occur in these petroleum development areas while concentrated calving shifted. That shift was completed by approximately 1987 when the Oliktok Point and Milne Point roads were completed and substantial infrastructure was in place. The uni-directional shift in concentrated calving in the developed zone, 1980-1995, has subsequently been confirmed ($P < 0.002$, Wolfe 2000). During the same years, however, the concentrated calving area in the reference area showed no uni-directional shift ($P = 0.14$, Wolfe 2000) (see also Fig. 4.7).

Since 1996 the bulk of high density calving in the developed zone has remained south of roads and pipelines although a small zone of high density calving occurred in the Kuparuk-Milne Point area in 1996 (Lawhead and Prichard 2001). The shift in calving distribution in the developed zone occurred even though the Milne Point and Kuparuk petroleum development areas included substantial improvements in field design and layout (e.g., elevated pipes, reduced road density) that should have facilitated caribou passage compared with the design of the older Prudhoe Bay Complex.

No other concentrated calving area of Alaska barren-ground herds has demonstrated a statistically significant

uni-directional shift during the past 2 decades. Kelleyhouse (2001) showed no uni-directional shift in concentrated calving for the Western Arctic herd, 1987-2000, but was unable to assess shifts in the concentrated calving areas of the Teshekpuk Lake herd due to an inadequate number of years for the test. As noted previously, directional shifts of concentrated calving areas of the Porcupine Caribou herd have not differed from randomness, 1983-2001.

Forage during peak lactation (NDVI₆₂₁) in the concentrated calving area in the developed zone of the Central Arctic herd declined as the concentrated calving area shifted south-southwest, 1980-1995 (Wolfe 2000). During this shift, forage during peak lactation remained highest in the area used for concentrated calving during 1980-1982 (Wolfe 2000). There was, however, no decline in forage availability on June 21 (NDVI₆₂₁) in the concentrated calving areas in the reference zone of the Central Arctic herd during 1980-1995 (Wolfe 2000). No clear biological evidence explained the shift of concentrated calving in the developed zone to an area of reduced forage availability for lactating females. Thus, petroleum development was implicated as a cause of the southerly shift in concentrated calving in the developed zone of the Central Arctic herd, 1980-1995.

Since the first census of the Central Arctic herd in 1978, the herd size has increased from approximately 5,000 to approximately 27,000 animals in 2000 (E. A. Lenart, Alaska Department of Fish and Game, personal communication. See also Fig. 4.2). There was a sharp decline (from 23,000 to 18,000) in the herd from 1992-1995 and a subsequent recovery. It is unknown whether the Central Arctic herd would have increased at a higher rate than observed had the concentrated calving area in the developed zone not shifted to the south-southwest by 1987.

The observation of either an increase or decrease of any magnitude in the size of the Central Arctic herd or any other herd is not, by itself, sufficient evidence to conclude that there has been an effect of development or lack thereof on herd size. For example, had the 1002 Area been developed in 1989, the subsequent natural decline of the Porcupine Caribou herd (Fig. 3.8) would not have constituted evidence of an effect of development.

To assess potential effects of development on the growth curve of the Central Arctic herd, we needed to make comparisons with an ecologically similar herd. The Porcupine Caribou herd does not constitute a good ecological comparison and neither does the Western Arctic herd. The Teshekpuk Lake herd (Fig. 3.9) is the most ecologically comparable herd to the Central Arctic herd in Alaska.

The Central Arctic herd and Teshekpuk Lake herd are certainly not identical, however: 1) both herds are relatively small in size and the trajectories of their growth

curves suggest exponential growth, 2) both herds have relatively high bull:cow ratios (~80:100), 3) calving ground habitats of both herds showed similar climate trends (Kelleyhouse 2001, Wolfe 2000), 4) Both herds exhibited the same dip in herd size during the mid-1990s (Fig. 3.9), 5) neither herd has consistently demonstrated the long distance migrations exhibited by the Western Arctic herd and Porcupine Caribou herd, and 6) Before 1987, both components of the Central Arctic herd as well as the Teshekpuk Lake herd calved in wet coastal habitats with relatively late snowmelt.

The apparent divergence in the relative sizes of the Central Arctic herd and adjacent Teshekpuk Lake herd after 1987 (Fig. 3.9) suggests that the growth rate of the Central Arctic herd may have slowed after roads and pipelines expanded in the developed zone and the concentrated calving area in the developed zone shifted south-southwest. The relative trajectories of the 2 herds' growth curves were parallel through the mid- to late-1980s when both herds were slightly less than 4 times as large as when first censused. Thereafter, their trajectories diverged slightly. By the late 1990s the Teshekpuk Lake herd was about 7 times larger than when first censused while the Central Arctic herd was only about 5.4 times as large as when first observed. Cronin et al. (1998) noted that exponential growth rate of the Teshekpuk Lake herd was approximately twice as great as the exponential growth rate estimated for the Central Arctic herd (0.152f vs. 0.077, respectively) from the mid-1970s through the mid-1990s.

Several ecological factors may have diluted or obscured any population consequences of avoidance of petroleum development areas by the Central Arctic herd during calving. First, only the half of the herd that used the developed zone was potentially affected. Reduction in available food for lactating females during peak lactation was demonstrated only for the females that used the developed zone concentrated calving area (approximately 25% of all females in the Central Arctic herd; Wolfe 2000).

Second, the Central Arctic herd remained on the coastal plain when it shifted its concentrated calving area in the developed zone. The parturient females and calves were not displaced to the adjacent foothills where predator densities were assumed to be greatest. Thus, the shift may have incurred little if any additional mortality due to predation.

Third, development of the complex of petroleum development areas from Prudhoe Bay to Kuparuk has occurred during a period of relatively favorable environmental conditions (Maxwell 1996). The resilience of herds to abiotic, biotic, or anthropogenic challenges would be expected to be greatest during favorable environmental conditions.

Fourth, because the Central Arctic herd obtained a relatively small proportion of its annual nitrogen budget from its calving ground compared with other herds (Fig. 3.22), the Central Arctic herd calving ground may have had less relative value to herd performance than the calving grounds of other herds.

Fifth, calving ground density of the Central Arctic herd has been, and remains, quite low (approximately one-fifth the effective density of the Porcupine Caribou herd; Whitten and Cameron 1985). Thus, even though females of the Central Arctic herd in the developed zone shifted their concentrated calving to an area with reduced total forage, the amount remaining per Caribou may have been sufficient to accommodate nutritional requirements.

Because ecological conditions for the Porcupine caribou herd are substantially different than for the Central Arctic herd, it is unlikely that all these ameliorating factors will apply to the response of the Porcupine caribou herd to development within its calving ground. Nevertheless, the avoidance of oil field roads and pipelines by parturient females of the Central Arctic herd during the calving season is transferable to Porcupine Caribou herd because sensitivity to disturbance by parturient caribou has been repeatedly noted elsewhere (Wolfe et al. 2000).

To assess the potential effects of petroleum development in the 1002 Area on the Porcupine Caribou herd, we assumed that displacement of Porcupine Caribou herd's concentrated calving grounds would occur, similar to the shift observed in the concentrated calving area in the developed zone of the Central Arctic herd (Lawhead et al. 1993, Wolfe 2000). We then used empirical habitat-demography relationships developed in the Porcupine caribou herd studies to assess the implications of this hypothetical displacement on calf survival during June for the Porcupine Caribou herd.

We based our predictions on an empirical model relating calf survival to forage in the annual calving ground on 21 June and to the proportion of calves born in low predation risk (Fig. 3.27). This empirical model was Percent June Calf Survival = [-0.0396 + (2.0989 * median NDVI_621 in the annual calving ground) + (0.00283 * proportion of calves born in low predation risk)] * 100, ($r^2 = 0.70$; $P < 0.001$). The spatially explicit nature of this intermediate-scale model subsumed the effects of temporal and spatial caribou density on individual calf survival.

First, we used the empirical model to predict calf survival in each of the 17 observed annual calving grounds of the Porcupine Caribou herd, 1985-2001 (Fig. 3.13). Then each concentrated calving area was displaced the minimum distance necessary to provide a 4 km clearance from the boundary of each of 4 hypothetical oil development scenarios for the 1002 Area presented in Tussing and Haley (1999; scenarios 2-5) and for the

single hypothetical development scenario presented in the 1987 Final Legislative Environmental Impact Statement (Clough et al. 1987). The scenarios in Tussing and Haley (1999) are based on the most recent estimates of the distribution and quantity of oil reserves within the 1002f Area (U.S. Geological Survey 2001).

This protocol assumed oil field design similar to the Kuparuk and Milne Point petroleum development areas within the scenario boundaries. The modeling exercise could be used to assess the potential effects of additional development scenarios that are not presented in Tussing and Haley (1999) or Clough et al. (1987).

Central Arctic herd parturient females actually separated their concentrated calving areas from development infrastructure by about 7-8 km (Wolf 2000). We used a conservative displacement of 4 km based on observations by Cameron et al. (1992) of increased caribou density from 4 km outward beyond roads and pipelines. Calving sites and the entire annual calving grounds were displaced along with the concentrated calving areas.

Our protocol stated that a concentrated calving area could not be moved onto the Beaufort Sea. We made no changes in shape of the concentrated calving areas or of annual calving grounds. As a result of these shifts, relatively small portions of the peripheral, low-density calving areas were occasionally moved onto the Beaufort Sea along with some associated calving sites. We treated these ocean sites as missing data when assessing the potential effects of displacement on calf survival.

Modeled displacement for the Porcupine caribou herd was to the east and south, parallel to the Beaufort coast line, because that is the direction of the herd's migratory approach to the annual calving grounds in spring. Displacement of the developed-zone concentrated calving areas of the Central Arctic herd has been primarily to the south, the direction of approach to that calving ground from winter range.

Our protocol minimized displacement of the Porcupine caribou herd calving grounds into the foothills and mountain zone. This tended to keep the annual calving grounds on the coastal plain in the best remaining foraging habitats. In some cases, observed concentrated calving areas (e.g., in 1988, 2000, and 2001) did not overlap the boundaries of any of the hypothetical development scenarios, and in those cases the annual calving ground was not displaced.

Once the concentrated calving areas and associated annual calving grounds and calving sites were displaced, the forage during peak lactation (NDVI₆₂₁) within the displaced annual calving ground was re-inventoried, the median was recalculated, and the proportion of calves born in the low predation risk zone (coastal plain) was recalculated.

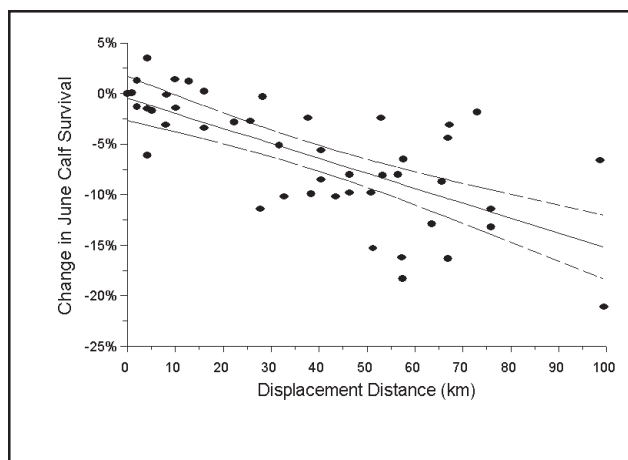


Figure 3.28. Estimated change in calf survival during June for the Porcupine caribou herd, 1985-2001, as a function of the distance of displacement of the annual calving ground and associated concentrated calving area and calving sites. Upper and lower dashed lines indicate 95% confidence intervals on the mean effect.

Then the empirical model was again used to predict calf survival for the displaced calving ground. The difference between the calf survival estimate for the displaced and observed calving ground was calculated and a dataset of 46 displacement distances and associated changes in calf survival was generated for analysis.

The model showed a significant ($r^2 = 0.47$, $P < 0.001$) inverse relationship between displacement distance and predicted change in calf survival (Fig. 3.28).

The simulations indicated that a substantial reduction in calf survival during June would be expected under full development of the 1002 Area. Eighty-two percent of observed calving distributions would have been displaced and the average distance of these displacements would have been 63 km (range 16-99 km). This would have yielded a net average effective displacement of 52 km and an expected mean reduction in calf survival of 8.2% (SEF = 0.7%).

It is remotely conceivable that calving caribou of the Porcupine caribou herd could select habitats that yielded equivalent forage and predation risk after displacement. Forage for lactating females of the Central Arctic herd, however, declined as the concentrated calving area in the developed zone shifted to the south-southwest (Wolf 2000). This suggests that such compensatory habitat use by the Porcupine caribou herd would be unlikely if their calving grounds were displaced by oil development.

Because there was no empirical basis for changing the shape of the observed calving distributions, it was impossible to estimate the magnitude of the effect of considering the peripheral calving areas and calving sites as missing data when they were displaced onto the ocean. The effect was expected to be small. Arbitrarily assigning calving sites that were displaced onto the ocean back onto the coastal plain and making no other adjustments would

have increased displaced calf survival by only about 0.6% on average. This probably constituted the maximum possible effect of treating areas and calving sites that were displaced to the Beaufort Sea as missing data.

stochastic simulation modeling (Walsh et al. 1995) indicated that a 4.6% reduction in Porcupine caribou herd calf survival during June, all else held equal, would have been sufficient to halt growth of the Porcupine caribou herd during the best conditions observed to date. A 10-km average displacement in our simulations would have been sufficient to bring the upper confidence interval on the mean effect below a 0% predicted change in calf survival (Fig. 3.28). A mean displacement of 27 km in our modeled predictions would have been sufficient to reach the threshold of 4.6% mean reduction in calf survival sufficient to halt growth of the Porcupine caribou herd under best observed growth conditions to date. This latter level of displacement could occur well before full development of the 1002 Area.

The estimated effect of displacement of the Porcupine caribou herd on calf survival during June was conservative for several reasons. First, we used the conservative estimate of a 4 km displacement of concentrated calving areas from infrastructure (Cameron et al. 1992) versus 7-8 km (Wolfe 2000). Second, we displaced the concentrated calving areas parallel to the Beaufort Sea coastline thus maintaining calving distributions on the best remaining coastal plain habitat and minimizing displacement into the foothills where predation would be expected to increase calf mortality. Finally, relatively low density calving was allowed for overlap developed areas, as has been observed for the adjacent Central Arctic herd (Wolfe 2000, Lawhead and Prichard 2001).

Because the assumptions were conservative, the results were conservative. Substantial (10 to 27 km) displacement of concentrated calving areas and associated annual calving grounds and calving sites of the Porcupine caribou herd is likely to negatively affect calf survival during June. At the upper end of this range of displacement (27 km), recovery of the herd from the current decline (Fig. 3.8) would be unlikely. These conclusions are consistent with those found in the 1987 Final Legislative Environmental Impact Statement (Clough et al. 1987).

The Porcupine caribou herd has demonstrated substantial natural variability in size and demography (Figs. 3.5, 3.8, 3.10a-c). Because development of the 1002 Area would take time, any effects on the herd's performance may take decades to detect. Reduced calf survival may slow the rate of increase during positive phases of the growth curve of the herd and increase the rate of decline during the negative phases of the herd's growth curve. The period of natural cycles in herd size

may increase and the amplitude of herd size may be affected.

The best empirical tool available for detecting potential effects of development is the modeled relationship between calf survival and forage for females during peak lactation demand (NDVI_621) within the extent of calving (Fig. 3.26). This model is independent of actual annual calving ground location and encompasses a near full cycle of herd size as well as substantial variation in hemispheric weather patterns (Fig. 3.5) and variation in calving ground location (Fig. 3.13).

With industrial development, if observed calf survival falls below the lower 95% confidence limit on the predicted observations from this model (Fig. 3.26), or if a parallel pattern of calf survival yields a significantly lower intercept term, then an effect of development on calf survival would be indicated.

Individual observations that fall below the lower confidence limit and which can be satisfactorily explained by exceptional environmental characteristics (e.g., carry-over effects of near-catastrophic conditions in 1992 of 1993 after eruption of Mount Pinatubo) (Fig. 3.26) need not be considered evidence for effects of development on calf survival. A pattern of observed calf survival below the lower confidence limit would be cause for concern.

Statistical methods for making these types of decisions are currently in development (Rexstad and Debevec 2001). This assessment will require continued intensive calving ground surveys and calf survival estimates.

Conclusions

Our research has shown that the Porcupine caribou herd has significant annual variance in calving ground location (Fig. 3.13), faces annual variance in habitat conditions, selects areas with abundant high quality forage for calving, has increased survival of calves born in the concentrated calving areas, and shows a correlation between calf survival and both forage for females during peak lactation and predation risk in the annual calving grounds. All this implies that unrestricted access to annual calving grounds and concentrated calving areas maximized performance of lactating Porcupine caribou herd females and their calves. Because the Porcupine caribou herd has shown limited capacity for growth, free access to calving ground habitats may have compensated for less than optimal wintering habitats.

