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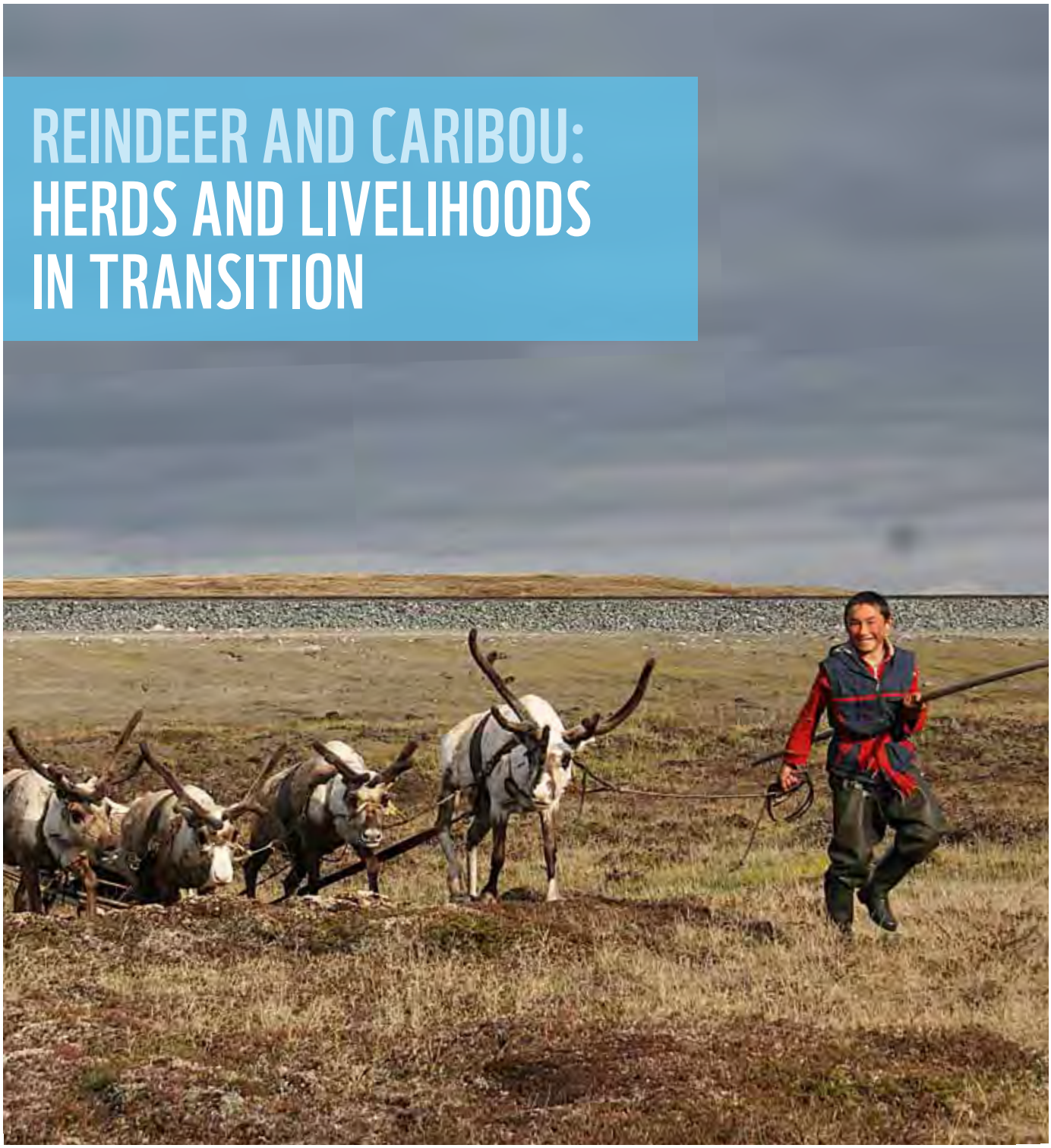
THE CIRCLE

REINDEER AND CARIBOU: HERDS AND LIVELIHOODS IN TRANSITION



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Contents

> "What (herders) find harder to handle, and have little leverage to influence, is the progressive loss of traditional territories and resources they need to survive – grazing lands, campsites, sacred sites, fresh-water fish – to rapidly advancing gas development.
>
> Dr. Bruce Forbes, article page 15

RANGIFERS

Photo: Jeff Kerby

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COVER:
A young Nenets boy leads his reindeer team across the new railway being built on Yamal Peninsula, West Siberia, Russia. The ancient territory of the Indigenous Nenets nomads hold some of the largest untapped natural gas deposits in the world.

Photo: Bruce Forbes, University of Lapland, Finland

Caribou: The Experience

THIS SPECIAL EDITION of *The Circle* contains excellent articles on the science, environmental threats, herd management – or mismanagement – and conservation efforts for caribou and reindeer populations. But what I found to be missing was the sense of what it is like to experience these nomadic animals in the wild. For me, the impressions are humbling and unforgettable.

From a cliff, I have observed some 10,000 animals attempting to cross an Arctic river in spring flood, being washed a kilometre or more downstream as they struggled to reach that far shore. Imagine the pandemonium – cows and calves calling for each other, little ones trying to keep up but often becoming separated, sometimes on opposite sides of the river. Some turned back midstream, while the bulls powered ahead – a successful passage always culminating with that triumphant shower of spray as they stopped to shake off after scrambling out of the current.

Another time I experienced an obviously large herd without ever seeing it, evidenced by the mats of caribou hair everywhere. Further proof of its passing was the muddy gravel churned into rubble by thousands of approaching and exiting hooves.

Through a spotting scope one afternoon, we watched with resignation as a grizzly bear inexorably honed in on a newborn calf, "hidden" in a dip in the hillside by its mother. She could only forlornly pace back and forth as we all witnessed the inevitable.

I have heard the croupy sound of a caribou infected by botflies, its coughs rising above the rush of rapids flowing over the gravel bar where it stood alone, weakly staggering, and likely dying.

Then imagine the peaceful panorama of 5,000 animals spread out as far as the eye can see, in ones and twos on the greening tundra, calmly feeding or resting and ruminating in the midsummer sun.

I was privileged to witness the magnificent spectacle of caribou migrating on ancient trails out of the mountains. They came right at us, down through the foothills, descending through a curtain of willows onto a coastal plain to calve. They poured out of the landscape, emerging one after another seemingly without end. A tide of life seeking renewal.

And how to describe that distinctive, lilting gait of the rangifer? Tireless and perfectly adapted to being on the move, accompanied by the clicking of tendons rubbing over foot bones as wide hooves clack on shoreline stones.

These are the sights and sounds we lose, if we lose caribou. And had I written this even a year ago, that loss seemed like a real possibility for many herds. Since then, as you will read, we have had more bad news. Surveys show that some formerly abundant herds are now in steep decline. Some may have disappeared. But we also appear to have hit bottom with others whose numbers have stabilized and may even be increasing.

These more hopeful trends likely reflect population responses to emergency management measures implemented during today's declines, whether natural or human-caused. These actions have taken collaboration and outright sacrifice by many parties. They have tested not just our commitment to caribou, but to each other.

To be sure, some herds need our help to recover. Now. But in the long run, our goal should be to sufficiently protect their environment so that populations can fluctuate under natural conditions. That way, there may be many animals in some years, fewer in others. But at least there will always be the experience of caribou. ○

IMAGINE THE PEACEFUL PANORAMA OF 5,000 ANIMALS SPREAD OUT AS FAR AS THE EYE CAN SEE, IN ONES AND TWOS ON THE GREENING TUNDRA, CALMLY FEEDING OR RESTING AND RUMINATING IN THE MIDSUMMER SUN

MONTE HUMMEL is President Emeritus of WWF-Canada, and co-author with Dr. Justina C. *Ray of Caribou and the North; A Shared Future*, Dundurn Press, 2008

Photo: WWF Murmansk

Russia's Kamenny gorod, or "Stone Town," gets protected status.

Stone town gets special status

THE ARKHANGELSK regional government in Russia has approved the creation a new National Protected Area of approximately 5000 hectares. "WWF has been working with the regional government on this for nearly three years," says Oleg Sutkaitis, head of WWF Barents Sea Regional Office. "We supported the environmental assessment of Kamenny gorod, or Stone Town, which is a biologically and historically rich area. It is also a popular tourist attraction with its unique, ancient stone formations." The area around the Belaya River is also a spawning place for many fish such as salmon, bulltrout and arctic char, and boasts 78 species of birds, such as lesser white-fronted goose and bewick swans, white-tailed eagle, peregrine falcon and gyrfalcon. The new 'Kamennyi gorod' protected area will also help preserve dwindling reindeer habitats and grazing ranges.

Spill proves vulnerability

WWF –NORWAY CEO Rasmus Hansson says an oil spill off the coast of Oslo, Norway is further proof that oil cannot be effectively cleaned up in ice covered waters. "The oil industry has to stop giving the impression that oil recovery equipment can protect vulnerable resources in harsh weather," he says. The cargo ship spilled roughly 500 tons of fuel oil into the icy fjord when it ran aground in February.

○ http://wwf.panda.org/arctic/news/oilspill

Important Arctic area off limits to oil companies for now

ONE OF THE MOST productive marine ecosystems in the circumarctic is off limits to oil and gas exploration while the Canadian government consults on boundaries for a new national marine conservation area. Lancaster Sound in the Canadian High Arctic has long been considered a prime candidate for conservation, hosting populations of narwhal, beluga and bowhead whales, walrus, polar bear, ringed, bearded and harp seals and migratory birds.

○ http://www.panda.org/arctic/news/lancaster

WWF scores environmental coup in Lofoten and Vesteralen

WWF NORWAY has applauded the Norwegian governments decision to support a petroleum-free future for one of the most significant coastal areas in the country, namely Lofoten, Vesterålen and Senja.

It has been a long political fight to keep the oil-industry out of this unique global marine area and it will now not be opened up for oil and gas, at least if the current government remains in office.

WWF Norway is still deeply concerned, however, about the government opening up for more petroleum activities in the northernmost areas and new areas in the Barents sea as a compromise.

The Norwegian government has decided not to

undertake an environmental impact assessment in the sea areas outside the Lofoten archipelago, which in reality would have been a precursor to oil/gas activities. The decision shows that the government in some areas puts the value of nature in front of the development of oil and shows that it is possible to leave valuable oil resources in the ground.

The decision stands until the next general election in 2013. This shows that the Norwegian government values the concept of particularly valuable and vulnerable areas as a management tool, and this is an important step towards better ecosystem-based management.

WWF hopes this is also the start of a stronger focus for a renewable Norway, and future green jobs. The government has every opportunity to make Norway a global example when it comes to renewable energy.

○ http://wwf.panda.org/what_we_do/where_we_work/arctic/news/?199691

Photo: WWF-Norway

Opponents of drilling in Lofoten at a WWF-organized torchlit march in Oslo.

Photo: Lawrence Hislop, GRID Arendal, www.grida.no/photolib/

Ice from Jakobshavn Glacier, Ilulissat Icefjord, Greenland.

New melt record for Greenland ice sheet

A STUDY JOINTLY funded by WWF, the US National Science Foundation and NASA shows 2010 set new records for the melting of the Greenland Ice Sheet, a phenomenon that is expected to be a major contributor to projected rising sea levels in coming decades. "Sea level rise is expected to top one metre by 2100, largely due to melting from ice sheets," says WWF climate specialist Dr. Martin Sommerkorn. "And it will not stop there – the longer we take to limit greenhouse gas production, the more melting and water level rise will continue."

○ http://www.panda.org/arctic/news/greenland_melt

Book review

■ *The World in 2050 – Four Forces Shaping Civilization's Northern Future*
LAURENCE C. SMITH
336 pages
Dutton Books

THIS IS an interesting book about the circumpolar world mostly because it does not focus solely on the circumpolar world. Smith, a geography professor from the University of California at Los Angeles, first explores demographic trends, climate change, the demand for natural resources and globalization around the world with projected impacts to 2050. The picture that emerges is disturbing for much of the world – parched, overcrowded, chaotic and scorched.

When he gets to the Arctic, the picture ameliorates. An already water-rich area gains even more water (except in Canada's south-central prairies and the Russian steppes). Crushingly cold winters ease off; it's not always shirt-sleeve weather, but the successive weeks of minus 40 become a thing of the past. In addition, the north holds a pool of untapped oil and gas for which the rest of the world is increasingly thirsting.

○ http://www.panda.org/arctic/review_worldin2050

Global warming: Timing is everything

A hundred miles from Greenland's west coast, craggy tundra gives way to an ice sheet that stretches across the horizon. Every June, caribou gather here to give birth to their calves just as they have for over 4,000 years. For almost two decades, Professor Eric Post and his graduate students from Penn State University have preceded this migration with one of their own – arriving before the caribou to set up and conduct one of the Arctic's longest running ecological studies. JEFF KERBY joined the project in 2009.

I SPENT most of last summer camped on the Greenland tundra documenting the lives of caribou, muskoxen, and the plants they both depend upon. With each passing year, this annual ritual offers irreplaceable observations on how species survive in the far north. The overwhelming story these data tell is clear: for life in the Arctic, timing is everything.

JEFF KERBY is a Phd candidate in the Ecology program at Pennsylvania State University where he studies the impacts of climate change on large herbivores and ecological communities in the Arctic. His research background has combined fieldwork and remote sensing approaches to study the ecology and conservation of herbivores in Ethiopia and Mongolia.

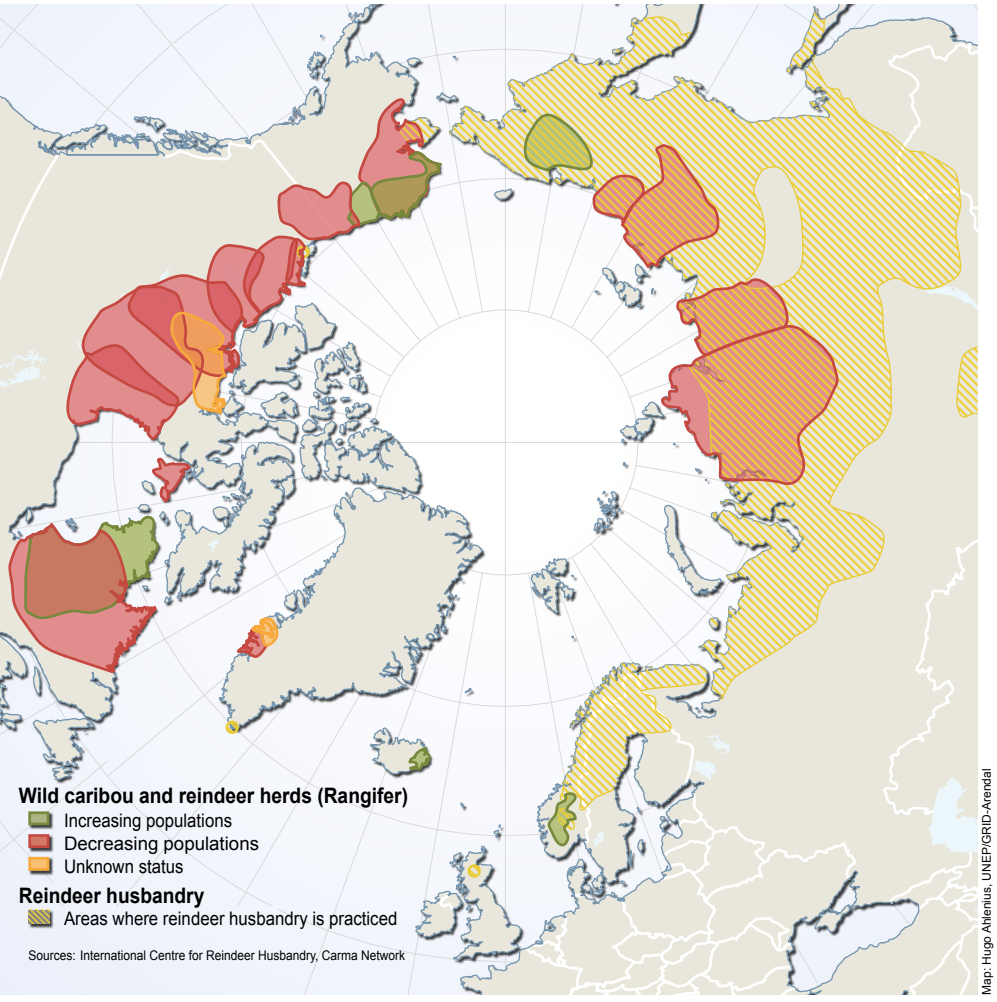
Since this project began in 1993, far northern latitudes have warmed faster than anywhere else on the planet. At our site, this warming has various effects on flora and fauna. For caribou populations, the most consequential of these changes occur everywhere across the landscape, yet to a casual visitor they are almost impossible to spot. Namely, how the timing of insect emergence and plant growth changes each year with the fluctuations in climate. This understanding, and the detailed analyses that support it, is made possible by many summers and thousands of hours of careful observation and record-keeping.

A field-season spent capturing the details of an Arctic summer is a field-season spent in stages. Upon arrival, the landscape is drab, seemingly dead where it is not covered with snow. Devoid of trees, it glows deep into the night under oblique Arctic sunlight. In the evenings when temperatures dip below freezing, the echoes of calving glaciers roll through the valleys, their rumbles a constant reminder of the forces that carved the east-west scars across the landscape. Aside from the lengthening days, the first signs of spring appear when scattered grasses begin emerging from ice-caked soil still firm enough to deflect the testing jab of a pocketknife. In a few short weeks, however, this initial trickle of growth erupts into a green wave that overwhelms the tundra, a flush of nutrients accompanied by the sudden sights and sounds of myriad Arctic fauna. By early June we are treated to the first glimpses of precocious, pale-white caribou calves.

CARIBOU POPULATIONS ARE DECLINING THROUGHOUT THEIR CIRCUMARCTIC RANGE.

Every day until the caribou finish giving birth and leave the area, I note the growth phase of every plant species in a scattered web of plots, some of which are artificially warmed while others are fenced to keep out large herbivores. In between vegetation plots, I pause to count and observe caribou and muskoxen, noting their group-size and makeup, particularly if any calves have been born or have died. My fellow researchers track pulses of insect emergence and growth, and and use sophisticated sensors to to determine carbon dioxide fluxes in the tundra. Each aspect of data collection complements the other, and as the project grows in scope each year, we are able to answer more complex questions that bridge numerous scales of observations, from individual plants to the entire ecosystem.

While the ecological implications of climate change in the Arctic are diverse, consistent narratives emerge from almost twenty years of data collection. For example, nearly all species at the site, from shrubs to mosquitoes, in some way adjust the timing of their growth to the changes in climate. But most importantly from an ecological perspective is that the size of these adjustments differs for most species. Over successive years, these slight differences in timing magnify, thus fundamentally changing the very nature of how certain species interact. Changing species interactions, rather than the direct influence



Map: Hugo Ahlenius, UNEP/GRID-Arendal

of a warmer climate itself, will have the greatest influence on which species persist and which species disappear as the Arctic continues to warm.

Caribou, for example, appear to be in trouble. Their populations are declining throughout their circum-Arctic range, and climate, through its effect on species interactions, is in large part responsible. This holds true for our site, where a mismatch in the timing of plant growth and caribou calving has seen calf survival plummet. Young plants are full of nutrition and are very easy to digest, an ideal food for nursing mothers and recently weaned young that must bulk up before the onset of winter. In warm years, plants emerge earlier, whereas caribou births occur over a very narrow range of dates every year regardless of temperature. This means that after a warm spring, caribou are effectively born after much of summer's nutrition has become locked away inside older plants that are more difficult to digest. If lacking in proper nutrition during these critical early weeks of growth, a caribou calf will struggle to survive.

Mosquitoes also emerge earlier with warmer temperatures and their presence is more than a nuisance to caribou and researchers alike. While not as abundant as mosquitoes in Siberia, where swarms can suck more than five pounds of blood from a single caribou over a summer, caribou in west Greenland still actively seek sanctuary by fleeing to ridge tops where the wind is stronger but the forage is poor. Earlier mosquito emergence means caribou spend more time roaming and less time feeding. Looking back through last summer's field notes, my own frustrated memories with the mosquito swarms resurface. Splotches of blood cover the pages where unfortunate mosquitoes landed as I was shutting the covers, patterns most noticeable from late May through June, inadvertent but precisely dated notes on the progression of an Arctic summer.