Location of the concentrated calving areas during the past 19 years (1983-2001) is the best estimate of the area that has provided the highest quality calving habitat for females and their calves. Calf survival within the aggregate extent of concentrated calving areas has been higher than for calves born in areas never used as a concentrated calving area (83.8% vs. 73.9%, respectively),

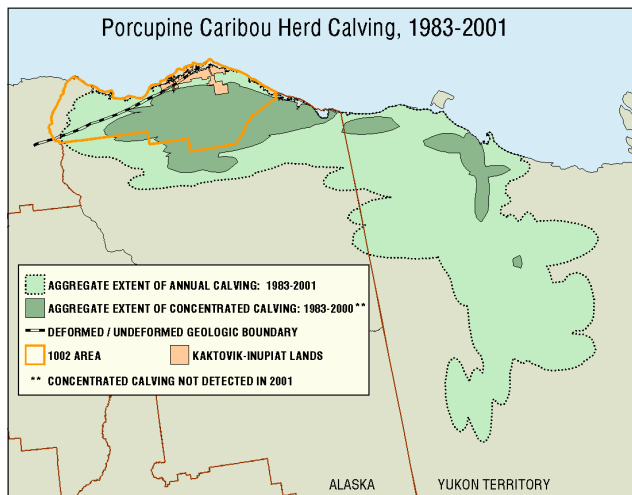


Figure 3.29. Aggregate extent of annual calving (light green shading) and aggregate extent of concentrated calving (dark green shading) for the Porcupine caribou herd, 1983-2001. The deformed/undeformed geological boundary is discussed in USGS Fact Sheet FS-028-01z (U.S. Geological Survey 2001).

1983-1994, $P = 0.026$). Thus, the aggregate extent of all observed concentrated calving areas (Fig. 3.29) identifies the most valuable portion of the extent of calving in terms of calf survival during June.

Our model prediction of a reduction in calf survival when calving grounds were displaced supports the concept that caribou made a critical “decision” in locating their annual calving grounds within the extent of calving, 1983-2001. It appears that actual calving ground location maximized June calf survival given the habitat conditions within the extent of calving for a given year.

Weight-gain of calves provided further evidence for the importance of unrestricted location of annual calving grounds. The lack of a relationship between calf weight-gain and habitat use within annual calving grounds suggests that weight-gain was optimized by selection of the annual calving grounds, particularly during the first 3 weeks of life.

Comparative growth of captive and wild Porcupine caribou herd calves (Parker et al. 1990) has shown that wild Porcupine caribou herd calves attain their maximum genetic potential for daily weight-gain during early- to mid-lactation (Gerhart et al. 1996). Therefore unrestricted selection of the annual calving ground may optimize weight-gain of calves for a year. The matching rank orders of NDVI₆₂₁ in the annual calving grounds and calf weights at 3 weeks of age, 1992-1994, support this concept.

Unrestricted selection of annual calving grounds likely had significant implications for the parturient females as well as for their calves. The matching rank orders of 1) NDVI₆₂₁ within annual calving grounds, 2) parturient

female weights, and 3) parturient female body condition scores during peak lactation, 1992-1994, suggest substantial contribution of the calving ground to parturient females' nutritional status. Because fall weights of parturient females influence their probability of conception (Cameron et al. 1993, Cameron and Ver Hoef 1994, Russell et al. 1998), calving ground habitats may contribute to parturition rates in the following year.

Petroleum development will most likely result in restricting the location of concentrated calving areas, calving sites, and annual calving grounds. Expected effects that could be observed include reduced survival of calves during June, reduced weight and condition of parturient females and reduced weight of calves in late June, and, potentially, reduced weight and reduced probability of conception for parturient females in the fall.

Whether these factors are additive to annual performance or are compensated on winter range will determine the net value of the annual calving grounds to herd performance. Determining the additive/compensatory nature of annual calving ground value, through field and simulation studies, should be the first research priority in future work.

It is unclear if the cause of the decline of the Porcupine caribou herd (Fig. 3.8) during a period when calving ground habitat conditions were favorable as a result of summer warming. Increased winter mortality was implicated by the herd decline because sub-adult and adult mortality on the calving ground has been inconsequential (Fancy et al. 1994, Walsh et al. 1995), and parturition rate and calf survival during June has remained high during the decline.

Possible mechanisms for this suspected increase in off-calving-ground mortality include: 1) reduced longevity of adult females as a result of the cumulative energetic costs of persistent high parturition and calf survival during climate warming, 2) increased energetic costs of insect harassment as the climate has warmed, 3) reduced availability of winter forage or other adverse effects associated with increasing frequency of freeze-thaw events, 4) the herd exceeded forage carrying capacity of winter range, or 5) an increase in some form of predation (human or natural) on the winter range.

Increased frequency of spring and fall icing events on non-calving habitats of the Porcupine caribou herd (Figs. 3.7a,b) supports the third hypothesis and may be implicated in the fifth hypothesis (increased predation mortality). Increased frequency of icing was not evident on the non-calving ranges of other Alaska barren-ground caribou herds that have not declined significantly during the 1990s (Central Arctic herd, Teshekpuk Lake herd, Western Arctic herd). Testing the remaining hypotheses will require substantial additional fieldwork.

In summary, the research-based ecological arguments indicate that the Porcupine caribou herd may be particularly sensitive to development within the 1002f portion of the calving ground:

Low productivity of the Porcupine caribou herd

The Porcupine caribou herd has had the lowest capacity for growth among Alaska barren-ground herds (Porcupine caribou herd = 4.9%, Central Arctic herd = 10.8%, Teshekpuk Lake herd = 13%, Western Arctic herd = 9.5%) and is the only barren-ground herd in Alaska known to be in decline throughout the 1990s. This low growth rate (Fig. 3.9) indicates that the Porcupine caribou herd has less capacity to accommodate anthropogenic, biological, and abiotic stresses than other Alaska barren-ground herds. Any absolute effect of development would be expected to have a larger relative effect on the Porcupine caribou herd than on the other herds. For example, an approximate 4.6% reduction in calf survival, all else held equal, would be enough to prevent Porcupine caribou herd growth under the best conditions observed to date (Walsh et al. 1995) or prevent recovery from the current decline. A similar reduction in calf survival, all else held equal, for other Alaska barren-ground herds, however, would not be sufficient to arrest their growth.

Demonstrated shift of concentrated calving areas off the Central Arctic caribou herd away from petroleum development infrastructures

It is assumed that the Porcupine caribou herd will avoid roads and pipelines during calving in a manner similar to the Central Arctic herd if development of the 1002 Area occurs. Avoidance of petroleum development infrastructure by parturient caribou during the first few weeks of the lives of calves is the most consistently observed behavioral response of caribou to development.

Lack of high-quality alternate calving habitat

Calving areas in Canada and away from the Alaska coastal plain were used only when the Arctic Refuge coastal plain, including the 1002 Area, were unavailable due to late snowmelt. Diet quality on the Canadian portions of the calving ground was substantially lower than on the Arctic Refuge coastal plain and 1002 portions of the calving ground. When snow cover reduced access by females to the Arctic Refuge coastal plain and 1002 Area for calving, calf survival during June was 19% lower than when they could calve on the Arctic Refuge coastal plain and 1002 Area.

Strong link between calf survival and free movement of females

The location of the annual calving grounds and concentrated calving areas was variable among years in response to variable habitat conditions and was often coincident with the 1002 Area. Empirical relationships between calf survival, forage available to females in the annual calving grounds, and predation risk derived from 17 years of ecological data predict that June calf survival for the Porcupine caribou herd will decline if the calving grounds are displaced, and that the effect will increase with displacement distance. This prediction (Fig. 3.28) is a function of displacement: 1) reducing access to the highest quality habitats for foraging and 2) increasing exposure to risk of mortality from predation during calving (first 3 weeks of June).

References

- Akaike, H. 1973. Information theory, an extension of the maximum likelihood principle. Pages 267-281 in B. N. Petrov and F. Csaki, editors. Second International Symposium on Information Theory. Akademiai Kiado, Budapest, Hungary.
- Allay-Chan, A. C. 1991. Physiological and ecological determinants of nutrient partitioning in caribou and reindeer. Dissertation, University of Alaska, Fairbanks, Alaska, USA.
- Baglio, J. V., and E. W. Holroyd, III. 1989. Methods for operational snow cover area mapping using the advanced very high resolution radiometer - San Juan Mountain test study. Research Technical Report, U.S. Geological Survey. EROS Data Center, Sioux Falls, South Dakota, USA.
- Bergerud, A. T. 1980. A review of the population dynamics of caribou and wild reindeer in North America. Pages 556-581 in E. Reimers, E. Gaare, and S. Skjennberg, editors. Proceedings of the Second International Reindeer/Caribou Symposium, Roros, Norway, 1979. Direktoratet for vilt og ferskvannsfisk, Trondheim, Norway.
- _____, and R. E. Page. 1987. Displacement and dispersion of parturient caribou at calving as antipredator tactics. Canadian Journal of Zoology 65:1597-1606.
- Billings, W. D., and H. A. Mooney. 1968. The ecology of arctic and alpine plants. Biological Review 43:481-529.
- Bliss, L. C. 1971. Arctic and alpine life cycles. Annual Review of Ecology and Systematics 2:405-438.
- Brown, R. D., and R. O. Braaten. 1998. Spatial and temporal variability of monthly Canadian snow depths, 1946-1995. Atmosphere and Ocean 36:37-54.
- Cameron, R. D. 1983. Issue: caribou and petroleum development in arctic Alaska. Arctic. 36:227-231.
- _____, D. J. Reed, J. R. Dau, and W. T. Smith. 1992. Redistribution of caribou in response to oil field developments on the Arctic Slope of Alaska. Arctic 45:338-342.
- _____, W. T. Smith, S. G. Fancy, K. L. Gerhart, and R. G. White. 1993. Calving success of female caribou in relation to body weight. Canadian Journal of Zoology 71:480-486.

- _____, and J. Ver Hoef. 1994. Predicting parturition rate of caribou from autumn body mass. *Journal of Wildlife Management* 58:674-678.2
- _____, and K. R. Whitten. 1979. Seasonal movements and sexual segregation of caribou determined by aerial survey. *Journal of Wildlife Management* 43:626-633.2
- _____, and _____. 1980. Nutrient dynamics of caribou forage on Alaska's Arctic Slope. Pages 159-166 in E. Reimers, E.2 Gaare, and S. Skjennenberg, editors. Proceedings of the 2 Second International Reindeer/Caribou Symposium, Roros,2 Norway, 1979. Direktoratet for vilt og ferskvannsfisk,2 Trondheim, Norway.2
- Chan-McLeod, A. C. A., R. G2White and D. F2Holleman. 1994.2 Effects of protein and energy intake, body condition, and2 season on nutrient partitioning and milk production in2 caribou and reindeer. *Canadian Journal of Zoology* 72:938-2 947.2
- _____, _____, and D. E. Russell. 1999. Comparative body2 composition strategies of breeding and non-breeding female2 caribou. *Canadian Journal of Zoology* 77:1901-1907.2
- Chapman, W2L., and J. E. Walsh. 1993. Recent variations of sea2 ice and air temperatures in high latitudes. *Bulletin of the2 American Meteorological Society* 74:33-47.2
- Clough, N. K., P2C. Patton, and A. C. Christensen, editors. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain2 resource assessment - report and recommendation to the2 Congress of the United States and final legislative2 environmental impact statement. U.S. Fish and Wildlife2 Service, U.S. Geological Survey, and Bureau of Land2 Management, Washington D.C., USA.2
- Cronin, M. A., S. C. Amstrup, G2M. Durner, L. E. Noel, T2L2 McDonald, and W2B. Ballard. 1998. Caribou distribution2 during the post-calving period in relation to infrastructure in2 the Prudhoe Bay oil field, Alaska. *Arctic* 51:85-93.2
- _____, W2B. Ballard, J. D. Bryan, B. J. Pierson, and J. D. McKendrick. 1998. Northern Alaska oil fields and caribou: a2 commentary. *Biological Conservation* 83:195-208.2
- Curatolo, J. A., and S. M. Murphy. 1986. The effects of2 pipelines, roads, and traffic on the movements of caribou,2 *Rangifer tarandus*. *Canadian Field-Naturalist* 100:218-224.2
- Dau, J. R., and R. D. Cameron. 1986. Effects of a road system2 on caribou distribution during calving. *Rangifer, Special2 Issue* 295-101.2
- Duquette, L. S. 1984. Patterns of activity and their implications to2 the energy budget of migrating caribou. Thesis, University of2 Alaska, Fairbanks, Alaska, USA.2
- Fancy, S2G2L2F2Pank, K. R. Whitten, and W2L. Regelin.2 1989. Seasonal movements of caribou in arctic Alaska as2 determined by satellite. *Canadian Journal of Zoology* 2 67:644-650.2
- _____, and R. G2White. 1987. Energy expenditures for2 locomotion by barren ground caribou. *Canadian Journal of2 Zoology* 65:122-128.2
- _____, and K. R. Whitten. 1991. Selection of calving sites by2 the Porcupine caribou herd. *Canadian Journal of Zoology* 2 69:1736-1743.2
- _____, _____, and D. E. Russell. 1994. Demography of the2 Porcupine caribou herd, 1983-1992. *Canadian Journal of2 Zoology* 72:840-846.2
- Fryxell, J. M. 1991. Forage quality and aggregation by large2 herbivores. *American Naturalist* 238:478-498.2
- _____. 1995. Aggregation and migration by grazing ungulates2 in relation to resources and predators. Pages 257-273 in A2 R. E. Sinclair and P2Arcese, editors. *Serengeti II: dynamics,2 management and conservation of an ecosystem*. University2 of Chicago Press, Chicago, Illinois, USA.2
- Gerhart, K. L., R. G2White, R. D. Cameron, and D. E. Russell.2 1996. Body composition and nutrient reserves of arctic2 caribou. *Canadian Journal of Zoology* 74:136-146.2
- Groisman, P2A., T2R. Karl, and R. W2Knight. 1994. Observed2 impact of snow cover on the heat balance and rise of2 continental spring temperatures. *Science* 263:198-200.2
- Gross, J. E., L. A. Shipley, N. T2Hobbs, D. E. Spalinger, and B.2 A. Wunder. 1993. Functional response of herbivores in2 food-concentrated patches - tests of a mechanistic model.2 *Ecology* 74:778-791.2
- Hamilton, W2D. 1971. Geometry for the selfish herd. *Journal of2 Theoretical Biology* 31:295-312
- Hare, S. R., and N. J. Mantua. 2000. Empirical evidence for2 North Pacific regime shifts in 1977 and 1989. *Progress in2 Oceanography* 47:103-145.2
- Haukioja, E., and R. Salovaara. 1978. Summer weight of2 reindeer (*Rangifer tarandus*) calves and its importance for2 their future survival. *Reports of the Kevo Subarctic2 Research Station* 24:1-4.2
- Helle, T2 and L. Tarvainen. 1984. Effects of insect harassment2 on weight gain and survival in reindeer calves. *Rangifer* 2 4:24-27.2
- Holben, B. N. 1986. Characteristics of maximum-value2 composite images from temporal AVHRR data. *International2 Journal of Remote Sensing* 7:1417.2
- Hope, A. S., J. S. Kimball, and D. A2Stow. 1993. The2 relationship between tussock tundra spectral reflectance2 properties and biomass and vegetation composition.2 *International Journal of Remote Sensing* 24:1861-1874.2
- Houghton, J. T2 L. G2Meira Fihlo, B. A. Callender, N. Harri, A2 Kattenberg, and K. Maskell. 1996. Climate change 1995:2 the science of climate change. Cambridge University Press,2 Cambridge, England, United Kingdom.2
- Johnson, D. H. 1980. The comparison of usage and availability2 measurements for evaluating resource preference. *Ecology* 2 61:65-71.2
- Jorgenson, J. C., P2E. Joria, T2R. McCabe, B. R. Reitz, M. K.2 Reynolds, M. Emers, M. A. Wilms. 1994. Users guide for2 the land-cover map of the coastal plain of the Arctic2 National Wildlife Refuge. U.S. Fish and Wildlife Service,2 Fairbanks, Alaska, USA.2
- Kelleyhouse, R. A. 2001. Calving ground selection and fidelity:2 Western Arctic and Teshekpuk Lake herds. Thesis,2 University of Alaska, Fairbanks, Alaska, USA.2
- Kuropat, P2J. 1984. Foraging behavior of caribou on a calving2 ground in Northwestern Alaska. Thesis, University of2 Alaska, Fairbanks, Alaska, USA.2
- Langvatn, R., and T2A. Hanley. 1993. Feeding-patch choice by2 red deer in relation to foraging efficiency - an experiment.2 *Oecologia* 95:164-170.2
- Lawhead, B. E. 1988. Distribution and movements of Central2 Arctic herd caribou during the calving and insect seasons.2 Proceedings of the Third North American Caribou2 Workshop. Alaska Department of Fish and Game. *Wildlife2 Technical Bulletin* 8:8-13.2

- _____, L. C. Byrne, and C. B. Johnson. 1993. Caribou 2 Synthesis: 1987-90 Endicott environmental monitoring 2 program. Unpublished report sponsored by U.S. Army 2 Corps of Engineers, Alaska District, Anchorage, Alaska, 2 USA. 2
- _____, and A. K. Prichard, 2001. Surveys of caribou and 2 muskoxen in the Kuparuk-Colville region, Alaska, 2000. 2 Final Report for Phillips Alaska, Inc., prepared by ABR, 2 Inc., Fairbanks, Alaska, USA. 2
- Malingreau, J. P. and A. S. Belward. 1992. Scale considerations 2 in vegetation monitoring using AVHRR data. International 2 Journal of Remote Sensing 13:2289-2307. 2
- Markon, C. J., M. D. Fleming, and E. F. Binian. 1995. 2 Characteristics of vegetation phenology over the Alaskan 2 landscape using AVHRR time-series data. Polar Record 2 31:179-190. 2
- Maxwell, B. 1996. Recent climate patterns in the Arctic. Pages 1-46 in W. C. Oechel, T. Callaghan, T. Gilmanov, J. I. Holten, B. Maxwell, U. Molau, and B. Sveinbjornsson, 2 editors. Global change and arctic terrestrial ecosystems. 2 Ecological Studies 124, Springer Verlag, New York, USA. 2
- Mielke, P. W. and K. J. Berry. 1982. An extended class of 2 permutation techniques for matched pairs. Communications 2 in Statistics: Theory and Methods 2 :1297-1207. 2
- Minnis, P. E., F. Harrison, L. L. Stowe, G. Gibson, F. M. 2 Denn, D. R. Doelling, and W. L. Smith, Jr. 1993. Radiative 2 climate forcing by the Mount Pinatubo eruption. Science 259:1412-1415. 2
- Murphy, S. M., and J. A. Curatolo. 1987. Activity budgets and 2 movement rates of caribou encountering pipelines, roads, 2 and traffic in northern Alaska. Canadian Journal of Zoology 2 65:2483-2490. 2
- _____, and B. E. Lawhead. 2001. Caribou. Pages 59-84 in J. C. 2 Truett and S. R. Johnson, editors. The natural history of an 2 Arctic oil field: development and the biota. Academic Press, 2 San Diego, California, USA. 2
- Myneni, R. B., C. J. Tucker, G. Asrar, and C. D. Keeling. 1998. 2 Interannual variations in satellite-based vegetation index 2 data from 1981 to 1991. Journal of Geophysical Research 2 D6 203:6145-6160. 2
- Myneni, R. B., C. D. Keeling, C. J. Tucker, A. Asrar, and R. R. 2 Nemani. 1997. Increased plant growth in the northern high 2 latitudes from 1981 to 1991. Nature 386:698-702. 2
- Nellemann, C. and R. D. Cameron. 1996. Effects of petroleum 2 development on terrain preferences of calving caribou. 2 Arctic 49:23-28. 2
- _____, and _____. 1998. Cumulative impacts of an evolving 2 oil-field complex on the distribution of calving caribou. 2 Canadian Journal of Zoology 76:1425-1430. 2
- Nixon, W. A. C. 1990. Group dynamics and behavior of the 2 Porcupine caribou herd during the insect season. Thesis, 2 University of Alaska, Fairbanks, Alaska, USA. 2
- O'Neill, R. V. and A. W. King. 1998. Homage to St. Michael: 2 or, why are there so many books on scale. Pages 3-16 in D. 2 L. Peterson and V. T. Parker, editors. Ecological scale: 2 theory and applications. Columbia University Press, New 2 York, New York, USA. 2
- Parker, K. L., R. White, M. P. Gillingham, and D. F. 2 Holleman. 1990. Comparison of energy metabolism in 2 relation to daily activity and milk consumption by caribou 2 and muskox neonates. Canadian Journal of Zoology 68:106-2 4. 2
- Paruelo, J. M., H. Epstein, W. K. Lauenroth, and I. C. Burke. 2 1997. ANPP estimates for NDVI for the central grassland 2 region of the United States. Ecology 78:953-958. 2
- Pollard, R. H., W. B. Ballard, L. E. Noel, and M. A. Cronin. 2 1996. Summer distribution of caribou, *Rangifer tarandus 2 granti*, in the area of the Prudhoe Bay oil field, Alaska, 2 1990-1994. Canadian Field-Naturalist 2 0:659-674. 2
- Post, E., and N. C. Stenseth. 1999. Climatic variability, plant 2 phenology, and northern ungulates. Ecology 80:1322-1339. 2
- _____, _____, R. Langvatn, and J. Fromentin. 1997. Global 2 climate change and phenotypic variation among red deer 2 cohorts. Proceedings of the Royal Society of London, 2 Series B 264:1317-1324. 2
- Rexstad, E. A., and E. Debevec. 2001. Hueristic metric for 2 ecological monitoring. Paper presented at the Annual 2 Meeting of The Wildlife Society, 28 September, 2001, Reno, 2 Nevada, USA. 2
- Roffe, T. J. 1993. Perinatal mortality in caribou from the 2 Porcupine herd, Alaska. Journal of Wildlife Diseases 29:295-303. 2
- Russell, D. E., K. L. Gerhart, R. White, and D. van de 2 Wetering. 1998. Detection of early pregnancy in caribou: 2 evidence for lactational infertility. Journal of Wildlife 2 Management 62:1066-1075. 2
- _____, A. M. Martell, and W. A. C. Nixon. 1993. Range 2 ecology of the Porcupine caribou herd in Canada. Rangifer 2 Special Issue 8. 2
- _____, and R. White. 1998. Surviving in the north - a 2 conceptual model of reproductive strategies in arctic 2 caribou. Proceedings of the Eighth North American Caribou 2 Workshop, 23-25 April 1998, Whitehorse, Yukon Territory, 2 Canada. 2
- Sakamoto, Y. M. Ishiguro, and G. Kitagawa. 1986. Akaike 2 information criteria statistics. KTK Scientific, Tokyo, Japan. 2
- Seaman, D. E., B. Griffith, and R. A. Powell. 1998. 2 KERNELHR: a program for estimating animal home ranges. 2 Wildlife Society Bulletin 26:95-100. 2
- _____, J. J. Millsaugh, B. J. Kernohan, G. C. Brundige, K. J. 2 Raedeke, and R. A. Gitzen. 1999. Effects of sample size on 2 kernel home range estimates. Journal of Wildlife 2 Management 63:739-747. 2
- _____, and R. A. Powell. 1996. An evaluation of the accuracy 2 of kernel density estimators for home range analysis. 2 Ecology 77:2075-2085. 2
- Serreze, M. C., J. E. Walsh, F. S. Chapin III, T. Osterkamp, M. 2 Dyrgerov, V. Romanovsky, W. C. Oechel, J. Morison, T. 2 Zhang, and R. Barry. 2000. Observational evidence of recent 2 change in the northern high latitude environment. Climatic 2 Change 46:159-207. 2
- Shiple, L. A., and D. E. Spalinger. 1992. Mechanics of 2 browsing in dense food patches - effects of plant and animal 2 morphology on intake rate. Canadian Journal of Zoology 2 70:1743-1752. 2
- Shippert, M. M., D. A. Walker, N. A. Auerbach, and B. E. 2 Lewis. 1995. Biomass and leaf-area index maps derived 2 from SPOT images for Toolik Lake and Imnavat Creek 2 areas, Alaska. Polar Record 31:147-154. 2
- Silverman, B. W. 1986. Density estimation for statistics and 2 data analysis. Chapman and Hall, London, England, United 2 Kingdom. 2

- Smith, W. T. and R. D. Cameron. 1983. Responses of caribou to industrial development on Alaska's Arctic slope. *Acta Zoologica Fennica* 275:43-45.
- Spalinger, D. E., T. A. Hanley, and C. T. Robbins. 1988. Analysis of the functional response in foraging in the Sitka black tailed deer. *Ecology* 69:1266-1275.
- Sparks, D. R., and J. C. Malechek. 1968. Estimating percentage dry weight in diets using a microscopic technique. *Journal of Range Management* 1:264-265.
- Stone, R. S., J. R. Key, and E. G. Dutton. 1993. Properties and decay of stratospheric aerosols in the Arctic following the 1991 eruptions of Mount Pinatubo. *Geophysical Research Letters* 20:2359-2362.
- Thompson, D. C., and K. H. McCourt. 1981. Seasonal diets of the Porcupine Caribou herd. *American Midland Naturalist* 105:70-76.
- _____, and J. M. Wallace. 1998. The Arctic Oscillation signature in wintertime geopotential height and temperature fields. *Geophysical Research Letters* 25:1297-1300.
- _____, and _____. 2001. Regional climate impacts of the Northern Hemisphere Annular Mode and associated climate trends. *Science* 293:85-89.
- Toupin, B., J. Huot, and M. Manseau. 1996. Effect of insect harassment on the behaviour of the Riviere George caribou. *Arctic* 49:375-382.
- Trudell, J., and R. G. White. 1981. The effect of forage structure and availability on food intake, biting rate, bite size, and daily eating time of reindeer. *Journal of Applied Ecology* 18:83-81.
- Tucker, C. J. 1979. Red and photographic infrared linear combinations for monitoring vegetation. *Remote Sensing of the Environment* 8:127-150.
- _____, I. Y. Fung, C. D. Keeling, and R. H. Gammon. 1986. Relationship between atmospheric CO₂ variations and a satellite-derived vegetation index. *Nature* 319:195-199.
- _____, and P. J. Sellers. 1986. Satellite remote sensing of primary production. *International Journal of Remote Sensing* 7:1395-1416.
- Tussing, A. R., and S. Haley. 1999. Drainage pierces ANWR in Alaska study scenario. *Oil and Gas Journal* 97:71-84.
- U.S. Geological Survey. 2001. Arctic National Wildlife Refuge, 2002 Area, petroleum assessment, 1998, including economic analysis. U.S. Geological Survey Fact Sheet FS-028-012 (Supersedes FS-040-98) April 2001.
- Walsh, N. E., S. G. Fancy, T. R. McCabe, and L. Pank. 1992. Habitat use by the Porcupine caribou herd during predicted insect harassment. *Journal of Wildlife Management* 56:465-473.
- _____, B. Griffith, and T. R. McCabe. 1995. Evaluating growth of the Porcupine caribou herd using a stochastic model. *Journal of Wildlife Management* 59:262-272.
- _____, T. R. McCabe, J. M. Welker, and A. N. Parsons. 1997. Experimental manipulations of snow-depth: effects on nutrient content of caribou forage. *Global Change Biology* 32 (Supplement 2):158-164.
- White, R. G. 1983. Foraging patterns and their multiplier effects on productivity of northern ungulates. *Oikos* 40:377-384.
- _____. 1992. Nutrition in relation to season, lactation, and growth of north temperate deer. Pages 407-417 in R. D. Brown, editor. *The biology of deer*. Springer-Verlag, New York, New York, USA.
- _____, F. L. Bunnell, E. Gaare, T. Skogland, and B. Hubert. 1981. Ungulates on arctic ranges. Pages 397-483 in L. C. Bliss, O. W. Heal, and J. J. Moore, editors. *Tundra ecosystems: a comparative analysis*. International Biological Program 25. Cambridge University Press, Cambridge, England, United Kingdom.
- _____, and J. R. Luick. 1984. Plasticity and constraints in the lactational strategy of reindeer and caribou. *Symposium of the Zoological Society of London* 51:215-232.
- _____, B. R. Thomson, T. Skogland, S. J. Person, D. E. Russell, D. F. Holleman, and J. R. Luick. 1975. Ecology of caribou at Prudhoe Bay, Alaska. Pages 251-201. in J. Brown, editor. *Ecological investigations of the tundra biome in the Prudhoe Bay region, Alaska*. Biological Papers, University of Alaska, Special Report 2.
- _____, and J. Trudell. 1980 a. Patterns of herbivory and nutrient intake of reindeer grazing tundra vegetation. Pages 180-195 in E. Reimers, E. Gaare, and S. Skjenneberg, editors. *Proceedings of the Second International Reindeer/Caribou Symposium*, Roros, Norway, 1979. Direktoratet for vilt og ferskvannsfisk, Trondheim, Norway.
- _____, and _____. 1980 b. Habitat preference and forage consumption by reindeer and caribou near Atkasook, Alaska. *Arctic and Alpine Research* 12:512-529.
- Whitten, K. R., and R. D. Cameron. 1983. Movements of collared caribou, *Rangifer tarandus*, in relation to petroleum development on the Arctic slope of Alaska. *Canadian Field-Naturalist* 97:143-146.
- _____, and _____. 1985. Distribution of caribou calving in relation to the Prudhoe Bay oil field. Pages. 35-39 in A. M. Martell and D. E. Russell, editors. *Caribou and human activity: proceedings of the First North American Caribou Workshop*, Whitehorse, Yukon Territory, 1983. Canadian Wildlife Service Special Publications, Ottawa, Ontario, Canada.
- _____, T. W. Garner, F. Mauer, and R. B. Harris. 1992. Productivity and early calf survival of the Porcupine caribou herd. *Journal of Wildlife Management* 56:201-212.
- Wiens, J. A. 1989. Spatial scaling in ecology. *Functional Ecology* 3:385-397.
- Wilmshurst, J. and J. Fryxell. 1995. Patch selection by red deer in relation to energy and protein intake: a re-evaluation of Langvatn and Hanley's (1993) results. *Oecologia* 104:297-300.
- Wolfe, S. A. 2000. Habitat selection by calving caribou of the Central Arctic herd, 1980-95. Thesis, University of Alaska, Fairbanks, Alaska, USA.
- _____, B. Griffith, and C. A. Gray Wolfe. 2000. Response of reindeer and caribou to human activities. *Polar Research* 9:63-73.
- Young, D. J., and T. R. McCabe. 1997. Grizzly bear predation rates on caribou calves in northeastern Alaska. *Journal of Wildlife Management* 61:1056-1066.
- Zhou, L., C. J. Tucker, R. K. Kaufmann, D. Slayback, N. V. Shabanov, and R. B. Myneni. 2001. Variation in northern vegetation activity inferred from satellite data of vegetation index during 1981 to 1999. *Journal of Geophysical Research-Atmospheres* 106 (D17):20069-20083.



Map 4-8

Arctic National Wildlife Refuge

Range of the Central Arctic and Porcupine Caribou Herds

Caribou Ranges

- Porcupine Caribou Herd Range
- Central Arctic Caribou Herd Range

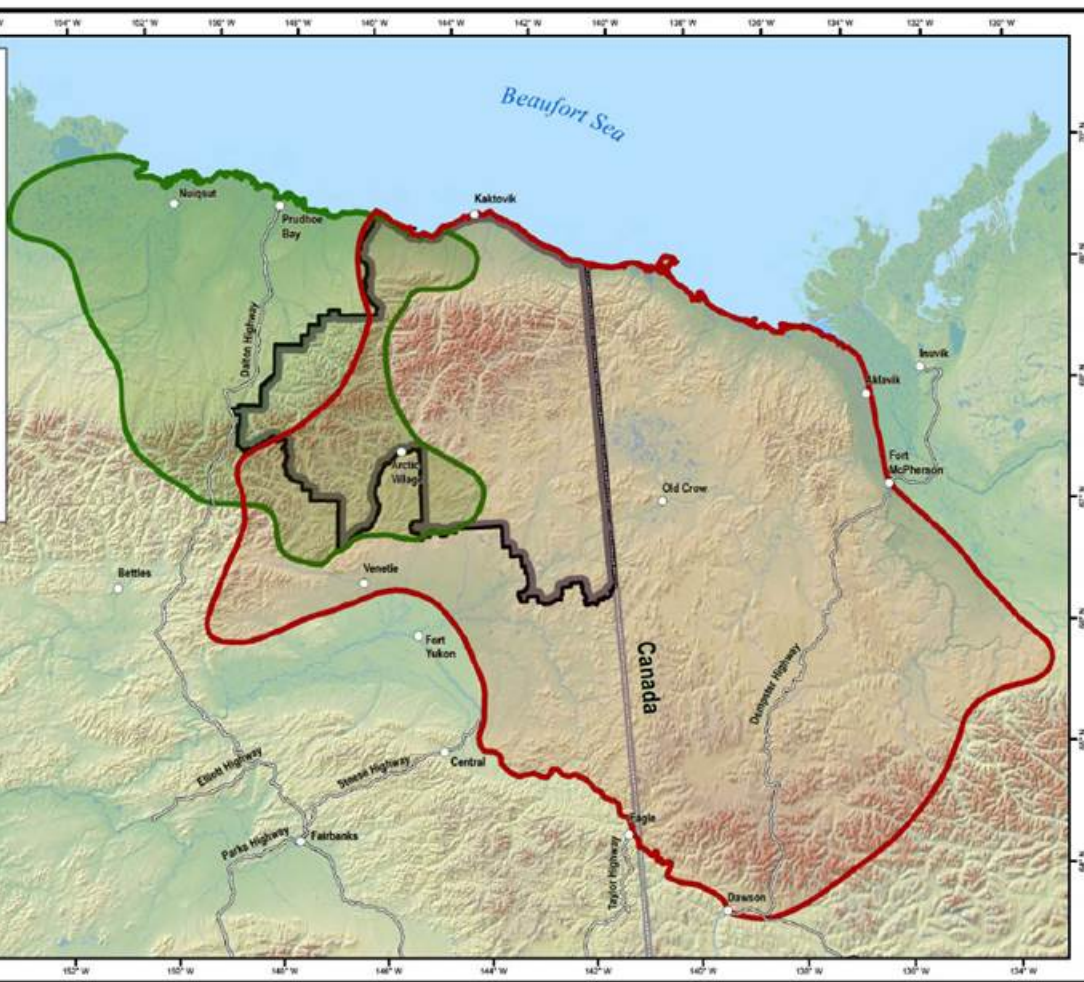
Other Features

- Arctic Refuge Boundary
- U.S. - Canada Border



Miles
0 10 20 30 40 50 60 70 80
Kilometers
0 10 20 30 40 50 60 70 80

Alaska Albers Equal Area Conic Projection, 1983 North American Datum.