Many questions about the future of Arctic ecosystems and communities remain unanswered, but research at this site and others like it provides the essential on-the-ground data needed to make these advances. My own research will continue to focus on the timing of species interactions, both between other Arctic herbivores, such as the muskoxen, and the vegetation communities, but also between this site and others in Greenland. In the coming decades, this increased focus on the timing of ecological interactions, rather than just their severity, will add clarity to the implications of an Arctic that is warming faster than at any point in its recorded history. ○

Santa's reindeers

Saami legend says their nation will die when the god Groma, son of the devil, fires a third arrow into Meandash the man-reindeer he is pursuing. Reindeer appear prominently in Saami folklore and mythology. Part of the Santa Claus myth is believed to be rooted in Saami legend because reindeer regularly graze on and get high from Fly Agaric (*Amanita Muscaria*) toadstools with a red cap and white spots. The reindeer become frisky and leap around after eating the mushrooms, giving rise to the story of Santa's flying reindeer.

Another ancient Saami legend tells of a cursed woman who is transformed into a white reindeer. She wanders the snowfields of the Midnight Sun luring all hunters who cross her path to their deaths. She cannot be stopped by bullets, but the spell is finally broken when her husband attacks and kills the White Reindeer with cold steel.

ighting inertia to conserve caribou herds

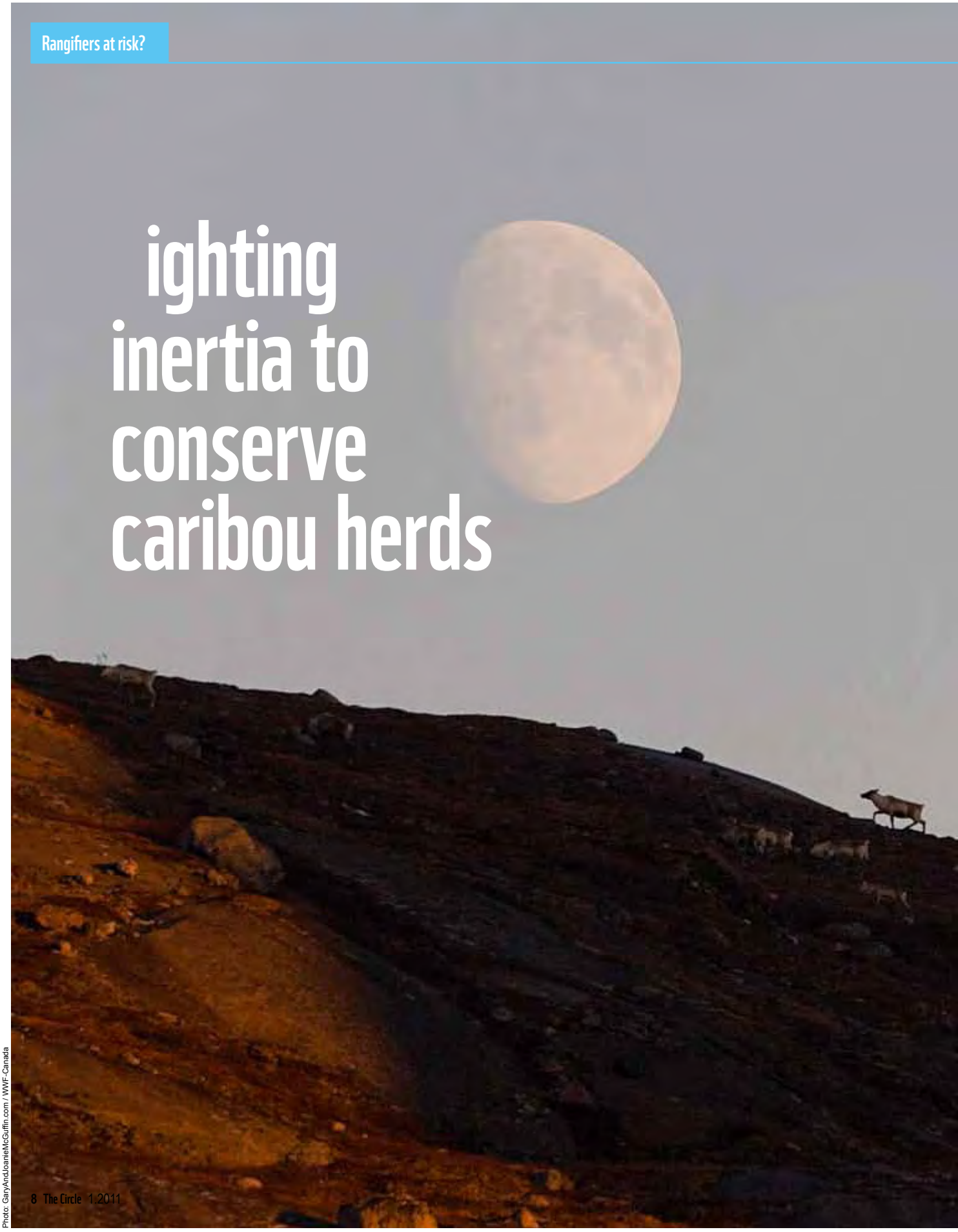


Photo: GaryAndJoanieMcGuffin.com / WWF-Canada

Are wild reindeer and barrens caribou at risk in the Arctic? Without question herds are faced with rapid global warming, increasing industrial development and growing numbers of people encroaching on migratory routes, calving grounds and the very tundra they rely on for survival. Canadian wildlife biologist and internationally recognized caribou expert ANNE GUNN says we do have options to protect these herds if we act quickly to collaborate on innovative strategies for conservation.

WE STILL HAVE time, if we do not waste time because the human foot-print on the Arctic tundra is still relatively light despite the cumulative effects of global warming. Responses to recent declines of caribou herds reveal an awareness of the strength of collaborative conservation. The real question then, is whether we are aware that the time to act, to implement conservation measures, is now.

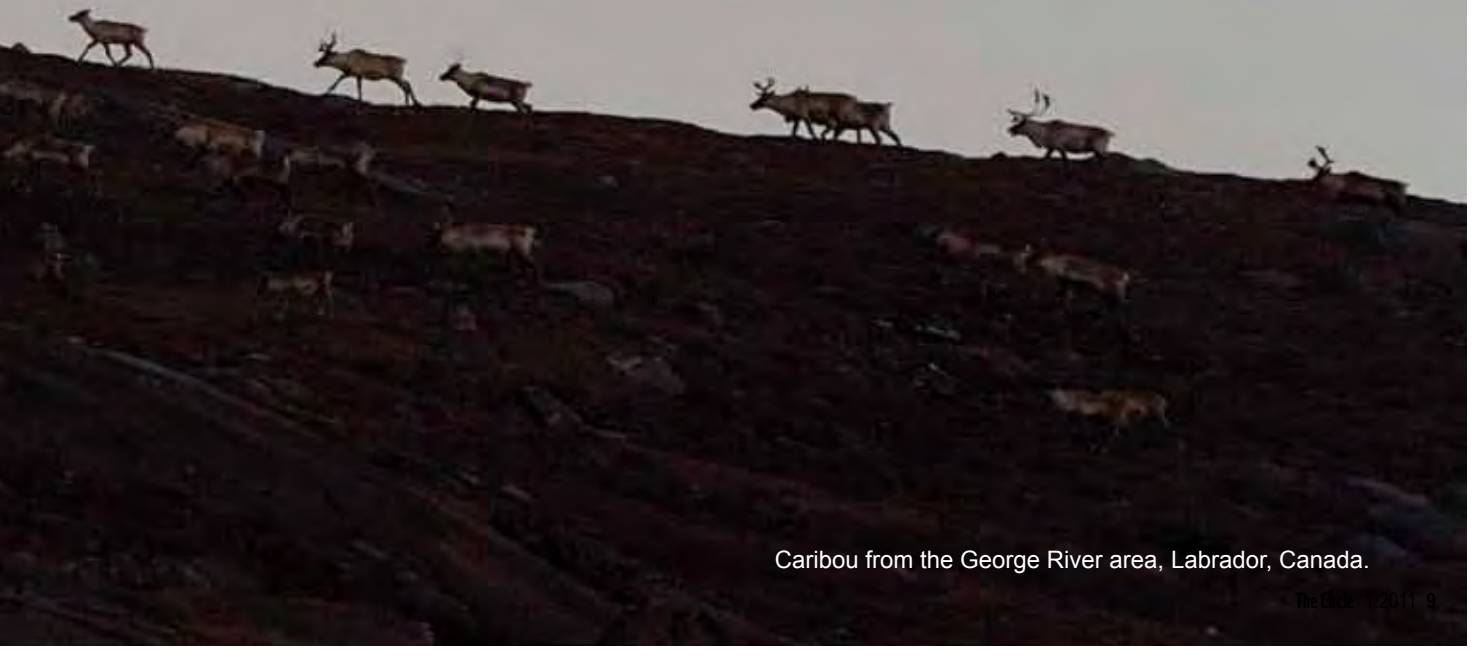
Migratory tundra caribou and wild reindeer are woven into the culture and existence of the Arctic's many Indigenous people. These migratory herbivores underpin much of the tundra's biodiversity through a complex web of relationships. Caribou and wild reindeer, for example, will leave a trail of fecal pellets on lake ice. When the ice melts, the pellets break down and feed mosquito larvae, which, in turn, feed the fish. The adult female mosquitoes will then feed on the caribou's hide if they don't become food for tundra-dwelling birds.

MANAGEMENT INERTIA

In the last 20 years, many herds have declined in Arctic Canada and Russia and, slightly, in Alaska. At least three Canadian herds are at historic lows possibly because of gaps in monitoring. Most herds, however, have stabilized in northern Canada, albeit at low numbers, because government and Indigenous peoples organizations worked collaboratively to restrict hunting.

«CARIBOU AND WILD REINDEER DEPEND ON "SAFETY IN NUMBERS"

Global warming will have far-reaching and complex effects on caribou and reindeer herds. In addition, there are the relatively small but relentless steps of increasing industrialization in the Arctic. The network of roads is creeping northward and the push to exploit oil, gas and minerals is accelerating. Roads inevitably and literally pave the way for pipelines, hydro-electric corridors and increased human presence that disrupt



Caribou from the George River area, Labrador, Canada.

ancient migratory routes. Migration is also diminished or even halted when the numbers of caribou or wild reindeer decline to the point that there are too few individuals to maintain the level of gregariousness essential for migratory behavior. Caribou and wild reindeer depend on "safety in numbers."

COLLABORATIVE PLANING, ACCESS TO INFORMATION ESSENTIAL

Innovative and collaborative planning – the sharing of information and decisions between groups with sometimes divergent interests and expertise – is essential for both maintaining enough caribou or wild reindeer to sustain migratory behavior as well as a landscape for unhindered migratory corridors to the herds' core spaces such as calving grounds.

ANNE GUNN has been studying caribou for more than three decades, spending much of her professional life as a wildlife biologist in Canada's Northwest Territories. She says she was "fortunate to have lived and worked in the Arctic, spending much time with car bou and the aboriginal people who depend on them."

Collaborative planning is already underway and finding acceptance in wild reindeer and caribou conservation in those parts of the Arctic where co-management boards are working with the knowledge and perspectives of First Nations. You will read of one excellent example of this in the following article about the Wek'èezhìi Renewable Resources Board (WRRB), the first ever combined land claim and self-government agreement in in Canada's Northwest Territories defining boundaries, land, resources and jurisdiction for all levels of government.

However, besides consultation with subsistence and commercial hunters, dialogue is also needed with industry well before positions are entrenched during environmental assessment hearings.

Access to information is essential for collaboration. The Internet is transforming the flow of information – even that which was previously hoarded in government files. Sharing information and coordinated approaches is starting but needs strengthening. An example of initiatives underway includes organizations such as CAFF – Conservation of Arctic Flora and Fauna -- which oversees networks like the CircumArctic Rangifer Monitoring and Assessment. CARMA is a collaborative body of co-management boards, university researchers and government agencies that are pooling information, building databases and encouraging standardization of monitoring for wild reindeer and caribou.

Photo: Jeff Kerby

Increased human presence disrupts ancient migratory routes, calving grounds.

"ROADS INEVITABLY AND LITERALLY PAVE THE WAY FOR PIPELINES, HYDRO-ELECTRIC CORRIDORS AND INCREASED HUMAN PRESENCE THAT DISRUPT ANCIENT MIGRATORY ROUTES."

On the global scale, wild reindeer and caribou are less well-served in nations that are not signatories to the Bonn Convention on Migratory Species, an international treaty under the United Nations Environment Program which promotes the conservation of wildlife and habitats. Links with other migratory terrestrial mammal conservation networks for saiga antelope, for example, would foster the synergy of shared ideas. Saiga antelope were once renowned for their huge numbers and migration on the Eurasian steppes but are now restricted to parts of Mongolia, Kazakhstan and Russia.

BUILDING RESILIENT HERDS

A more adaptive and collaborative approach accepting the reality and

uncertainties of climate and increasing human presence should focus on the adaptability of wild reindeer and caribou to build resilient herds that can buffer environmental changes and help create a resilient landscape. For example, young herds with high calf survival and high pregnancy rates are typically resilient to environmental changes.

Yet planning resilient landscapes that are able to withstand changes without losing essential features such as caribou or wild reindeer migration is the most undeveloped aspect of conservation. It requires tiered levels of accessibility through a network of protected areas that consider both land users and wildlife. The seasonal ranges of wild reindeer and caribou often cross jurisdictional boundaries, further complicating the requirements of diverse and legitimate land users. A proactive approach would use the annual range for each herd as the unit for collaborative land-use planning. Through time-sensitive thresholds, levels of acceptable risk to ensuring wild reindeer and caribou access to core seasonal ranges and unhindered migration corridors would be maintained. The emphasis would be on minimizing disturbances caused by human activities and habitat changes especially during calving and post-calving seasons.

But the hurdles to planning resilient landscapes are daunting. Innovative partnerships that inspire and empower will take land use planning to the level needed to create a resilient Arctic landscape.

We have choices. But we have to choose soon so that our legacy is not a quieter and stiller Arctic tundra lacking that breathtaking sea of bobbing antlered heads accompanied by the distinctive smell and soundscape of clicking, grunting, bleating caribou or wild reindeer by the hundreds, thousands and tens of thousands. Without those seemingly endless mass migrations of abundant caribou and wild reindeer, it would not be the Arctic tundra – or at least not the one that was our legacy to protect and nurture. ○

Subsistence harvesting:

Balancing Expectations: The Wek'èezhìi example of herd management

The Tłı̨chǫ people in Canada's Northwest Territories depend on subsistence-based harvesting of wild animals. Fish, moose, waterfowl and small mammals are all hunted to greater or lesser degrees, but none are as important to the Tłı̨chǫ way of life as barren ground caribou.
Both the Bluenose East and the Bathhurst herds have their winter ranges in Wek'èezhìi, and the Tłı̨chǫ people have relied on them for centuries. In recent years the herds have been in decline but in 2009, the Government of the Northwest Territories (GNWT) reported a drastic reduction in the Bathurst caribou herd, from a high of 472,000 in 1986 to 32,000 in 2009. The cause was reported as likely due to increased cow mortality from over-harvesting combined with reduced calf survival.

THE WEK'ÈEZHÌI Renewable Resources Board (WRRB), was established through the Tłı̨chǫ Agreement, signed by the Government of Canada, the Government of the Northwest Territories and the Tłı̨chǫ in 2005. It is the first ever combined land claim and self-government agreement in the Northwest Territories defining boundaries and providing greater certainty regarding land, resources and jurisdiction for all levels of government. It also established the WRRB as a co-management board responsible for the management of wildlife and habitat including forests, plants and protected areas in Wek'èezhìi.
The board consists of eight members, half Tłı̨chǫ citizens appointed by the Tłı̨chǫ Government and half made up of territorial and federal government appointees.

When making decisions, the WRRB is mandated to consider the inter-relatedness of wildlife, land and people, conservation, the precautionary principle and use of the best information available. The Tłı̨chǫ agreement requires the Board to consider both science and traditional knowledge in its decision-making. It promotes a "parallel process" for research and monitoring programs considering both Tłı̨chǫ knowledge and science to be conducted simultaneously and then reported to the WRRB. The WRRB is then able to make balanced decisions supporting the Tłı̨chǫ philosophy of *"Strong Like Two People"*.

To allow the Bathurst herd to recover,

the GNWT and the Tłı̨chǫ Government submitted a joint management proposal to the WRRB in November 2009 and a revised joint management proposal in May 2010 proposing limitations to all aboriginal and non-aboriginal harvesters. Following a required Proceeding, including public hearings, the WRRB concluded that there is a conservation concern for the Bathurst caribou herd and that management actions – including harvest restrictions – are vital for herd recovery

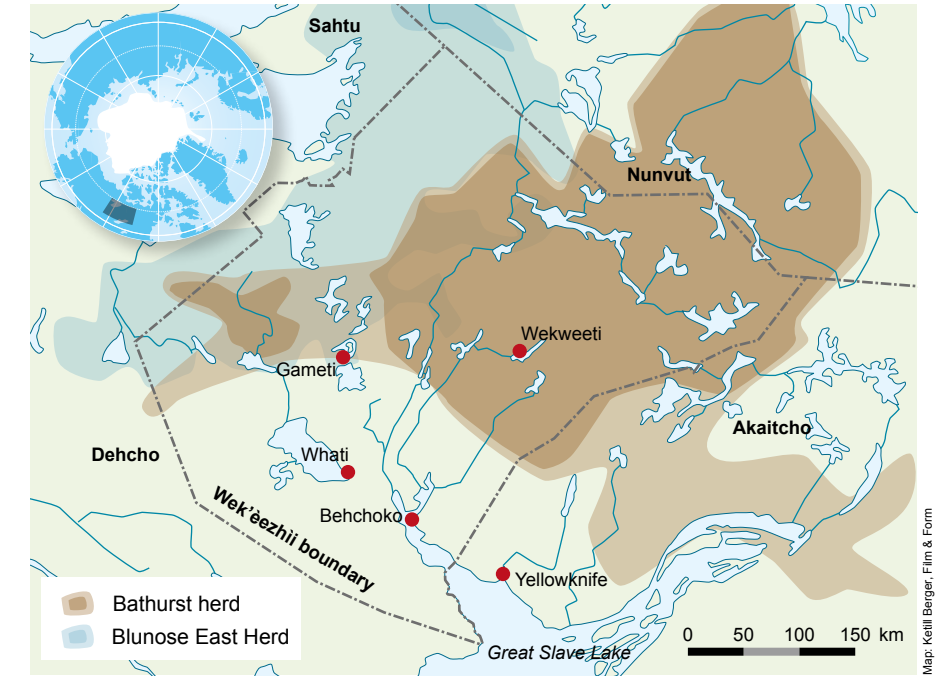
JODY SNORTLAND Pellissey has lived in the Northwest Territories for more than a decade. She has a degree in Environmental Science and a certificate in Wildlife Technology. Following ten years as Executive Director of the Sahtu Renewable Resources Board, Jody has been the Wek'èezhìi Renewable Resources Board's Executive Director since January 2010.

KARIN CLARK has lived in the Yukon and Northwest Territories for the last 23 years with a short stint down south studying ecology. She has worked in environmental consulting and as a wildlife technician and environmental assessment specialist with the Government of the Northwest Territories. Karin is now the wildlife management biologist with the Wek'èezhìi Renewable Resources Board.

In its final report to the GNWT and Tłı̨chǫ government in 2010, the WRRB outlined 60 recommendations related to monitoring and management actions required for the herds. The board recommended the establishment of a harvest target of 300 Bathurst caribou, selective towards bulls. In addition, all commercial, outfitted, and resident harvesting in Wek'èezhìi was closed. The Board further recommended detailed scientific and Tłı̨chǫ knowledge monitoring actions, conservation-education programs as well as the development and implementation of a Bathurst caribou management plan.