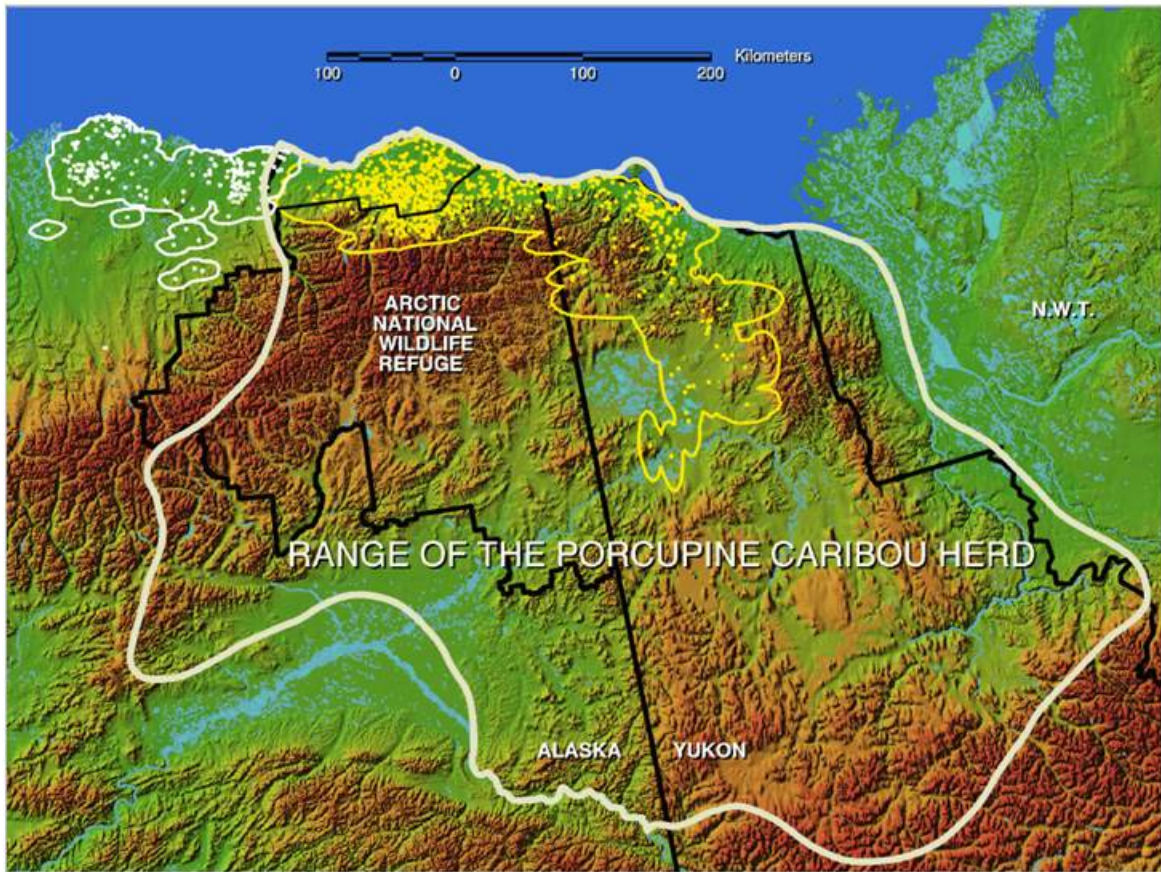
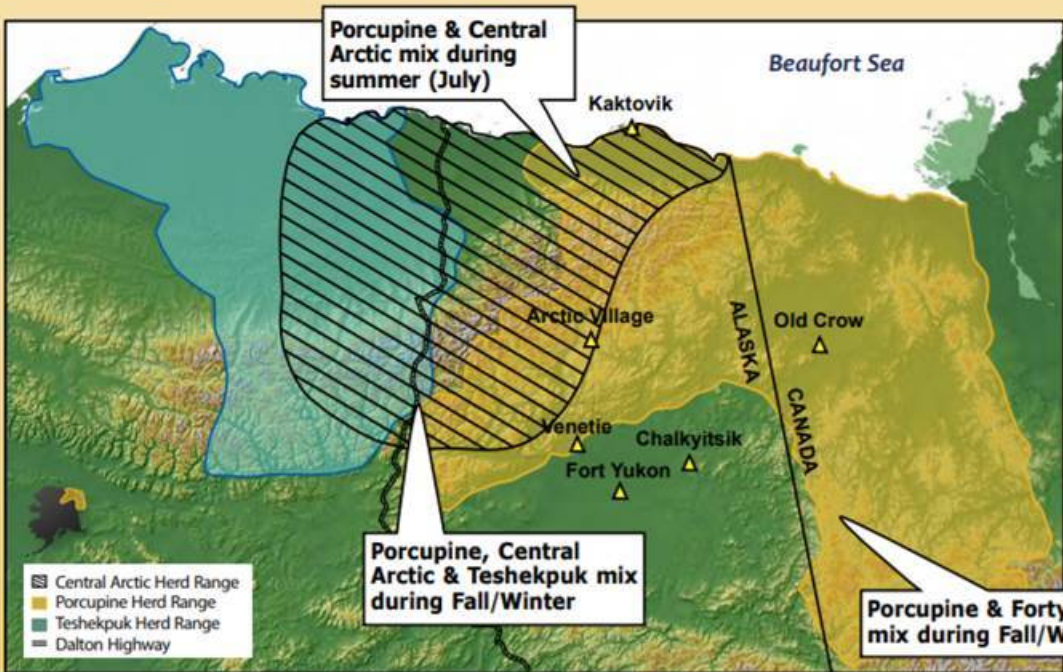


Figure 3.2. For the Porcupine caribou herd: annual range (wide white solid line), calving sites (yellow points), and aggregate extent of calving (thin solid yellow line), 1983-2001. For the Central Arctic caribou herd: aggregate extent of calving (thin solid white line) and calving sites (white points), 1980-1995. (Adapted from Wolfe 2000).





Map 4-8

Arctic National Wildlife Refuge

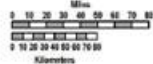
Range of the Central Arctic and Porcupine Caribou Herds

Caribou Ranges

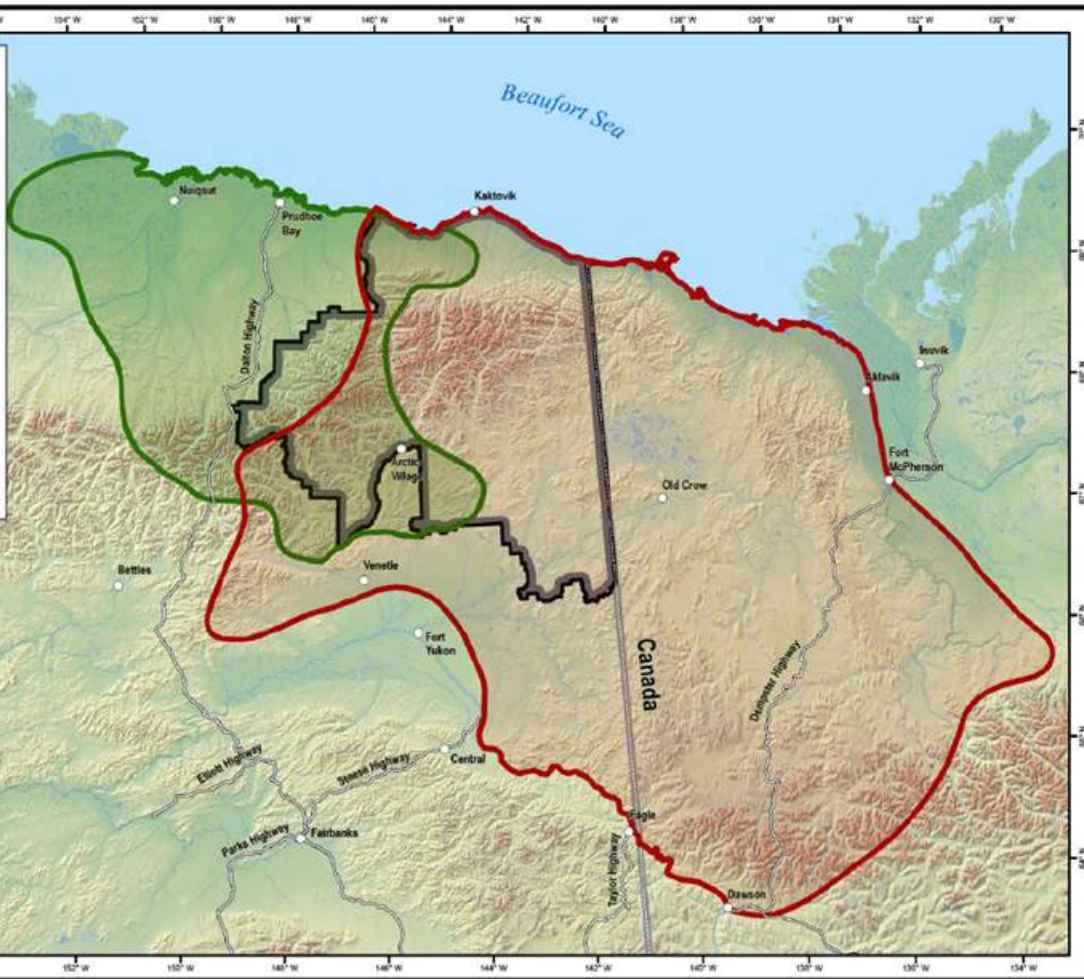
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- Central Arctic Caribou Herd Range

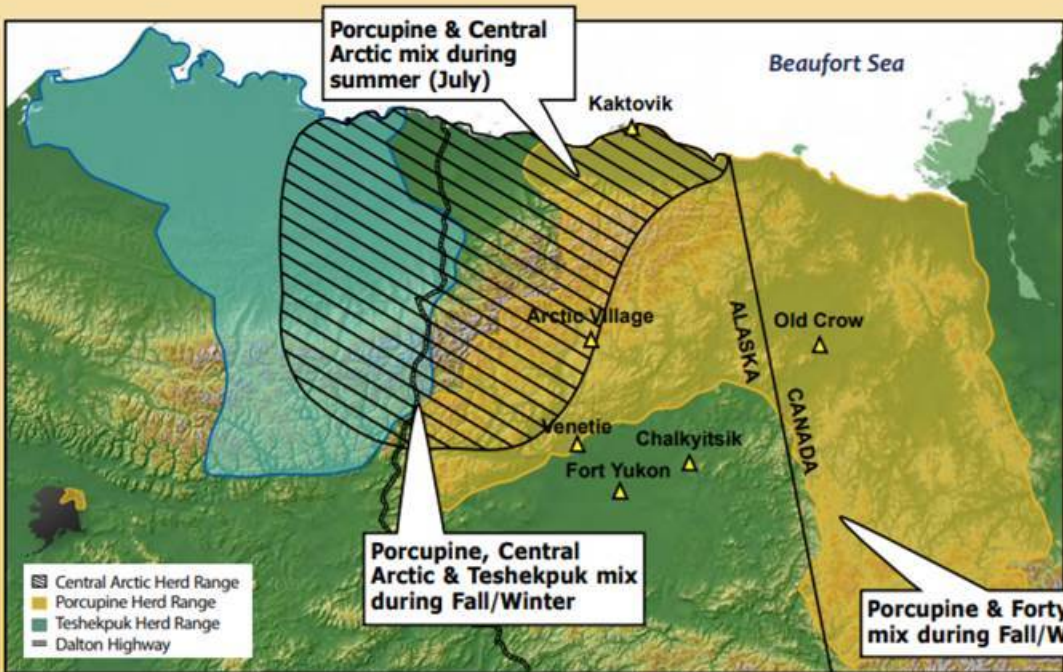
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Alaska Albers Equal Area Conic Projection, 1983 North American Datum.