The WRRB, Tłı̨chǫ Government and GNWT are now working collaboratively to implement the recommendations, primarily in remote Indigenous communities. Subsistence lifestyles are fraught with times of plenty and times of scarcity, so adapting to caribou abundance cycles is not new to the Tłı̨chǫ. Unfortunately, government-imposed restrictions on caribou harvest are also nothing new. What is new in this case is that the Tłı̨chǫ people themselves, through their own government and a legislated co-management process, have been a part of recognizing and assessing the situation and developing a solution all the way through to making it work on the ground.

The WRRB recommended conservation measures based on a 'snapshot' in time using information from 2009 as the baseline for decision-making. But the situation is dynamic and the board has to adapt to changes while managing public expectations. New information was brought forward based on aerial surveys of the Bathurst herd calving ground in spring 2010. The information suggests that the Bathurst herd has potentially 'bottomed out' but there is no statistical difference between the 2009 and 2010 data. However, the public will interpret that new data to mean the herd is recovering. Stakeholders may expect an increase or removal of the current harvest target of 300, an increase in or removal of the allowable harvest of cows, a reinstatement of resident, sport and commercial harvests and possibly a decrease in support for comprehensive scientific and Tłı̨chǫ knowledge monitoring programs. From a biological standpoint, there is no sustainable harvest of a declining herd, yet there are expectations for harvest to meet subsistence needs. The challenge for the WRRB and other co-management partners is how to balance stakeholder expectations with the need to allow the recovery of the herd. ○



Map: Ketill Berger, Film & Form

A lesson in sharing

North American First Nations folklore says the Barrens Caribou herds became so large that they threatened the existence of all the plants and other creatures that lived in the Barrens. When the caribou refused to move or share, the other animals asked the Creator for help. Since that day, swarms of mosquitoes and flies force the caribou to move to other pastures and so we witness one of the longest yearly migrations of animals on earth.

Protecting wild reindeer in Siberia

The northern parts of Western Siberia contain gigantic deposits of natural gas. In particular, the Yamal, Tazovsky and Gydansky peninsulas have large gas fields that supply most of the demand for natural gas in European Russia, Central, and Western Europe. Here, LEONID BASKIN, TOBIAS KUEMMERLE, and VOLKER C. RADELOFF speak to the critically urgent need to identify, protect and preserve reindeer migratory routes and calving grounds that are threatened by industrialization.

BEFORE 1964, when the first gas fields were discovered, the remote Yamal, Tazovsky and Gydansky peninsulas were virtually untouched and pristine. For centuries, the only land use was by four Indigenous groups – the Nentsy, Entsy, Khanty, and Kety – who have practiced reindeer herding, hunting, and fishing for centuries.

In decades past, wild reindeer were still thriving in these areas. The development of infrastructure and settlements during the natural gas boom in this region was favorable for domestic reindeer herders, because they suddenly had access to larger markets while the demand for reindeer products also increased. As a consequence, the number of herders tripled while the number of domestic reindeer doubled with numbers peaking at 650,000.

However, the gas boom caused wild reindeer herds to collapse and many are now under imminent threat of being wiped out. There are three reasons for these declines. The first was poaching and the destruction of reindeer pastures. Many of the newcomers to the region in the wake of the development of the gas industry were much less connected to the natural environment of this unique region and lacked an understanding of its vulnerability. That resulted in an overuse of natural resources, and their often unintentional destruction. The other reason for decline were the gas pipelines and roads that sometimes caused severe fragmentation of reindeer herd ranges and interrupted traditional migration routes.

CONSERVATION URGENTLY NEEDED

During the annual cycle of reindeer migration, the calving grounds – those places where reindeer find good conditions for birthing and calf survival during their first three weeks – play a critical role in the survival of wild reindeer populations. Calving grounds are unique in many aspects. Reindeer prefer them to be at least 50 kilometres away from the forest line, an anti-predator strategy to avoid wolves, for example, which typically spend the summer in the forest. Reindeer also favour hilly places for calving, because the snow melts sooner in those places. Moreover, gentle slopes appear to be an important characteristic for reindeer calving grounds.

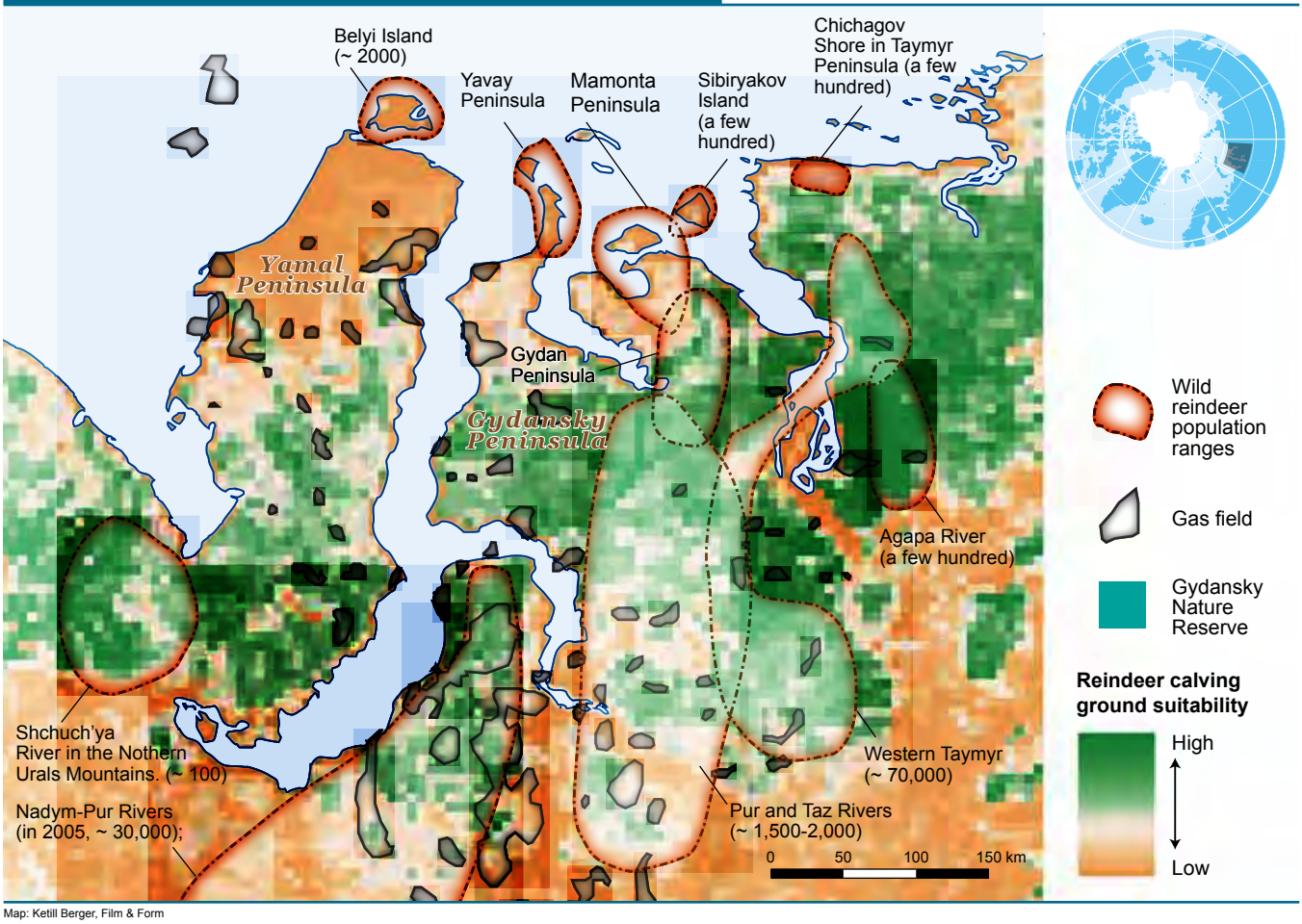
As the exact locations of many rein-

Following university, **LEONID BASKIN** was director of a reindeer farm in Kamchatka. He is widely published on the subject of reindeer ecology, behavior, husbandry and populations. Since 1994 he has been chief scientist at the Institute of Ecology and Evolution, Russian Academy of Sciences

TOBIAS KUEMMERLE holds a Ph.D. in Geography and is currently a researcher at the Potsdam Institute for Climate Impact Research, Germany. His research now focuses on Eastern Europe and the former Soviet Union to explore how the drastic changes in land use and natural resource exploitation have affected the region's wildlife populations.

VOLKER C. RADELOFF holds a Ph.D in Forest Ecology and Management. He now teaches Forest and Wildlife ecology at University of Wisconsin – Madison. His main scientific interests are the use of remote sensing methods in evaluating the impact of land use changes on biodiversity.

Wild reindeer population ranges and reindeer calving ground suitability index



Map: Ketill Berger, Film & Form

deer calving grounds are not known, partly because some populations are now reduced to very low numbers, we used species distribution models and a set of known calving grounds to study calving ground characteristics and to predict calving grounds across the region. Our map shows that areas suitable for calving may be more widespread than previously thought, shedding new light on calving grounds of populations that were not known before. For example, our results suggest that the Nadym and Pur River population migrates north after wintering and birth their young in the hilly areas of the Tazovsky Peninsula. These likely calving grounds are also the site of the largest gas fields in the region. Conservation action to safeguard and restore these populations of wild reindeer is urgent. Our first mapping of calving grounds in the north of Western Siberia shows potential conflicts between reindeer conservation and industrial activity. The solution could be a nature reserve in Tazovsky Peninsula similar to that in the Arctic National Wildlife Refuge in Alaska, where industrial activity is limited for three to five weeks during reindeer calving and where the coexistence of the oil industry and reindeer populations appears at least so far to be successful. ○

Productive meatings

Rival gas producers Russia and Qatar have found common ground over reindeer meat. Reuters reports Russia has promised to export and butcher reindeer meat according to Muslim dietary law. The news wire says exporting halal reindeer meat to the desert kingdom first surfaced when the governor of the USSR's Arctic Yamal Nenets region was in Qatar for investment ta ks. "We told the Qatari leadership that we don't only have oil and gas. We also have reindeer. And then a She kh asked, 'is reindeer halal? Can Muslims eat it?' It turns out they can," Yamal's governor Dmitry Kobylkin told Reuters. Upon returning home to Russia, Koby kin arranged for ritual Islamic slaughter and trial production of 1,000 cans of halal reindeer meat. "Our plan is to build a separate slaughter house, canning and sausage factory," says Sergei Uramayeve, a spokesman for the Reindeer Co.

A lesson in global warming and gas exploitation

The last several years have seen an explosion in public awareness of the potential impacts of Arctic climate change. Some regions are already experiencing a variety of effects, ranging from new species of fish in their waters to increased shrub abundance on reindeer pastures. Many residents and scientists have concluded that we are in the midst of a warming phase outside the range of personal experience and historical measurements of temperature, precipitation, sea level and sea ice extent. However, in our rush to anticipate and mitigate or adapt to a warmer North, we risk overlooking an important disturbance regime that already presents greater direct threats to people and reindeer than climate change. BRUCE FORBES writes that hydrocarbon extraction from Arctic regions is undergoing a major surge as prices for oil and gas have made even the most remote fields locked in permafrost or sea ice economically recoverable.

FEW PEOPLE are aware of the scale of massive untapped gas deposits, such as those in Northern Russia.

The largest semi-domestic reindeer herds in modern Russia are managed by nomadic Nenets, an Indigenous people whose territory straddles the Polar Urals and whose herds number some 800,000 animals. Their situation is worth a closer look.

The Yamal Peninsula, at the northern edge of Russia's West Siberian Plain has been both warming and undergoing extensive gas development in recent decades. In the course of their annual migrations between the winter lichen grounds near treeline and summer pastures on the Kara Sea, herders travel hundreds of kilometres. They are encountering increasingly intrusive infrastructure associated with gas extraction while coping with more frequent and intensive extreme weather events. These include earlier thawing in spring, later freeze-up in autumn, excessive heat in summer and warmer winters.

"HERDERS COMPLAIN THAT GAS WORKERS ARE POACHING FISH, BIRDS AND EVEN OCCASIONAL REINDEER."

PROGRESSIVE LOSS OF TRADITIONAL TERRITORIES

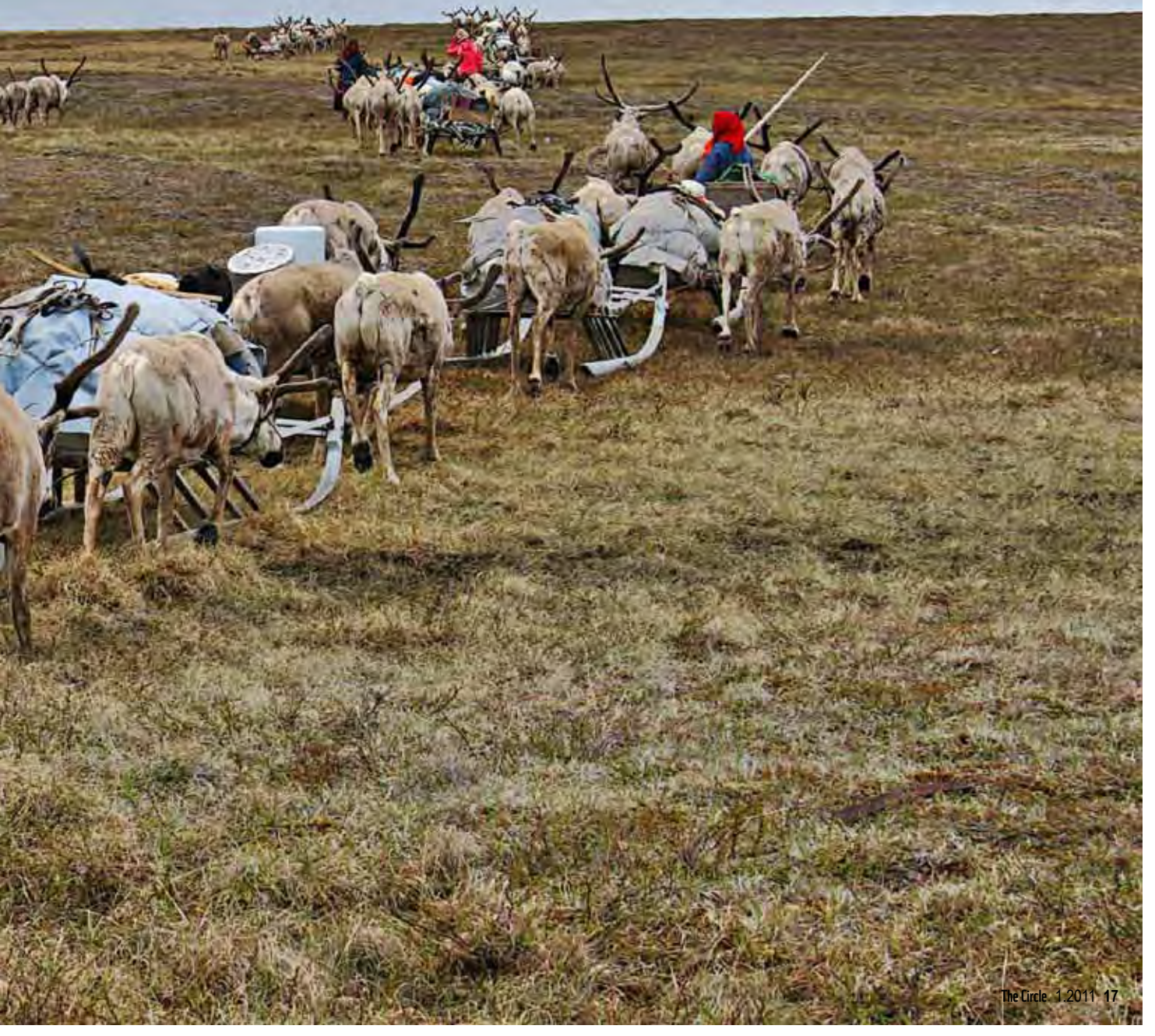
When rain falls on snow in winter and refreezes, reindeer have to struggle to reach fodder at a time when herds al-

ready have overall low energy reserves. This is often cited among scientists as a major concern for *Rangifer* populations and indeed herds on Yamal have lost up to 25 per cent of their animals as a result of successive freeze/thaw conditions in recent years. So far herders consider such losses within the normal range of what they have dealt with historically and accept this. What they find harder to handle, and have little leverage to influence, is the progressive loss

"THE SIGNALS OF A WARMING CLIMATE HAVE BECOME UNDENIABLE AND THE GAS DEVELOPMENT IS SPREADING RAPIDLY."

of traditional territories and resources they need to survive – grazing lands, campsites, sacred sites, freshwater fish – to rapidly advancing gas development. For the Nenets, fish still constitute an essential source of protein for maintaining a nomadic livelihood, particularly during the long summer migration.

Modern hydrocarbon fields have greatly reduced their footprint over the past 30 years or so. Unfortunately, Russia still lags far behind the West in its efforts to reduce the number and extent of direct and cumulative impacts, as enforcement tends to be lax. This is despite relatively progressive laws on paper for mitigation and compensation. On Yamal it is



still distressingly common to see things like large sand quarries with no apparent efforts at revegetation and off-road vehicles with tank tracks tearing up the tundra. Herders complain that gas workers are poaching fish, birds and even occasional reindeer. They observe that feral dogs coupled with loud noise, toxic spills and random trash left behind all threaten the health and mobility of their herds. Herders also note that as soon as the new railway line linked up to the large Bovanenkovo gas field, fish migrated away from lakes and streams in the vicinity of the transport corridor, they believe because of the strong subsurface vibrations emitted by heavy train traffic. Administrators are mostly aware of these and other problems and vow to improve the record of prevention and remediation. Yet the sheer scale of the Yamal enterprise - with its huge pipelines to Europe slated to begin production in 2013 and employing thousands of new workers – may soon overwhelm those state-owned and private herding units that share the most affected territories.

BRUCE FORBES is Professor of Global Change at the Arctic Centre, University of Lapland, Finland. His research emphasizes social-ecological systems and resilience. Since1991 he has conducted participatory fieldwork among the Nenets people on Russia's Yamal Peninsula on impacts of industrial development and climate change.

THERE IS AN URGENT NEED FOR MORE FRANK AND OPEN COMMUNICATION BETWEEN HERDERS, WORKERS AND DECISION MAKERS.