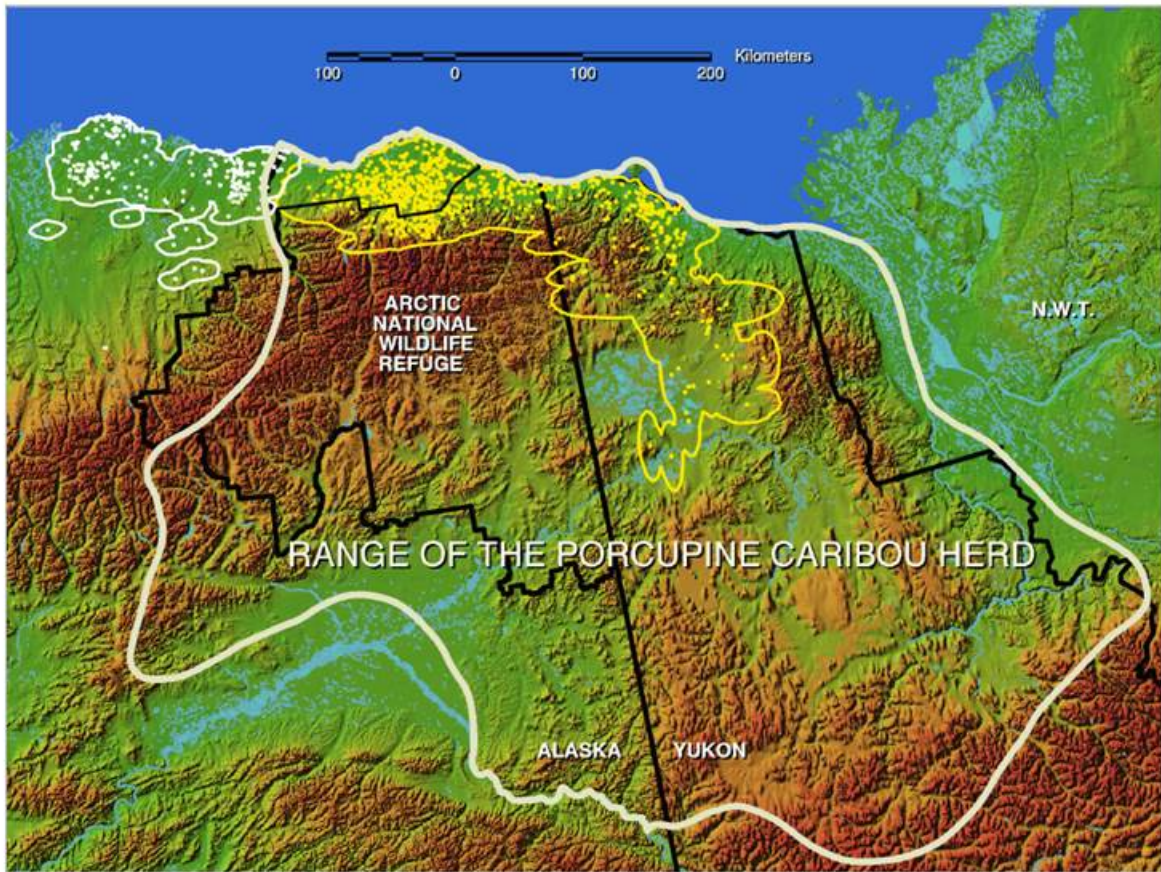


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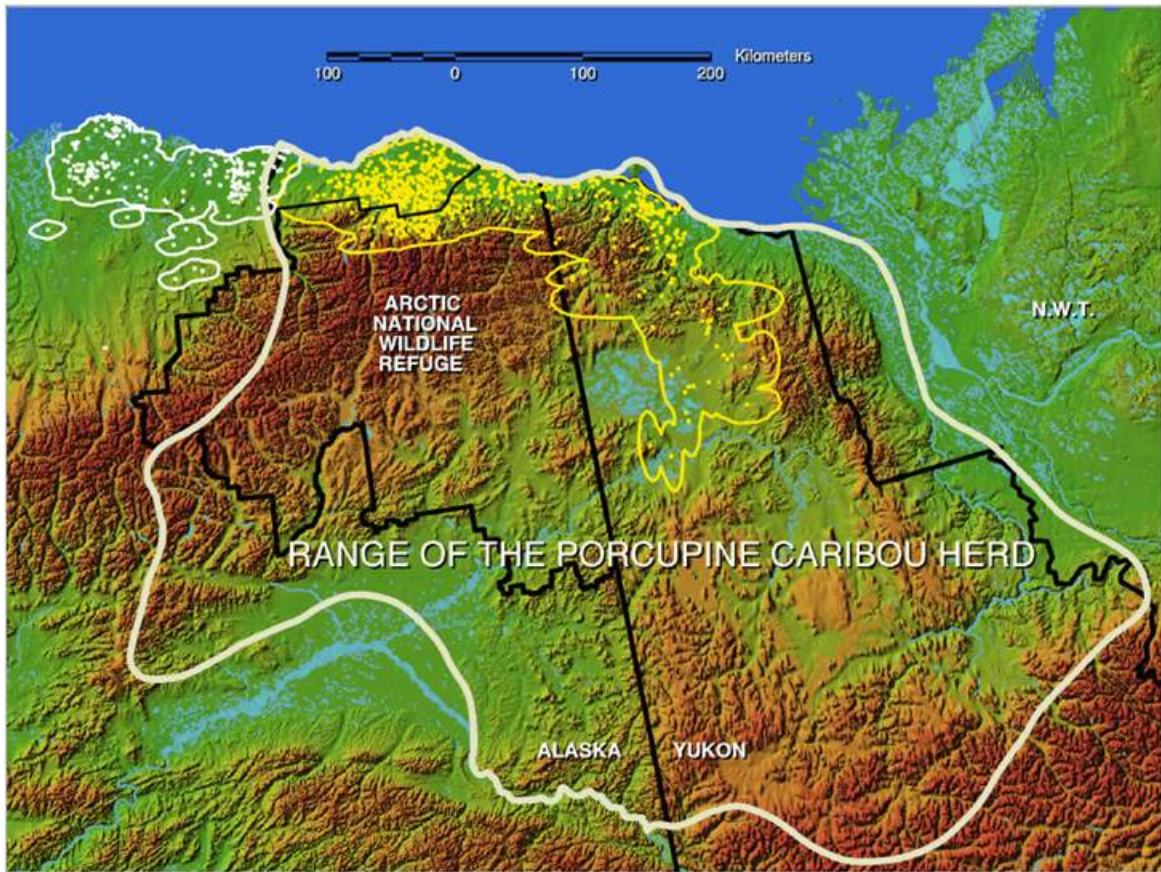
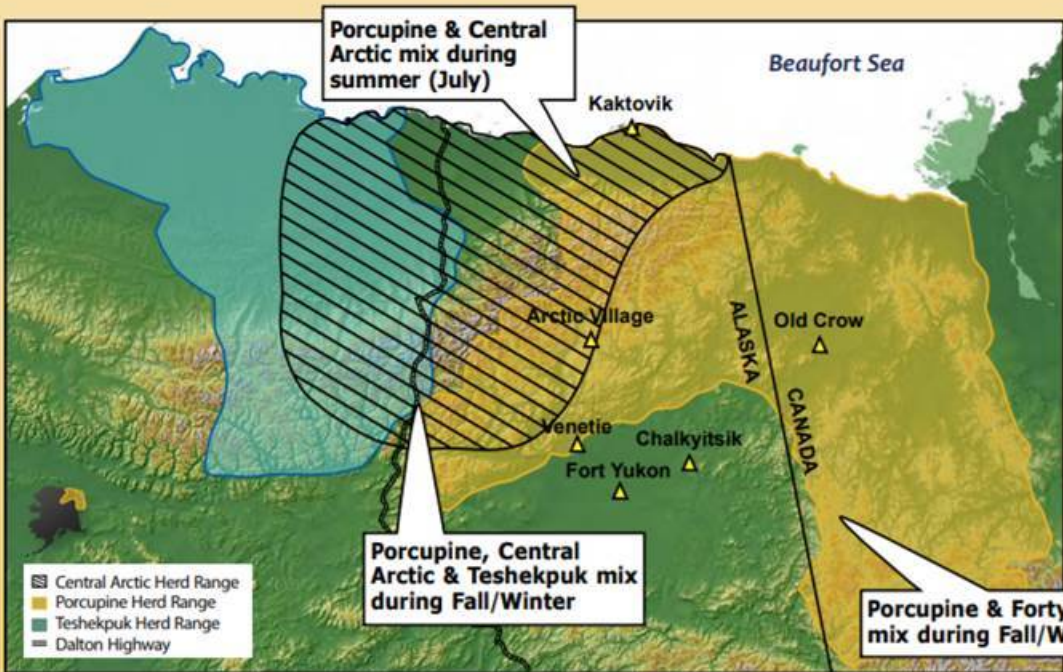


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Map 4-8



Arctic National Wildlife Refuge

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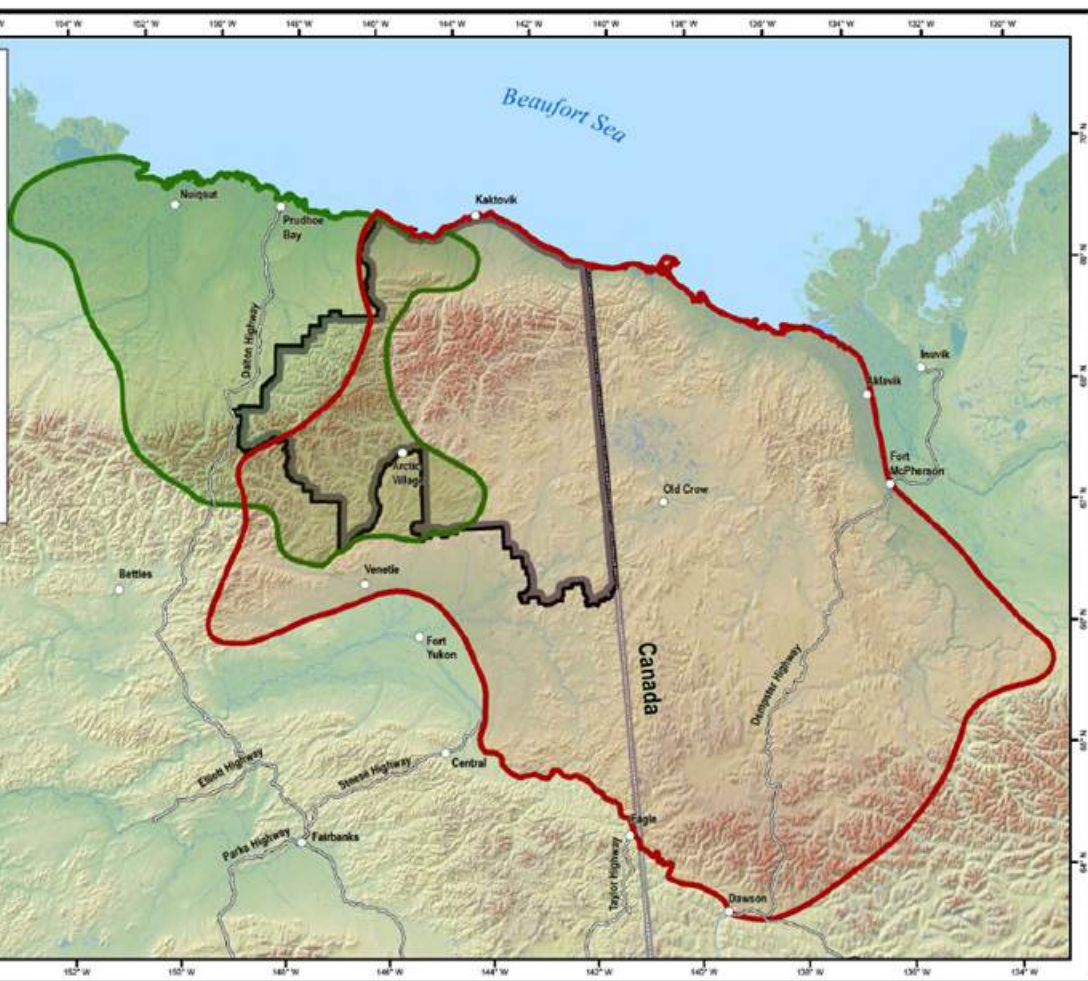
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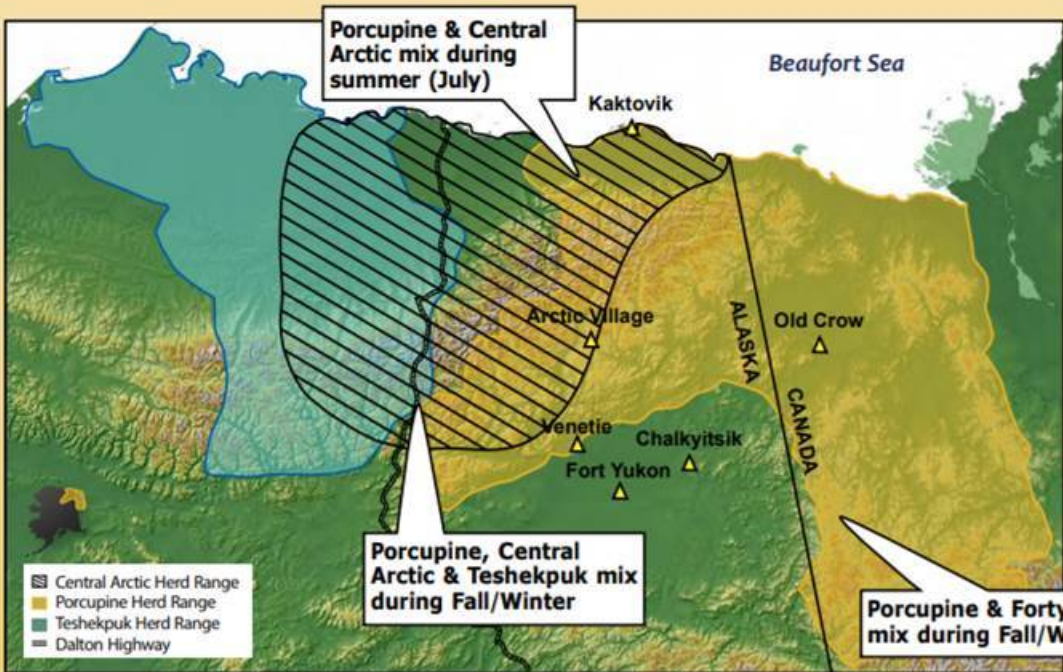
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Alaska Albers Equal Area Cyclic Projection, 1983 North American Datum.





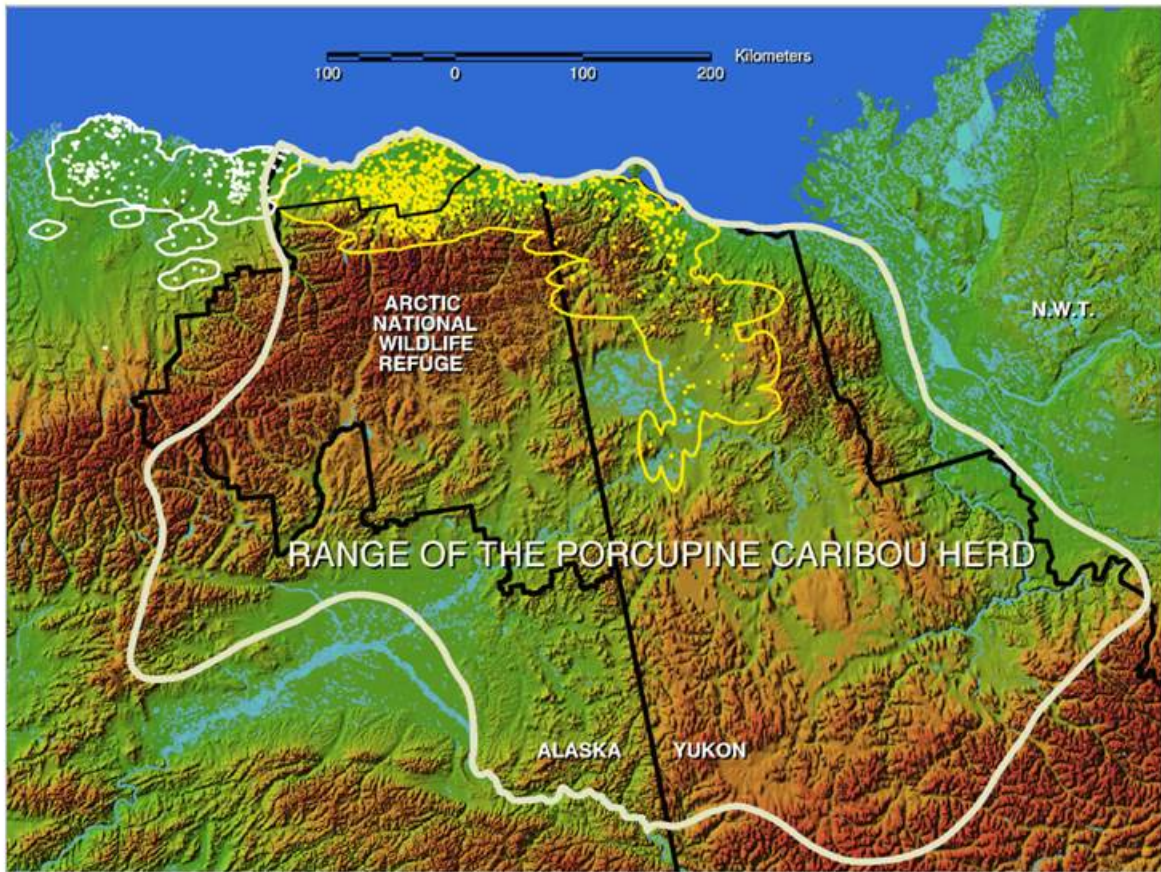


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Map 4-8



Arctic National Wildlife Refuge

Range of the Central Arctic and Porcupine Caribou Herds

Caribou Ranges

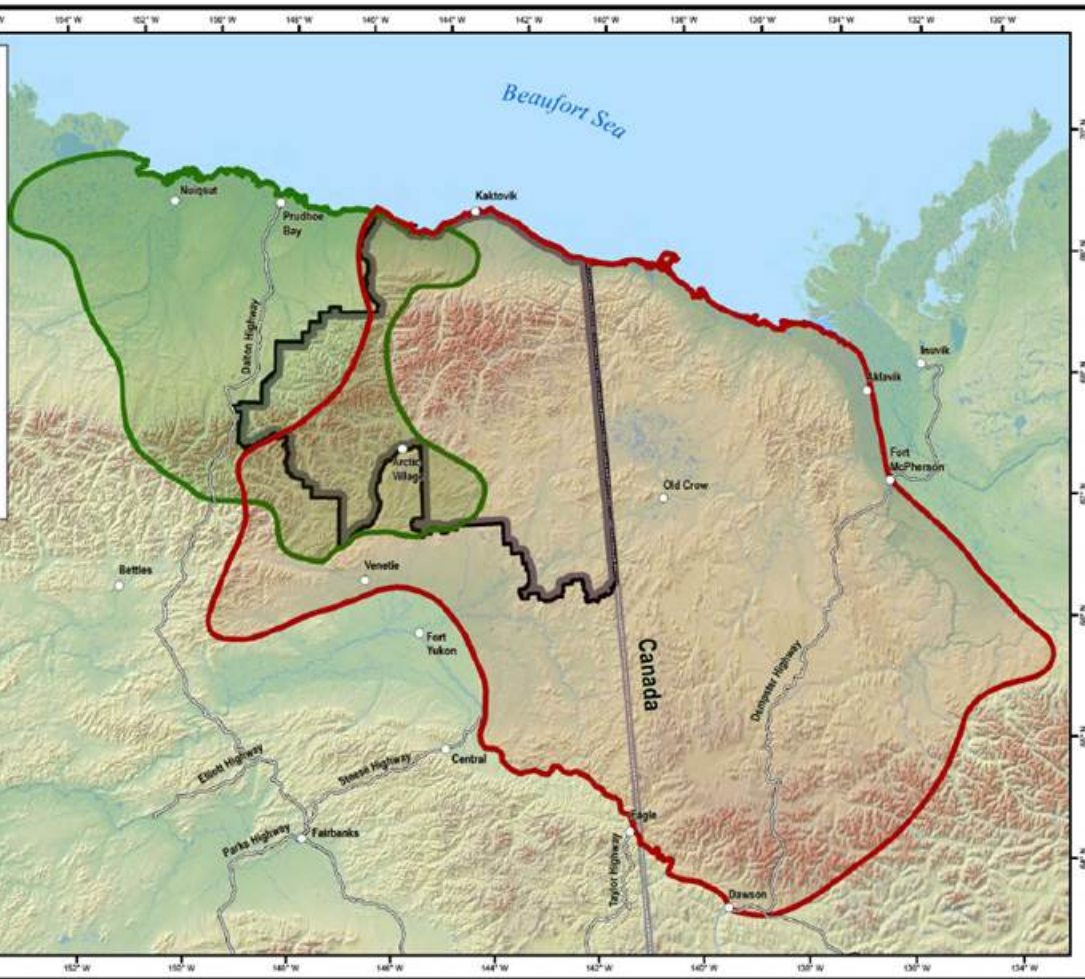
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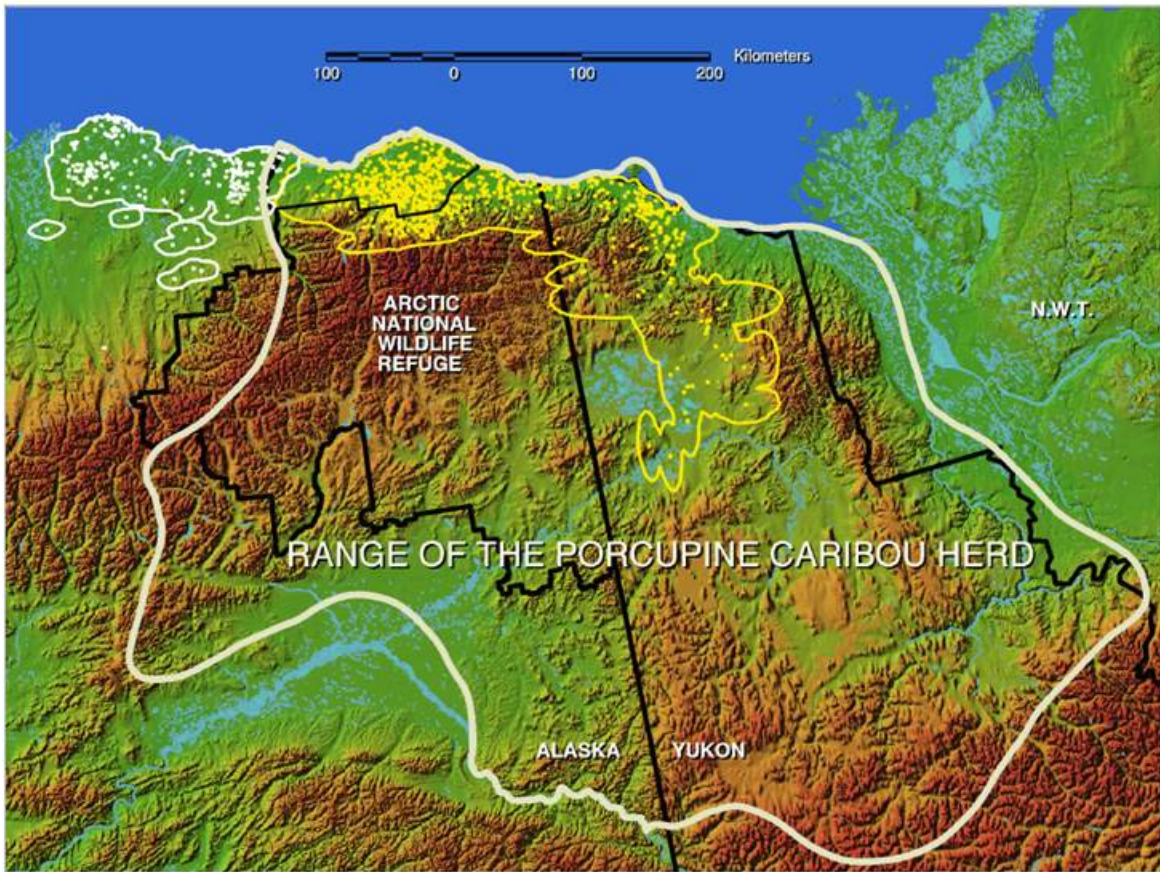