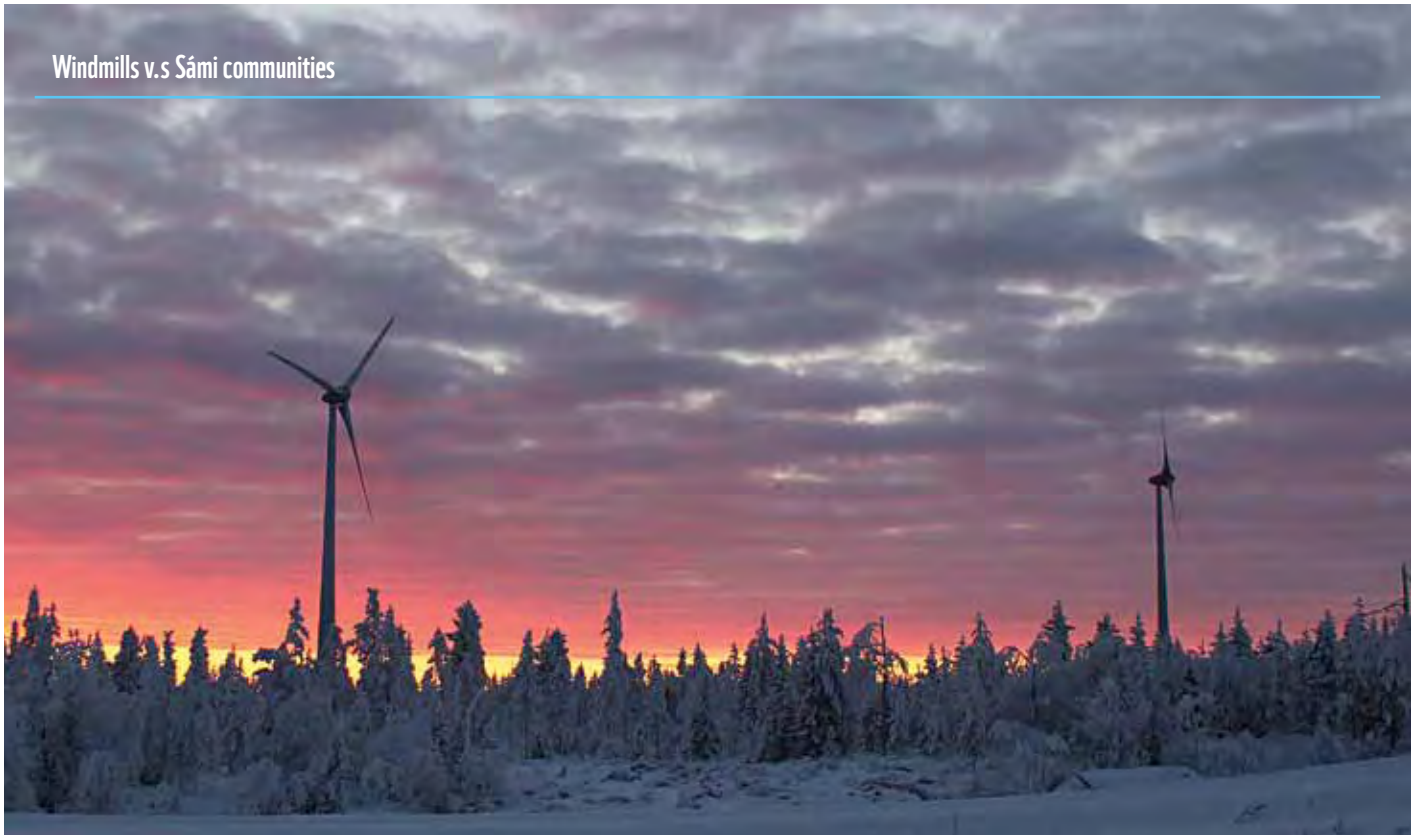
Through our extensive field research on Yamal, my colleagues and I have found its tightly linked social-ecological system to be remarkably resilient. Over the past 20-30 years the populations of both herded animals and nomadic Nenets have been increasing steadily, even though there have been tangible incentives for people to move into settlements and cities. Interestingly, for the past half-century scientists have repeatedly warned that Yamal's tundra pastures are heavily 'overgrazed' and the reindeer populations are routinely predicted to crash. During this same time period, the signals of a warming climate have become undeniable and the gas development is spreading rapidly.

MEANINGFUL CONSULTATION SORELY LACKING

Given this potent cocktail of threats, we must ask where do the real risks lie if Nenets and their herds are to thrive in the 21st century? There is no one answer, given the myriad manifestations of rapid social and environmental change. However, the Nenets say meaningful consultation is sorely lacking, alongside stricter enforcement of existing laws governing hydrocarbon extraction. Successful adaptation to both climate change and industrial development requires not only relatively unhindered access to lands and waters, but conservation of the ecological conditions that allow fish, wildlife and reindeer populations to remain viable. Nenets have been conscious and effective stewards of their territories for centuries. Scientists and administrators have much to learn from them as the open tundra becomes ever more fragmented and the space for nomadism inevitably contracts. There is an urgent need for more frank and open communication between herders, workers and decision makers. Nenets have been careful observers during the gas exploration and construction phases on Yamal and have excellent ideas on how to manage a future in which reindeer herding and gas production can co-exist. At this point what they need most is to be genuinely listened to in the fast-paced dialogue surrounding development. ○

Foto: Gazprom

Gas treatment unit No.9 at Kharvutinskaya area of Yamburg field.



GREEN COLONIALISM?

The Swedish government has recently granted approval to build what is being touted as one of the biggest wind farms in the world. The Markbygden wind park in northern Sweden will ultimately see more than 1100 turbines erected at a cost of $8.2 billion. While wind power is a priority for the Swedish government, the turbines will cut a swath through lands that have been used by Sami reindeer herds for centuries. The following two articles present conflicting viewpoints of the repercussions of this development.

JONAS LUNDMARK works for the Wind Power Centre owned by the municipality of Pitea. He writes that wind power development is needed in the region to meet the growing demand for sustainable energy. Sami parliamentarian LARS-ANDERS BAER says the Markbydgen project will cut a swath through reindeer calving grounds and winter herding pastures in the Sámi community of Östra Kikkejaur. He writes there is a green wind blowing and it smells of colonialism.

Windmill colonialism: A threat to Arctic Indigenous people

OVER THE CENTURIES, the Sámi people have managed to survive many changes without our culture being swallowed up and disappearing. But current conditions are drastic and extremely threatening. In the last 50 years roughly 25 per cent of the reindeer pastures of the Euro-Arctic Barents Region have been lost to development and industrialization. In Sweden, 35 percent of areas identified as locations for wind power are within core reindeer herding areas, and there are plans for more than 2000 windmills to be established within reindeer grazing lands.

We recognize that the Sámi are also part of the global consumption of energy due to our lifestyles and choice of products. We also realize that it is important to counteract climate change and to use and develop new technologies such as wind power. But today's global climate debate focuses primarily on the symptoms of climate change. From a Sámi perspective this is not good enough. Our holistic approach dictates that we all have to look at the underlying causes of climate change – the processes of industrialisation and globalisation, our lifestyles, our consumption habits, and the continuing large-scale exploitation of natural resources. It involves asking uncomfortable questions and making uncomfortable changes to our habits, lifestyles and routines. But everyone – individuals, authorities, governments and industry – has a responsibility to take a hard look at the choices we make, to make change happen.

The final report from the Swedish Commission on *Climate and Vulnerability35, 2007,* concluded that the conditions for reindeer herding in Sweden will be significantly affected by climate change. The commission also predicts a risk of conflict regarding land use between reindeer herding infrastructure, mining, wind power, space operations and military exercises.

UP TO NOW THE RIGHTS AND INTERESTS OF THE SÁMI PEOPLE IN GENERAL AND THE REINDEER HERDING COMMUNITY HAVE BEEN IGNORED AND NEGLECTED

Findings published in January 2011 by the Special Rapporteur on the situation of human rights and fundamental freedoms of Indigenous people, James Anaya, also reflected on "the situation of the Sami people in the Sápmi region of Norway, Sweden and Finland." He urged the Swedish government to recognize the rights of the reindeer herding communities both when windmill projects are planned and when permissions are granted.

Up to now the rights and interests of the Sámi people in general and the reindeer herding community have been ignored and neglected by the governments of Sweden, Norway and Finland as well as the companies hoping to de-

LARS-ANDERS BAER is a reindeer herder and a former president of the Saami Parliament in Sweden. He is also chairmen of Galdu, the Resource Centre for the Rights of Indigenous Peoples, established by an order of the Norwegian government. As a key figure in the Saami Council, he was involved in establishing an Indigenous-to-Indigenous development aid programme in Latin America, Asia and Africa. He has been involved in the United Nations Working Group on Indigenous Populations since 1983.

Kjøllefjord wind farm, Finnmark, Norway

Photo: Statkraft

velop wind power in northern Sweden.

The Sámi Parliament is protesting the Markbydgen windmill project because of this lack of consultation, the disrespect of the rights of the reindeer herding communities and the absence of will to give the Sámi villages fair compensation for loss of land and livelihoods.

After the fifteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Copenhagen in December 2009, it is expected that efforts to mitigate climate change by increased use of renewable resources, such as windmills and hydroelectric dams, will intensify pressure on grazing lands.

As an Indigenous nation, we also expect and foresee an escalation in conflict between windmill proponents and the Sámi people because of this lack of recognition of our rights to land and self-determination. ○

LARS-ANDERS BAER

Wind power – Europe's shining star?

AS WE STRIVE to reduce our environmental footprint while maintaining current levels of service and industry, various new sources of energy are being tried and tested.

In Sweden wind power is still a small player in the power generating game, providing only 2.4 per cent of the total energy consumption in Sweden. Even though there was a 40 per cent increase in installed wind power last year, Sweden's major energy sources continue to be hydroelectricity which provides 45 per cent of our energy needs and nuclear power, which accounts for another 45 per cent of power requirements.

But wind power has the most potential to decrease energy generated by environmentally hostile coal power plants

STUDIES HAVE SHOWN THAT PEOPLE WHO ACTUALLY LIVE CLOSE TO WIND FARMS ARE LESS NEGATIVE TOWARDS WIND POWER THAN PEOPLE WHO HAVE NO WIND TURRETS AT ALL IN THEIR VICINITY.

The current favourable climate for wind power is due to two factors: politics and improved technology. Politicians within the European Union have set a goal of 20-20-20 legally committing nations to a target of 20 per cent renewable energy sources by 2020.

The other favourable factor is that technology has advanced so that it is now possible to build wind turbines that can function in forested and near-arctic regions.

A decade ago the wind-towers were too low to be effective in forested areas. Tree-tops create turbulence when the wind sweeps in, making the windmills less effective. Now it is possible to build towers that exceed 100 metres – a height where tree turbulence is much lower. Two of the turbines in Dragaliden, the first pilot-park of the Markbygden 1101-project, have a hub-height of 137 metres, and a blade height of approximately 180 metres at their highest point. Measurements show

JONAS LUNDMARK works for the Wind Power Centre in the Barents region, which is owned and managed by Piteå municipality. The centre's objective is to help develop wind power in the region and encourage developments such as the Markbygden wind farm. His role is to further the growth of wind power.

that energy production is significantly greater the higher you get.

The Barents region has the best wind conditions in Europe, namely large areas with low population and regional authorities that are keen for new investments to help battle unemployment and migration.

There is, however, one perennial factor in these debates: the NIMBY phenomenon – Not In My Back Yard. Most people agree wind power is an interesting and important way of producing green energy, but they don't want to see them or be close to them. Studies have shown that people who actually live close to wind farms are less negative towards wind power than people who have no wind turrets at all in their vicinity.

SO WHERE SHOULD THESE WINDFARMS GO?

Those of us working to promote wind power in the Barents region believe the expansion of wind power should happen here, while considering other factors and sensitivities. One of the most important considerations is how we can have wind power side by side with reindeer herding and tourism. Most wind power projects in northern Sweden are slated to be built within Sápmi, the traditional lands of the Sami people in northern Europe who have been traditional reindeer herders for centuries.