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Arctic National Wildlife Refuge

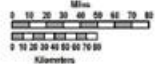
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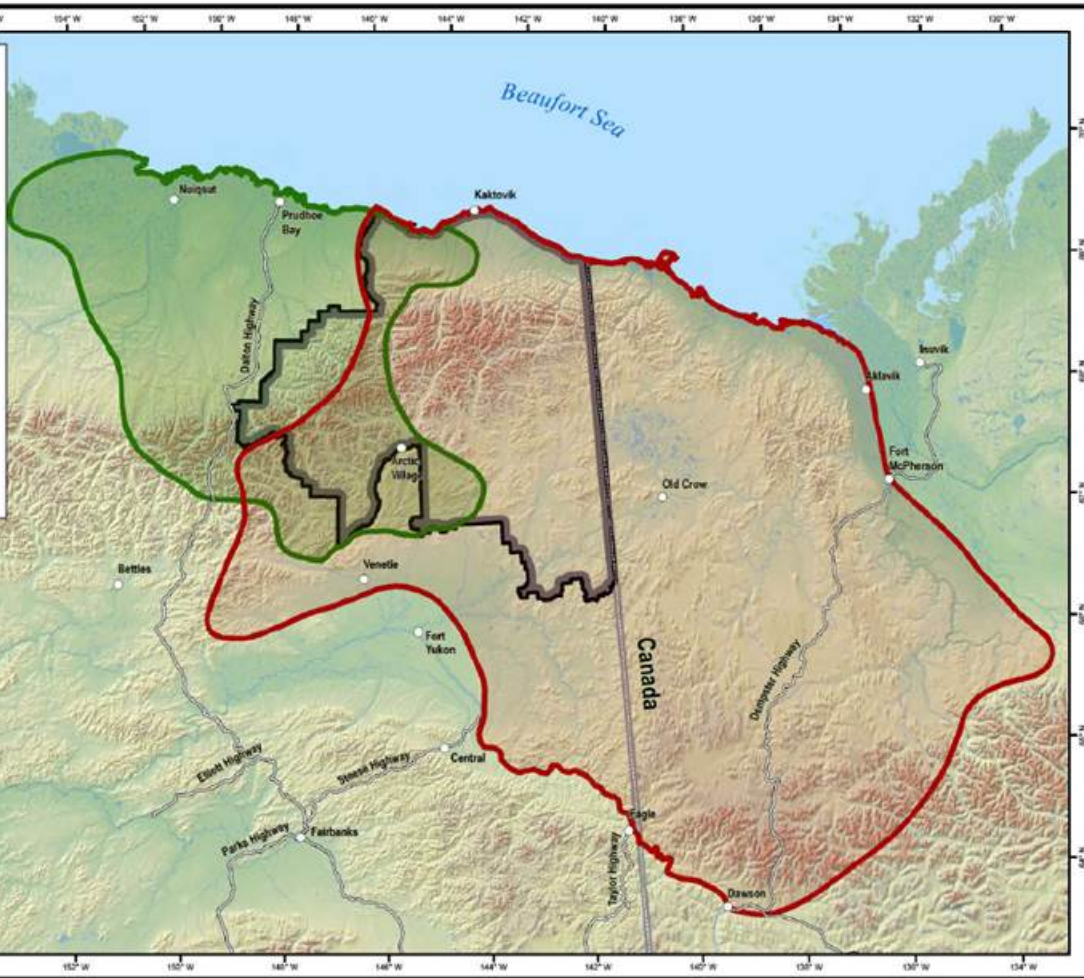
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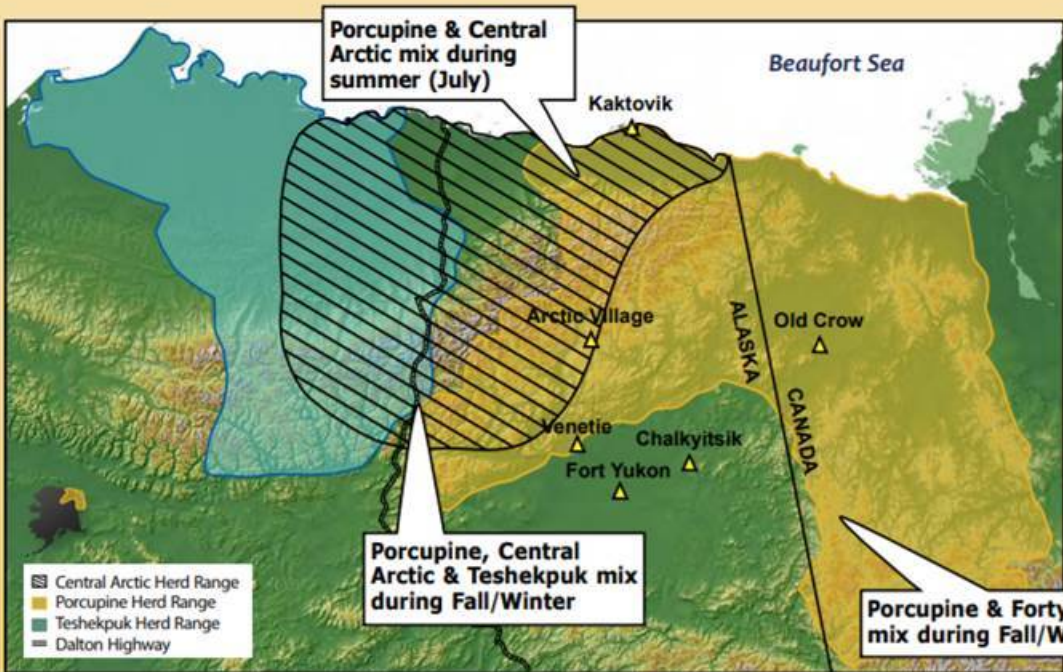
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Alaska Albers Equal Area Conic Projection, 1983 North American Datum.





Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:04 PM

Conversation Contents

Fwd: Scoping Meetings - Coastal Plain

Ted Murphy <t75murph@blm.gov>

From: Ted Murphy <t75murph@blm.gov>
Sent: Fri Mar 30 2018 13:08:59 GMT-0600 (MDT)
To: mnhayes@blm.gov
Subject: Fwd: Scoping Meetings - Coastal Plain

fYI. Any chance?

Sent from my iPhone

Begin forwarded message:

From: "Seidlitz, Joseph (Gene)" <gseidlit@blm.gov>
Date: March 30, 2018 at 11:07:19 AM AKDT
To: Ted Murphy <t75murph@blm.gov>, "Mouritsen, Karen" <kmourits@blm.gov>
Cc: Jill Moran <jcmoran@blm.gov>
Subject: Scoping Meetings - Coastal Plain

Team AK,

Hi! Per Joe and his schedule, please consider having a meeting in Anchorage and/or Fairbanks on Monday May 7th. Joe will not attend the Fairbanks/Anchorage meetings. He does need to be back to DC on May 8th-9th.

Thanks for consideration,
Gene

Gene Seidlitz
ASLM Analyst-Liaison
202-208-4555 (O)
775-304-1008 (C)

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Fri Mar 30 2018 13:18:43 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, Ted Murphy <t75murph@blm.gov>
Subject: Fwd: Scoping Meetings - Coastal Plain

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Seidlitz, Joseph (Gene)** <gseidlitz@blm.gov>
Date: Fri, Mar 30, 2018 at 11:07 AM
Subject: Scoping Meetings - Coastal Plain
To: Ted Murphy <t75murph@blm.gov>, "Mouritsen, Karen" <kmourits@blm.gov>
Cc: Jill Moran <jcmoran@blm.gov>

Team AK,

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775-304-1008 (C)

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:04 PM

Conversation Contents

Evolving List of Information needs for the Arctic Refuge Coastal Plain 1002 area from FWS

Wendy Loya <Wendy_loya@fws.gov>

From: Wendy Loya <Wendy_loya@fws.gov>
Sent: Wed Mar 28 2018 11:40:47 GMT-0600 (MDT)
To: Nicole Hayes <mnhayes@blm.gov>, John Pearce <jpearce@usgs.gov>
Subject: Evolving List of Information needs for the Arctic Refuge Coastal Plain 1002 area from FWS

Nicole and John,

Can you please share upward, especially in preparation for tomorrow's meeting hosted by BLM?

Thank you...Wendy

Dear DOI Colleagues,

The FWS Alaska continues to work on refining the list of information needs for the 1002 area, and the lists are available for viewing at the link below. It is titled: 1002 Arctic Refuge Resource Assessment Table Evolving "Frankensheet"

These spreadsheets are a work in progress (DRAFT), being revised as our understanding of oil exploration, leasing and development increases, as well as our understanding of the information needed to evaluate those activities increases. Studies may be added, changed or removed over time. Notes about how studies might be conducted, who potential partners might be or other information does not reflect a commitment by those agencies, including the FWS if studies included here are the responsibility of another agency.

PLEASE REFRESH THE LINK BEFORE USING THIS WORKBOOK, AS IT IS CHANGING FREQUENTLY

If you would like editing access, please contact me and I will provide that.

<https://docs.google.com/spreadsheets/d/1q3C0tmgDjmYoZjIS2FEg4ulZd4ye0CObCsCmknPMEXs/edit?usp=sharing>

Thank you,
Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

"Pearce, John" <jpearce@usgs.gov>

From: "Pearce, John" <jpearce@usgs.gov>
Sent: Wed Mar 28 2018 12:48:24 GMT-0600 (MDT)
To: Wendy Loya <Wendy_loya@fws.gov>
CC: Nicole Hayes <mnhayes@blm.gov>
Subject: Re: Evolving List of Information needs for the Arctic Refuge Coastal Plain 1002 area from FWS

Thanks for sharing this Wendy. I have just one comment below:

On the Refuge Priorities tab in cell M9, it says, " May be funded through tribal wildlife grant." That column M is for the USGS response and I don't have a record of entering that text for USGS. Maybe that text belongs in cell N9?

Thanks again and see you all tomorrow.

John

John M. Pearce, Ph.D.
Supervisory Wildlife Biologist
Manager, Wetland and Terrestrial Ecosystems Office
U.S.Geological Survey, Alaska Science Center
4210 University Drive
Anchorage, Alaska 99508
Tel. 907.786.7094
Email: jpearce@usgs.gov
<http://alaska.usgs.gov/staff/staffbio.php?employeeid=173>

On Wed, Mar 28, 2018 at 9:40 AM, Wendy Loya <Wendy_loya@fws.gov> wrote:

Nicole and John,

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Thank you,
Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:04 PM

Conversation Contents

Fwd: Engagement with tribes and ANCs on 10-02 lease sale

"Murphy, Ted" <t75murph@blm.gov>

From: "Murphy, Ted" <t75murph@blm.gov>
Sent: Mon Mar 26 2018 09:51:38 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: Engagement with tribes and ANCs on 10-02 lease sale

----- Forwarded message -----

From: **Wackowski, Stephen** <stephen_wackowski@ios.doi.gov>
Date: Mon, Mar 19, 2018 at 9:32 AM
Subject: Engagement with tribes and ANCs on 10-02 lease sale
To: Karen Mouritsen <kmourits@blm.gov>, Ted Murphy <t75murph@blm.gov>, Karen Clark <karen_clark@fws.gov>, Greg Siekaniec <greg_siekaniec@fws.gov>, Lesia Monson <lesia_monson@ios.doi.gov>, Joseph Hayes <joseph.hayes@boem.gov>
Cc: Joseph Balash <joseph_balash@ios.doi.gov>, Jason Larrabee <jason_larrabee@ios.doi.gov>

To avoid getting wires crossed on engagement with Alaska Native stakeholder groups on the 10-02 lease sale, Lesia will set up a shared calendar for your teams to populate with scheduled calls, trips, G2Gs, etc.

As you know ASLM and I have some long standing relationships with various stakeholders up there, and we would rather not hear after the fact about DOI engagement with folks from Kaktovik, Utqiagvik, Arctic Village and surrounding villages/gov't entities.

We will add in our own formal meetings or calls into the calendar for your visibility.

Greg/Karen- I realize you have a lot of day-to-day business in the Arctic Refuge not related to the lease sale--no need to add that to the calendar. However, it would be good for us to understand what the usual order business is with tribes, ANCs, and NGOs in/around the refuge is. Perhaps we should do a call or a visit to the Arctic Refuge office in Fairbanks sooner than later.

Steve Wackowski
Senior Adviser for Alaskan Affairs

Department of the Interior
4230 University Drive, Suite 300
Anchorage, AK 99508
907-271-5485

--

Ted A Murphy
Alaska-Associate State Director
907-271-5076

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Mon Mar 26 2018 19:35:59 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: Engagement with tribes and ANCs on 10-02 lease sale

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Monson, Lesia** <lesia_monson@ios.doi.gov>
Date: Tue, Mar 20, 2018 at 10:26 AM
Subject: Re: Engagement with tribes and ANCs on 10-02 lease sale
To: Joseph Hayes <joseph.hayes@boem.gov>, Greg Siekaniec <greg_siekaniec@fws.gov>, Ted Murphy <t75murph@blm.gov>, Karen Clark <karen_clark@fws.gov>, Karen Mouritsen <kmourits@blm.gov>, Jason Larrabee <jason_larrabee@ios.doi.gov>, Joseph Balash <joseph_balash@ios.doi.gov>
Cc: "Wackowski, Stephen" <stephen_wackowski@ios.doi.gov>

Hi Everyone,

I created and shared a calendar with you. It should appear in your list of calendars as "10-02 Engagement". You have sharing privileges, in case you have staff who will be entering the information on your behalf.

Let me know if you have any questions, or are having trouble accessing or sharing it.

Thank you,
Lesia

Lesia Monson

Department of the Interior
Office of the Secretary
[4230 University Drive, Suite 300](#)
[Anchorage, AK 99508](#)
[907-271-5485](#)

On Mon, Mar 19, 2018 at 9:32 AM, Wackowski, Stephen <stephen_wackowski@ios.doi.gov> wrote:

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[4230 University Drive, Suite 300](#)
[Anchorage, AK 99508](#)
[907-271-5485](#)

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:04 PM

Conversation Contents

Fwd: Airborne snow mapping in 1002 area next month

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Mon Mar 26 2018 19:26:44 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, Serena Sweet <ssweet@blm.gov>, Marlo Draper <mdraper@blm.gov>, Ted Murphy <t75murph@blm.gov>, "Nichelle (Shelly) Jones" <njones@blm.gov>
Subject: Fwd: Airborne snow mapping in 1002 area next month

we should discuss tomorrow. Though I think this is a FWS issue

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Devaris, Aimee** <adevaris@usgs.gov>
Date: Fri, Mar 23, 2018 at 9:36 AM
Subject: Fwd: Airborne snow mapping in 1002 area next month
To: Gregory Siekaniec <greg_siekaniec@fws.gov>, Karen Mouritsen <kmourits@blm.gov>

Hi Greg and Karen,

This is the kind of thing I'm hoping we can discuss next week. This is new work apparently being undertaken by USGS, and it's not clear to me what the relative priority is or how useful it will be. Thus far, I understood the need for snow depth information to be related to water availability in terms of the EIS. Is this snow drift modeling for polar bear den habitat needed for the IHA? I hadn't heard of this requirement before.

Thanks,
Aimee

----- Forwarded message -----

From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Thu, Mar 22, 2018 at 2:56 PM
Subject: Airborne snow mapping in 1002 area next month
To: Todd Atwood <tatwood@usgs.gov>, George Durner <gdurner@usgs.gov>, Patrick Lemons <patrick_lemons@fws.gov>, Craig Perham <craig.perham@boem.gov>

Cc: Drew Crane <drew_crane@fws.gov>, Paul Leonard <paul_leonard@fws.gov>, John Pearce <jpearce@usgs.gov>, Matthew Sturm <msturm1@alaska.edu>

Dear Beaufort Sea Polar Bear Researchers,

Please share with others as needed...

The FWS Arctic LCC has been working with Matthew Sturm (UAF) and Frank Urban (USGS) to identify a preliminary study to gather information on snow depth in the Arctic National Wildlife Refuge 1002 area. Matthew was able to secure funding to fly LiDAR and Structure for Motion imagery over a select area of the coastal plain, and now we are looking for feedback on areas of interest. We see this as an opportunity to have data at three scales for a point in time (April 10-19, 2018): ground measurements, aircraft based imagery and satellite remote sensing data, to give us some quantitative information to inform further discussions. Our goals are two-fold:

1) To work with you all to determine if we can refine existing models or work with to create new models that annually identify snow drifts with highest probability to create potential polar bear denning habitat; and 2) to establish how to monitor for minimum snow required for winter tundra travel to protect taller stature vegetation (tussocks and shrubs) in the 1002 area during exploration and development.

Frank Urban would lead the ground survey team by snowmachine while Matthew and Chris Larson fly. Frank has three remote snow/temperature monitoring stations on the 1002 Coastal Plain, including Camden Bay, March Creek and Niguanik. They have proposed the following for the snow survey, but are looking for feedback on what areas would be of interest:

*Are there any priority areas in the 1002 area that you would want to see mapped for snow depth? with the budget we have, and time, we can cover two **15 by 4 km swaths**. Our current plan is to lay these over areas that we measured in 2014 with some measurements in 2015. One swath would be from Camden Bay south to Marsh Creek; the other from just south of Kaktovik SE to Niguanik. If there is some other location that has high priority please let us know.*

Our field protocols emphasize the collection of a large number of snow depth values, which allow us to proof the structure from motion snow depth maps. we will also collect some snow stratigraphy and density, which will allow us to convert depths to water and to think about over-snow trafficability issues. Other aspects of the snow of interest?

I would be grateful for your feedback based on your knowledge and experience with polar bear denning to identify the what might be useful. I understand that early winter snow depth is potentially more relevant to polar bear denning habitat selection, but I do hope that this information will help us understand general snow depth/redistribution patterns associated with topography. I will also be consulting the Arctic National Wildlife Refuge staff for other insights into terrain variation that could

affect snow depth for winter tundra travel.

Thank you in advance for your time. I know that those of you from USGS are out in the field looking for bears, but I hope you'll have a chance to share your thoughts early next week or let me know what additional information you may need and when you might be able to reply.

Thank you,

Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--

Aimee M. Devaris
Regional Director
U.S. Geological Survey
[4210 University Drive](#)
[Anchorage, Alaska](#)
[907-786-7055](#)

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Tue Mar 27 2018 10:08:50 GMT-0600 (MDT)
To: "Mouritsen, Karen" <kmourits@blm.gov>
Serena Sweet <ssweet@blm.gov>, Marlo Draper
<mdraper@blm.gov>, Ted Murphy <t75murph@blm.gov>,
CC: "Nichelle (Shelly) Jones" <njones@blm.gov>
Subject: Re: Airborne snow mapping in 1002 area next month

Yes, I agree it is a FWS issue.

Nicole Hayes

Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Mon, Mar 26, 2018 at 5:26 PM, Mouritsen, Karen <kmourits@blm.gov> wrote:
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Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

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To: Gregory Siekaniec <greg_siekaniec@fws.gov>, Karen Mouritsen <kmourits@blm.gov>

Hi Greg and Karen,

This is the kind of thing I'm hoping we can discuss next week. This is new work apparently being undertaken by USGS, and it's not clear to me what the relative priority is or how useful it will be. Thus far, I understood the need for snow depth information to be related to water availability in terms of the EIS. Is this snow drift modeling for polar bear den habitat needed for the IHA? I hadn't heard of this requirement before.

Thanks,
Aimee

----- Forwarded message -----

From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Thu, Mar 22, 2018 at 2:56 PM
Subject: Airborne snow mapping in 1002 area next month
To: Todd Atwood <tatwood@usgs.gov>, George Durner <gduerner@usgs.gov>, Patrick Lemons <patrick_lemons@fws.gov>, Craig Perham <craig.perham@boem.gov>
Cc: Drew Crane <drew_crane@fws.gov>, Paul Leonard <paul_leonard@fws.gov>, John Pearce <jpearce@usgs.gov>, Matthew Sturm <msturm1@alaska.edu>

Dear Beaufort Sea Polar Bear Researchers,

Please share with others as needed...

The FWS Arctic LCC has been working with Matthew Sturm (UAF) and Frank Urban (USGS) to identify a preliminary study to gather information on snow depth in the Arctic National Wildlife Refuge 1002 area. Matthew was able to secure funding to fly LiDAR and Structure for Motion imagery over a select area of the coastal plain, and now we are looking for feedback on areas of interest. We see this as an opportunity to have data at three scales for a point in time (April 10-19, 2018): ground measurements, aircraft based imagery and satellite remote sensing data, to give us some quantitative information to inform further discussions. Our goals are two-fold: 1) To work with you all to determine if we can refine existing models or work with to create new models that annually identify snow drifts with highest probability to create potential polar bear denning habitat; and 2) to establish how to monitor for minimum snow required for winter tundra travel to protect taller stature vegetation (tussocks and shrubs) in the 1002 area during exploration and development.

Frank Urban would lead the ground survey team by snowmachine while Matthew and Chris Larson fly. Frank has three remote snow/temperature monitoring stations on the 1002 Coastal Plain, including Camden Bay, March Creek and Niguanik. They have proposed the following for the snow survey, but are looking from feedback on what areas would be of interest:

*Are there any priority areas in the 1002 area that you would want to see mapped for snow depth? with the budget we have, and time, we can cover two **15 by 4 km swaths**. Our current plan is to lay these over areas that we measured in 2014 with some measurements in 2015. One swath would be from Camden Bay south to Marsh Creek; the other from just south of Kaktovik SE to Niguanik. If there is some other location that has high priority please let us know.*

Our field protocols emphasize the collection of a large number of snow depth values, which allow us to proof the structure from motion snow depth maps. we will also collect some snow stratigraphy and density, which will allow us to convert depths to water and to think about over-snow trafficability issues. Other aspects of the snow of interest?

I would be grateful for your feedback based on your knowledge and experience with polar bear denning to identify the what might be useful. I understand that early winter snow depth is potentially more relevant to polar bear denning habitat selection, but I do hope that this information will help us understand general snow depth/redistribution patterns associated with topography. I will also be consulting the Arctic National Wildlife Refuge staff for other insights into terrain variation that could affect snow depth for winter tundra travel.

Thank you in advance for your time. I know that those of you from USGS are out in the field looking for bears, but I hope you'll have a chance to share your thoughts early next week or let me know what additional information you may need and when you might be able to reply.

Thank you,

Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--

Aimee M. Devaris

Regional Director

U.S. Geological Survey

[4210 University Drive](#)

[Anchorage, Alaska](#)

[907-786-7055](#)

Label: "_Coastal Plain"

Created by: mnhayes@blm.gov

Total Messages in label: 776 (219 conversations)

Created: 08-07-2018 at 17:00 PM

Conversation Contents

[EXTERNAL] EIS Process for 1002

Attachments:

/91. [EXTERNAL] EIS Process for 1002/1.1 image003.png
/91. [EXTERNAL] EIS Process for 1002/2.1 image003.png
/91. [EXTERNAL] EIS Process for 1002/3.1 image003.png
/91. [EXTERNAL] EIS Process for 1002/4.1 image003.png

<Andrew.Smith@gov.yk.ca>

From: <Andrew.Smith@gov.yk.ca>
Sent: Wed Apr 04 2018 12:21:28 GMT-0600 (MDT)
To: <mnhayes@blm.gov>
Subject: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Good morning Nicole.

I got your contact information through Mike Sutor here at Yukon government.

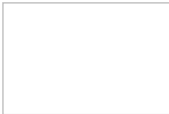
We are looking at how we will be able to participate in the EIS scoping and commenting period for the potential lease opportunities in the 1002 area.

Right now, I am just trying to find some resources that describe that process – stages and timelines, matters to be considered in the scoping, etc. Are there any quick reference guides to your process?

I'm sure I'll have some more questions later on, but for now am just trying to get YG up to speed on how the process will work.

Thanks for your help.

Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Wed Apr 04 2018 12:24:10 GMT-0600 (MDT)
To: Lesli Ellis-Wouters <lellis@blm.gov>
CC: "Murphy, Ted" <t75murph@blm.gov>, Serena Sweet <ssweet@blm.gov>
Subject: Fwd: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Hi Lesli,
Would you like me to respond or should you?

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

----- Forwarded message -----

From: <Andrew.Smith@gov.yk.ca>
Date: Wed, Apr 4, 2018 at 10:21 AM
Subject: [EXTERNAL] EIS Process for 1002
To: mnhayes@blm.gov

Good morning Nicole.

I got your contact information through Mike Sutor here at Yukon government.

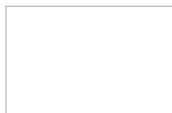
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Thanks for your help.

Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

"Ellis-Wouters, Lesli" <lellis@blm.gov>

From: "Ellis-Wouters, Lesli" <lellis@blm.gov>
Sent: Wed Apr 04 2018 12:26:23 GMT-0600 (MDT)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Subject: Re: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Have you started an interested parties list? You can answer and let him know we can add him to that list as well to check our website for updates. It would be okay to explain the basic NEPA process.

Lesli J. Ellis-Wouters

Communications Director
Alaska State Office
Bureau of Land Management
907-271-4418 | cell - 907-331-8763

On Wed, Apr 4, 2018 at 10:24 AM, Hayes, Miriam (Nicole) <mnhayes@blm.gov> wrote:

Hi Lesli,
Would you like me to respond or should you?

Nicole Hayes
Project Coordinator
Bureau of Land Management
[222 W. 7th Avenue #13](#)
[Anchorage, Alaska 99513](#)
Desk: (907) 271-4354

----- Forwarded message -----

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Date: Wed, Apr 4, 2018 at 10:21 AM
Subject: [EXTERNAL] EIS Process for 1002
To: mnhayes@blm.gov

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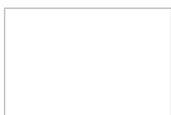
I got your contact information through Mike Sutor here at Yukon government. We are looking at how we will be able to participate in the EIS scoping and commenting period for the potential lease opportunities in the 1002 area.

Right now, I am just trying to find some resources that describe that process – stages and timelines, matters to be considered in the scoping, etc. Are there any quick reference guides to your process?

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Thanks for your help.

Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

Sent: Wed May 09 2018 15:39:19 GMT-0600 (MDT)
To: Andrew.Smith@gov.yk.ca
Subject: Re: [EXTERNAL] EIS Process for 1002
Attachments: image003.png

Hi Andrew,
BLM is in the scoping phase which began April 20, 2018. The National Environmental Policy Act guides the EIS process, and you can obtain more information about meeting times/locations (when announced) at our website which will have the most up to date information.

<https://www.blm.gov/programs/planning-and-nepa/plans-in-development/alaska/coastal-plain-eis>

Thank you,
Nicole

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Wed, Apr 4, 2018 at 10:21 AM, <Andrew.Smith@gov.yk.ca> wrote:

Good morning Nicole.

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We are looking at how we will be able to participate in the EIS scoping and commenting period for the potential lease opportunities in the 1002 area.

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Thanks for your help.

Andrew



Andrew G. Smith
Senior Planner
Executive Council Office | Major Projects Yukon
T 867-456-3857 | Yukon.ca

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:04 PM

Conversation Contents

Fwd: Scoping Meetings - Coastal Plain

Ted Murphy <t75murph@blm.gov>

From: Ted Murphy <t75murph@blm.gov>
Sent: Fri Mar 30 2018 13:08:59 GMT-0600 (MDT)
To: mnhayes@blm.gov
Subject: Fwd: Scoping Meetings - Coastal Plain

fYI. Any chance?

Sent from my iPhone

Begin forwarded message:

From: "Seidlitz, Joseph (Gene)" <gseidlit@blm.gov>
Date: March 30, 2018 at 11:07:19 AM AKDT
To: Ted Murphy <t75murph@blm.gov>, "Mouritsen, Karen" <kmourits@blm.gov>
Cc: Jill Moran <jcmoran@blm.gov>
Subject: Scoping Meetings - Coastal Plain

Team AK,

Hi! Per Joe and his schedule, please consider having a meeting in Anchorage and/or Fairbanks on Monday May 7th. Joe will not attend the Fairbanks/Anchorage meetings. He does need to be back to DC on May 8th-9th.

Thanks for consideration,
Gene

Gene Seidlitz
ASLM Analyst-Liaison
202-208-4555 (O)
775-304-1008 (C)

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Fri Mar 30 2018 13:18:43 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, Ted Murphy <t75murph@blm.gov>
Subject: Fwd: Scoping Meetings - Coastal Plain

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Seidlitz, Joseph (Gene)** <gseidlitz@blm.gov>
Date: Fri, Mar 30, 2018 at 11:07 AM
Subject: Scoping Meetings - Coastal Plain
To: Ted Murphy <t75murph@blm.gov>, "Mouritsen, Karen" <kmourits@blm.gov>
Cc: Jill Moran <jcmoran@blm.gov>

Team AK,

Hi! Per Joe and his schedule, please consider having a meeting in Anchorage and/or Fairbanks on Monday May 7th. Joe will not attend the Fairbanks/Anchorage meetings. He does need to be back to DC on May 8th-9th.

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Gene

Gene Seidlitz
ASLM Analyst-Liaison
202-208-4555 (O)
775-304-1008 (C)

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:04 PM

Conversation Contents

Fwd: Engagement with tribes and ANCs on 10-02 lease sale

"Murphy, Ted" <t75murph@blm.gov>

From: "Murphy, Ted" <t75murph@blm.gov>
Sent: Mon Mar 26 2018 09:51:38 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: Engagement with tribes and ANCs on 10-02 lease sale

----- Forwarded message -----

From: **Wackowski, Stephen** <stephen_wackowski@ios.doi.gov>
Date: Mon, Mar 19, 2018 at 9:32 AM
Subject: Engagement with tribes and ANCs on 10-02 lease sale
To: Karen Mouritsen <kmourits@blm.gov>, Ted Murphy <t75murph@blm.gov>, Karen Clark <karen_clark@fws.gov>, Greg Siekaniec <greg_siekaniec@fws.gov>, Lesia Monson <lesia_monson@ios.doi.gov>, Joseph Hayes <joseph.hayes@boem.gov>
Cc: Joseph Balash <joseph_balash@ios.doi.gov>, Jason Larrabee <jason_larrabee@ios.doi.gov>

To avoid getting wires crossed on engagement with Alaska Native stakeholder groups on the 10-02 lease sale, Lesia will set up a shared calendar for your teams to populate with scheduled calls, trips, G2Gs, etc.

As you know ASLM and I have some long standing relationships with various stakeholders up there, and we would rather not hear after the fact about DOI engagement with folks from Kaktovik, Utqiagvik, Arctic Village and surrounding villages/gov't entities.

We will add in our own formal meetings or calls into the calendar for your visibility.

Greg/Karen- I realize you have a lot of day-to-day business in the Arctic Refuge not related to the lease sale--no need to add that to the calendar. However, it would be good for us to understand what the usual order business is with tribes, ANCs, and NGOs in/around the refuge is. Perhaps we should do a call or a visit to the Arctic Refuge office in Fairbanks sooner than later.

Steve Wackowski
Senior Adviser for Alaskan Affairs

Department of the Interior
4230 University Drive, Suite 300
Anchorage, AK 99508
907-271-5485

--

Ted A Murphy
Alaska-Associate State Director
907-271-5076

"Mouritsen, Karen" <kmourits@blm.gov>

From: "Mouritsen, Karen" <kmourits@blm.gov>
Sent: Mon Mar 26 2018 19:35:59 GMT-0600 (MDT)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: Engagement with tribes and ANCs on 10-02 lease sale

Karen E. Mouritsen
Acting State Director for BLM-Alaska
phone 907-271-5080
cell 202-329-2030

----- Forwarded message -----

From: **Monson, Lesia** <lesia_monson@ios.doi.gov>
Date: Tue, Mar 20, 2018 at 10:26 AM
Subject: Re: Engagement with tribes and ANCs on 10-02 lease sale
To: Joseph Hayes <joseph.hayes@boem.gov>, Greg Siekaniec <greg_siekaniec@fws.gov>, Ted Murphy <t75murph@blm.gov>, Karen Clark <karen_clark@fws.gov>, Karen Mouritsen <kmourits@blm.gov>, Jason Larrabee <jason_larrabee@ios.doi.gov>, Joseph Balash <joseph_balash@ios.doi.gov>
Cc: "Wackowski, Stephen" <stephen_wackowski@ios.doi.gov>

Hi Everyone,

I created and shared a calendar with you. It should appear in your list of calendars as "10-02 Engagement". You have sharing privileges, in case you have staff who will be entering the information on your behalf.

Let me know if you have any questions, or are having trouble accessing or sharing it.

Thank you,
Lesia

Lesia Monson

Department of the Interior
Office of the Secretary
[4230 University Drive, Suite 300](#)
[Anchorage, AK 99508](#)
[907-271-5485](#)

On Mon, Mar 19, 2018 at 9:32 AM, Wackowski, Stephen <stephen_wackowski@ios.doi.gov> wrote:

To avoid getting wires crossed on engagement with Alaska Native stakeholder groups on the 10-02 lease sale, Lesia will set up a shared calendar for your teams to populate with scheduled calls, trips, G2Gs, etc.

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Steve Wackowski
Senior Adviser for Alaskan Affairs
Department of the Interior
[4230 University Drive, Suite 300](#)
[Anchorage, AK 99508](#)
[907-271-5485](#)

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:06 PM

Conversation Contents

Need to get with you about Coastal Plan Drupal page

"Rathbun, Vanessa" <vrathbun@blm.gov>

From: "Rathbun, Vanessa" <vrathbun@blm.gov>
Sent: Thu Mar 01 2018 19:42:07 GMT-0700 (MST)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Subject: Need to get with you about Coastal Plan Drupal page

It's about 2 weeks out from the tentative NOI and we really should have the ePlanning site and Drupal Pages created before that date when a news release will be sent out about it and need to reference the websites.

Trying to be proactive and get it up before we all get slammed more.

Here's what I need:

1 photo of the landscape of the Area. I can't find any on FWS flickr or website of something showing the Coastal Plain area. Everything is south ANWR with Brooks Range mountains.

Project Description: 2 paragraphs around 250 words

NEPA process status? Step 1 Planning Assessment Phase I guessing and then when the NOI is released it goes to step 2.

POC info:

District Manager/Office involved:

Mailing list email address:

ePlanning site link:

URL approvals:

Long URL: <https://www.blm.gov/programs/planning-and-nepa/plans-in-development/alaska/coastal-plain-eis>

Short URL: www.blm.gov/CoastalPlainEIS

Vanessa Rathbun

Alaska 508 Coordinator | [508 Guidance Website](#)

Alaska Visual Information Specialist | Alaska Intranet/External Web Manager

Office of Communications

Bureau of Land Management Alaska

907-271-5727

vrathbun@blm.gov

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Fri Mar 02 2018 10:44:36 GMT-0700 (MST)
To: "Rathbun, Vanessa" <vrathbun@blm.gov>
Subject: Re: Need to get with you about Coastal Plan Drupal page

Yes - Ted wants us to wait on this. Probably AFTER next week but I can start compiling information.

Nicole Hayes

Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Thu, Mar 1, 2018 at 5:42 PM, Rathbun, Vanessa <vrathbun@blm.gov> wrote:

It's about 2 weeks out from the tentative NOI and we really should have the ePlanning site and Drupal Pages created before that date when a news release will be sent out about it and need to reference the websites.

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Short URL: www.blm.gov/CoastalPlainEIS

Vanessa Rathbun

Alaska 508 Coordinator | [508 Guidance Website](#)
Alaska Visual Information Specialist | Alaska Intranet/External Web Manager
Office of Communications
Bureau of Land Management Alaska
907-271-5727

"Ellis-Wouters, Lesli" <lellis@blm.gov>

From: "Ellis-Wouters, Lesli" <lellis@blm.gov>
Sent: Wed Mar 14 2018 19:18:51 GMT-0600 (MDT)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Subject: Fwd: Need to get with you about Coastal Plan Drupal page

Nicole,
We'll take care of putting this together and it won't go live until it's reviewed by everyone.

Lesli J. Ellis-Wouters

Communications Director
Alaska State Office
Bureau of Land Management
907-271-4418 | cell - 907-331-8763

----- Forwarded message -----

From: Rathbun, Vanessa <vrathbun@blm.gov>
Date: Wed, Mar 14, 2018 at 1:24 PM
Subject: Fwd: Need to get with you about Coastal Plan Drupal page
To: "Ellis-Wouters, Lesli" <lellis@blm.gov>

Vanessa Rathbun

Alaska 508 Coordinator | [508 Guidance Website](#)
Alaska Visual Information Specialist | Alaska Intranet/External Web Manager
Office of Communications
Bureau of Land Management Alaska
907-271-5727
vrathbun@blm.gov

----- Forwarded message -----

From: Hayes, Miriam (Nicole) <mnhayes@blm.gov>
Date: Fri, Mar 2, 2018 at 8:44 AM
Subject: Re: Need to get with you about Coastal Plan Drupal page
To: "Rathbun, Vanessa" <vrathbun@blm.gov>

Yes - Ted wants us to wait on this. Probably AFTER next week but I can start compiling information.

Nicole Hayes

Project Coordinator
Bureau of Land Management
[222 W. 7th Avenue #13](#)
[Anchorage, Alaska 99513](#)
Desk: (907) 271-4354

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Short URL: www.blm.gov/CoastalPlainEIS

Vanessa Rathbun

Alaska 508 Coordinator | [508 Guidance Website](#)

Alaska Visual Information Specialist | Alaska Intranet/External Web Manager

Office of Communications

Bureau of Land Management Alaska

907-271-5727

vrathbun@blm.gov

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:09 PM



Conversation Contents

Road map for ANWR drilling gets clearer

Serena Sweet <ssweet@blm.gov>

From: Serena Sweet <ssweet@blm.gov>
Sent: Mon Mar 12 2018 10:56:11 GMT-0600 (MDT)
To: Nicole Hayes <mnhayes@blm.gov>, Serena Sweet <ssweet@blm.gov>
Subject: Road map for ANWR drilling gets clearer

<https://www.eenews.net/energywire/2018/03/12/stories/1060076031>--

Serena Sweet
Acting Deputy State Director
BLM-Alaska, Resources Division
Desk: 907-271-4543
Cell: 907-223-3267

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:09 PM

Conversation Contents

News quotes

"Ellis-Wouters, Lesli" <lellis@blm.gov>

From: "Ellis-Wouters, Lesli" <lellis@blm.gov>
Sent: Tue Mar 06 2018 11:25:25 GMT-0700 (MST)
To: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>, Serena Sweet <ssweet@blm.gov>, Ted Murphy <t75murph@blm.gov>
Subject: News quotes

Speaking at a major oil industry conference in Houston, Texas, on Monday, Sen. Dan Sullivan (R-Alaska) said members of the Trump administration are in Alaska this week to lay the groundwork for drilling in the Arctic Refuge and that the administration might hold the first lease sale for oil and gas development in the Arctic National Wildlife Refuge as early as next year. News reports quoted Sullivan as saying, "It's my hope, and this is a very aggressive timeline, that we would have the first lease sale ... to be sometime in 2019."

Legislation passed in December to open the Arctic Refuge to the oil industry does not require a lease sale until 2021. In response to Sullivan's comments, The Wilderness Society released the following statement from Alaska Regional Director Nicole Whittington-Evans:

"This egregious timeline betrays promises by Sen. Lisa Murkowski and others that lease sales and development would proceed without circumventing environmental analyses. There is simply no way to complete the required environmental reviews, public processes, and tribal consultations in time for leasing in 2019.

"Once again, the Trump administration appears to be racing to sell off America's public lands, and they seem perfectly happy to shortcut normal processes and overlook the concerns of local communities in the pursuit of reckless development," Whittington-Evans said. "This administration cannot possibly evaluate all of the relevant information and make informed decisions about the impacts of oil and gas on the refuge's sensitive coastal plain in such a short amount of time."

Lesli J. Ellis-Wouters

Communications Director
Alaska State Office
Bureau of Land Management
907-271-4418 | cell - 907-331-8763

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:11 PM

Conversation Contents

Fwd: FWS-BLM Weekly Check-in on Coastal Plain 1002

"Draper, Marlo" <mdraper@blm.gov>

From: "Draper, Marlo" <mdraper@blm.gov>
Sent: Tue Feb 27 2018 11:20:30 GMT-0700 (MST)
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>
Subject: Fwd: FWS-BLM Weekly Check-in on Coastal Plain 1002

I am going to call-in since there is a 3pm Willow meeting.

----- Forwarded message -----

From: **Wendy Loya** <wendy_loya@fws.gov>
Date: Tue, Feb 27, 2018 at 8:46 AM
Subject: RE: FWS-BLM Weekly Check-in on Coastal Plain 1002
To: "Miriam (Nicole) Hayes" <mnhayes@blm.gov>, Joanna Fox <joanna_fox@fws.gov>, Tracy Fischbach <tracy_fischbach@fws.gov>, Steve Berendzen <steve_berendzen@fws.gov>, Serena Sweet <ssweet@blm.gov>, Drew Crane <drew_crane@fws.gov>, "Nichelle (Shelly) Jones" <njones@blm.gov>, Marlo Draper <mdraper@blm.gov>, Eric Taylor <eric_taylor@fws.gov>, Stephanie Brady <stephanie_brady@fws.gov>, John Trawicki <john_trawicki@fws.gov>

Good morning everyone,

Today's meeting with BLM for those of your in Anchorage will be in the Engineering Conference Room, in Suite 118.

Please add to today's agenda here: https://docs.google.com/document/d/1WV13_WBiKPJBoyKtdh9GTw5AUXzJXAEZBc73RMTP8p0/edit

Best regards,

Wendy

Dr. Wendy M. Loya,

Arctic Program Coordinator, Office of Science Applications

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.227.2942 (mobile)

-----Original Appointment-----

From: mnhayes@blm.gov [<mailto:mnhayes@blm.gov>] **On Behalf Of** mnhayes@blm.gov

Sent: Monday, February 05, 2018 1:56 PM

To: mnhayes@blm.gov; wendy_loya@fws.gov; joanna_fox@fws.gov; tracy_fischbach@fws.gov; steve_berendzen@fws.gov; ssweet@blm.gov; drew_crane@fws.gov; njones@blm.gov; mdraper@blm.gov; eric_taylor@fws.gov; stephanie_brady@fws.gov; john_trawicki@fws.gov

Subject: FWS-BLM Weekly Check-in on Coastal Plain 1002

When: Tuesday, February 27, 2018 2:00 PM-3:00 PM (UTC-09:00) Alaska.

Where: 1-877-754-9021, participant passcode #1729202

Please send any agenda topics to me by noon each Tuesday. We can have our first weekly check-in next week!

--

Marlo Draper
Branch Chief - Renewable Resources
BLM Alaska State Office
(907)271-5546

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Tue Feb 27 2018 11:22:18 GMT-0700 (MST)
To: "Draper, Marlo" <mdraper@blm.gov>
Subject: Re: FWS-BLM Weekly Check-in on Coastal Plain 1002

Sounds good!

Nicole Hayes

Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Tue, Feb 27, 2018 at 9:20 AM, Draper, Marlo <mdraper@blm.gov> wrote:

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----- Forwarded message -----

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Best regards,

Wendy

Dr. Wendy M. Loya,

Arctic Program Coordinator, Office of Science Applications

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.227.2942 (mobile)

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Sent: Monday, February 05, 2018 1:56 PM

To: mnhayes@blm.gov; wendy_loya@fws.gov; joanna_fox@fws.gov; tracy_fischbach@fws.gov; steve_berendzen@fws.gov; ssweet@blm.gov; drew_crane@fws.gov; njones@blm.gov; mdraper@blm.gov; eric_taylor@fws.gov; stephanie_brady@fws.gov; john_trawicki@fws.gov

Subject: FWS-BLM Weekly Check-in on Coastal Plain 1002

When: Tuesday, February 27, 2018 2:00 PM-3:00 PM (UTC-09:00) Alaska.

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Marlo Draper
Branch Chief - Renewable Resources
BLM Alaska State Office
(907)271-5546

Label: "_Coastal Plain"

Created by:mnhayes@blm.gov

Total Messages in label:782 (223 conversations)

Created: 08-07-2018 at 17:30 PM

Conversation Contents

Interior to move quickly on ANWR leasing — Murkowski

"Burns, Casey" <ctburns@blm.gov>

From: "Burns, Casey" <ctburns@blm.gov>
Sent: Wed Feb 21 2018 11:17:50 GMT-0700 (MST)
To: Marlo Draper <mdraper@blm.gov>, "Kenneth (Alan) Peck" <kpeck@blm.gov>, "Guyer, Scott" <sguyer@blm.gov>, "Geisler, Eric" <egeisler@blm.gov>, "Varner, Matthew" <mvarner@blm.gov>, "Robert (Bob) King" <r2king@blm.gov>, Michael McCrum <mmccrum@blm.gov>, Daniel Sharp <dsharp@blm.gov>, "Miller, Mark" <memiller@blm.gov>, Serena Sweet <ssweet@blm.gov>, "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>, Wayne Svejnoha <wsvejnoh@blm.gov>, Robert Brumbaugh <rbrumbau@blm.gov>, zlyons@blm.gov, "Nichelle (Shelly) Jones" <njones@blm.gov>, Sarah LaMarr <slamarr@blm.gov>, Debora Nigro <dnigro@blm.gov>, "Vosburgh, Timothy" <tvosburgh@blm.gov>, Thomas Bickauskas <tbickaus@blm.gov>, "Goodwin, Randy" <rgoodwin@blm.gov>
Subject: Interior to move quickly on ANWR leasing — Murkowski

Interior to move quickly on ANWR leasing — Murkowski

Margaret Kriz Hobson, E&E News reporter
Published: Wednesday, February 21, 2018

ANCHORAGE, Alaska — Sen. Lisa Murkowski (R-Alaska) said Monday that the Interior Department is moving quickly to offer an oil and gas lease sale in the Arctic National Wildlife Refuge within the next three years, before President Trump's first term ends.

In a speech to an Anchorage business group, Murkowski also noted that Deputy Secretary of the Interior David Bernhardt is planning a trip to Alaska in the coming months to lay the groundwork for working with state residents on a drilling program.

Bernhardt, the department's point person on ANWR leasing, plans to meet with residents of Kaktovik, the only Native village located within the coastal plain of the wildlife refuge.

"The push right now within Interior is to [issue leases] before four years," Murkowski said. "They are working fairly and aggressively to put in place, to lay the groundwork for what comes next ... because once you get those leases out into the hands of those who can then move forward, it's tougher to throw the roadblocks in place."

But Alaska's senior senator warned that environmental opponents are already planning to go to court in an effort to block oil development on the coastal plain.

"We're fooling ourselves to think that we're going to get a free pass on this, that it will not be litigated," she said. "This is Alaska, and this is the oil industry. You pretty much know that it will come our way."

Murkowski, chairwoman of the Senate Energy and Natural Resources Committee, also said she's working on a separate ANWR bill focused on requiring regulators to conduct health impact studies and air monitoring in Kaktovik.

Those provisions were included in her earlier ANWR measures but were removed last month when congressional Republicans voted to open ANWR's coastal plain as part of their sweeping overhaul of the U.S. tax code.

Under Senate rules, "anything that was not directly related to revenue raising, or that was determined to be not substantially necessary, had to be scrapped" from the budget reconciliation bill, she explained.

Now, Murkowski hopes to pass a separate ANWR bill and add it to an upcoming must-pass Senate measure. "As you know, in the Senate, vehicles are what you look for," she said. "And we would look to do that. But in terms of timing, we haven't scheduled anything yet."

New bill 'in the queue'

Murkowski also noted that she's already begun working with Sen. Maria Cantwell (D-Wash.) to draft an updated energy package. That measure, which she described as a "refreshed bill," would include language on cybersecurity, liquefied natural gas exports and renewable energy. It would also incorporate the concerns voiced last year by House lawmakers.

The new bill is "in the queue to be teed up on the Senate calendar," she said.

Last week, Cantwell, the ranking member of the Energy and Natural Resources Committee, released a series of bills that would address grid modernization and security, the energy workforce, and smart building concerns ([Greenwire](#), Feb. 19).

Murkowski and Cantwell are hoping to pair their measure with a congressional infrastructure bill, which would likely touch on similar issues.

But Murkowski's energy bill could face a bumpy road in the House. At the Anchorage business meeting, Alaska Rep. Don Young (R) warned that Cantwell angered House Republicans by

Label: "_Coastal Plain"

Created by: mnhayes@blm.gov

Total Messages in label: 782 (223 conversations)

Created: 08-07-2018 at 17:45 PM

Conversation Contents

Leasing Team

"Brumbaugh, Robert" <rbrumbau@blm.gov>

From: "Brumbaugh, Robert" <rbrumbau@blm.gov>
Sent: Thu Feb 01 2018 13:09:59 GMT-0700 (MST)
To: Miriam Hayes <mnhayes@blm.gov>
CC: "Svejnoha, Wayne" <wsvejnoh@blm.gov>
Subject: Leasing Team

When we get to the point of assigning lease tract numbers to the leases (in preparation of the first lease sale), Carol Taylor (SPV LLE), Gina Kendall (LLE) and Julie McLane (LLE/GIS) would be involved.

--

Rob Brumbaugh
BLM-Alaska Oil and Gas Section Chief
Division of Resources
Bureau of Land Management
222 W 7th Ave., Ste 13
Anchorage, AK 99513
907-271-4429

"Hayes, Miriam (Nicole)" <mnhayes@blm.gov>

From: "Hayes, Miriam (Nicole)" <mnhayes@blm.gov>
Sent: Thu Feb 01 2018 13:34:23 GMT-0700 (MST)
To: "Brumbaugh, Robert" <rbrumbau@blm.gov>
CC: "Svejnoha, Wayne" <wsvejnoh@blm.gov>
Subject: Re: Leasing Team

Ok - thank you!
Nicole

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354

On Thu, Feb 1, 2018 at 11:09 AM, Brumbaugh, Robert <rbrumbau@blm.gov> wrote:

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would be involved.

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Rob Brumbaugh
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Division of Resources
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[222 W 7th Ave., Ste 13](#)
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[907-271-4429](#)