The impact of wind farms varies. But the 1101 project in Markbygden stands out as the largest by far, and will have the biggest impact on the environment and those who occupy it – in a positive and maybe also a negative way.

It will undoubtedly affect reindeer herding, especially during the construction phase which will involve a substantial amount of heavy machinery working in the area. However, that will occur mostly during the summer when herds are grazing elsewhere. Right now the developers are in negotiations with the Sami and I am convinced they can reach a solution. Once the turrets are erected and in production, research indicates there is very little or no impact on wildlife.

Statistics and predictions for the future development of northern Sweden show we are facing a tough challenge. New industrial projects are a vital solution. We have to find new engines of growth to provide employment, education, development and hope. Wind power is a new industry for the Barents region with more than 10,000 turrets planned and roughly 10,000 new jobs. This, in turn, will attract other industry to the Barents region.

At Vindkraftcentrum, we are looking into every possible opportunity for growth connected to the wind power industry and how we can promote this development. We believe it will have a significant positive impact on employment, education, entrepreneurship, tourism and regional self-esteem.

Right now the focal point is Markbygden and the 1101 project. It will be the template for future projects. There are very few, possibly no other areas in Europe a wind park of this size could be built. I am convinced we must give wind power a serious chance. The positive spin-offs are too great to ignore. ○

JONAS LUNDMARK

Drooping sales

"Viagra has ruined everything," according to reindeer herder Johan Mikkel Haetta. He recently complained to NRK public radio in Norway that the pharmaceutical has caused the bottom to fall out of the reindeer antler market. The antlers were in great demand in the Far East to make aphrodisiacs, making them a significant source of supplemental income for the herders. "The availability of synthetic aphrodisiacs such as Viagra has had a major negative impact on the market," NRK reported.

Weather forecast:

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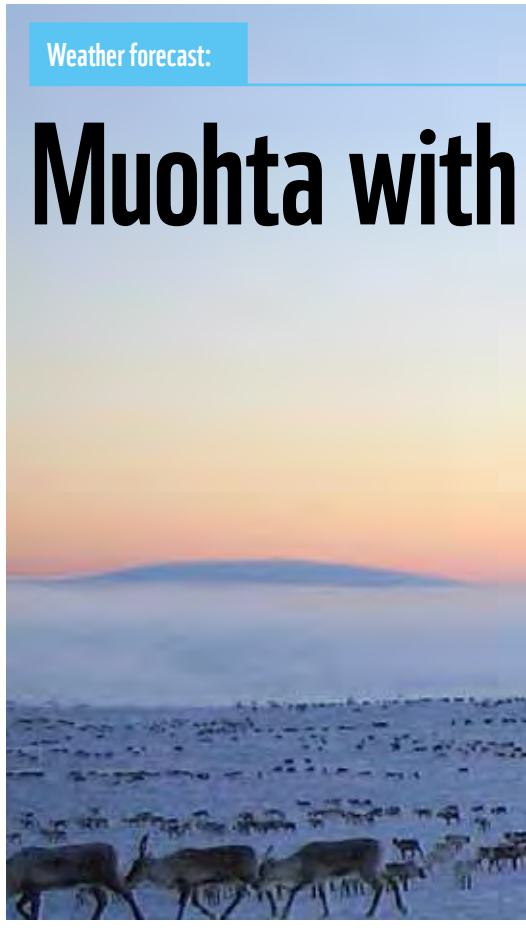


THE SÁMI LANGUAGES have numerous terms to describe snow cover related to migrations and transportation, hunting and reindeer herding. The surface is often described from a mobility perspective while the descriptions of snow layers detail the ability of the animals to find grazing.

The snow definitions are season-specific. During autumn, the first freshly fallen snow is described by the ability to track animals, for hunting or herding, and the ability to use skis or snowmobiles to monitor herds. The transitional period, when the new snow becomes crustier, is described in the context of understanding the changes that will occur when the snow thickness increases, and the reindeers' grazing ability is affected. In wintertime, the terms vary to focus on the thickness of snow and the snow layers that largely affect the reindeers' access to forage. The definition and descriptions of the different snow layers depend on where in the snow vertical profile the

the threat of climate change

The reindeer-herding Sámi have adapted their way of life to seasonal snow cover, creating a profound base of accumulated knowledge and detailed definitions of snow cover and its changes. The knowledge passed from generation to generation is summarized in definitions describing "positive" and "negative" properties of snow cover critical for the survival of the reindeer herds and the Sámi themselves. Hereditary reindeer herder NIKLAS LABBA says climate change will affect season-specific snow layers and create new and unknown challenges for the Sámi people.

layer is, how thick the layers are and how much ice the layer consists of. These characteristics determine the ability of reindeer to access food beneath the snow. During spring, the surface becomes more important than the snow layers, and the definitions then describe the snow's ability to carry animals and humans.

This knowledge and understanding of the properties of snow has facilitated and preserved the way of life for the reindeer-herding Sámi people for centuries.

By nature reindeer always walk towards the wind, continuously searching for better grazing. A longer annual migration is based on the search for better snow conditions and growth seasons. Shorter movements within a seasonal grazing area is based on local wind direction. The herders are aware of the ground conditions when the first snow falls, the wind direction and how the vertical snow layers develop. Knowledge of the grazing area and reindeer behavior, wind and snow conditions, will determine and influence herding decisions.

Due to climate change the autumn becomes longer and warmer, and the frequency when the first snow falls on warm ground increases. When this occurs it is the start for a snow condition that reindeers avoid – Bodneskárta, Bodnevihki, Skildži (16), and Cevvi (6) (see table on following page).The frequency of rain on snow during the late autumn and early winter has also increased. This is a severe problem for the survival of reindeer. It is not the rain itself that creates the problem, but the cold weather that follows the temporary warmer weather. Depending on the amount of rain, the length and the frequency of the warmer periods, the effect on the snow cover can range from moderately to completely impenetrable, which is called Geardni (8), Gaskageardni (18), Cuoŋu (9), and Jiekŋa (17). Depending on the condition of the snow, herders can force the reindeer to dig through the snow via intense herding, or as a last option allow the reindeer to disperse into the nearby mountains to search for suitable grazing conditions individually.

A general good snow condition is defined as Seaŋaš, (4). This condition makes it easy for the reindeers to dig through the snow. The grazing craters in the snow are defined as suovdnji (12), and Fieski (13). Over time, in the same snow cover, the reindeer will dig more craters and the snow will become more packed. Finally the

NIKLAS LABBA has grown up as a traditional reindeer herder. Today he is also the leader of Gáisi Sámi Language Centre in Tromso. He is involved in numerous projects monitoring the advent of climate change and works as a researcher at the Nordic Sámi Institute with a focus on reindeer herding economy and traditional knowledge.

Sámi snow categories and herding relevance

Sámi snow categories used in our fieldwork and their relevance for reindeer herding.
Main informants: Nils Tomas Labba, Gustav Labba (Saarivuoma). Erik Anders Niia, Håkan Kuhmunen (Gabna)

Category		Snow properties	Herding relevance
1	**Bihci**	'Thin layer of icy frost on vegetation, ground, vehicles, windows, etc.'	May lead to stomach problems when icy vegetation is eaten.
2	**Gutna guohtun**	'Ash snow' or 'powder snow'	Very good grazing conditions for reindeer
3	**Vahca**	'New loose snow'	
4	**Seaŋaš**	'Granular snow at the base of a layer of snow or most of the snow pack', or 'depth hoar'	The snow appears like coarse salt minerals. Reindeer can easily dig through this layer. The granular snow does not encase the reindeer grazing plants or the lichens.
5	**Skoavdi**	'Thin layer of snow with an "air pocket" between snow and ground'. Appears at the end of winter and the beginning of spring.	Reindeer can kick and penetrate a snow layer such as *sievlla* (see below) above the air pocket.
6	**Ceavvi**	'Hard-packed or hard-compacted snow' developed during heavy snowfalls under relatively high temperatures and compressed by later snowfall' (Eriksson, 1976; Pruitt, 1979).	Reindeer can normally dig through this snow freely (if locomotion conditions are difficult or if forced by herders). If it falls on unfrozen ground, this snow can promote the growth of mould which also prevents reindeer from smelling lichens. It probably also facilitates the accumulation of CO_2 under the snow cover (Eriksson, 1976; Pruitt, 1979).
7	**Čearga**	'Hard snowdrift'	Potentially severe grazing conditions for reindeer
8	**Geardni**	'Thin crust on top of snow pack'	
9	**Cuoŋu**	'Hard crust on snow'	Difficult for reindeer to get to ground level to forage. It forces reindeer to spread and search for more easily available forage.
10	**Moarri**	'Sharp, non-bearing crust which may damage reindeer feet'. *Cuoŋu* can turn into '*moarri*', i.e. a hard snow cover starts to get softer, but when it re-freezes it is transformed into sharp crust.	Reindeer avoid walking into areas with such conditions.
11	**Sievlla**	'Wet, non-bearing snow in spring (April-May)'	Herders cannot move the reindeer, i.e. they must migrate at night when this layer freezes.
12	**Suovdnji**	Feeding crater	More or less transformed snow due to grazing
13	**Fieski**	'Area where grazing has occurred'(slightly to moderately packed snow)	The more grazing, the more packing and icing and consequently the less accessibility for continued grazing.
14	**Čiegar**	'Area where a grazing herd has been for a longer period' (moderately to completely packed snow)	
15	**Čiegargovvi**	'Large area where grazing has occurred several times over a long period' (completely packed to ice-covered snow)	The snow is so heavily compacted that it is impenetrable for reindeer. The animals are in danger of dying if not moved to accessible pasture
16	**Bodneskárta Bodnevihki Skilži**	Ice on the ground encapsulating plants and lichens	Blocks access to vegetation. Ice on lichens and plants can lead to stomach problems for the reindeer.
17	**Jiekŋa**	Ice	
18	**Gaskageardni**	'Crust in the middle of the snow pack'	Several *gaskageardni* in a snow pack can prevent reindeer reaching the ground vegetation.

(Riseth et.al 2010 Polar Record)

snow becomes so packed that it is not possible to penetrate the surface. This is known as Čiegar (14) and Čiegargovvi (15). This snow condition will occur more often due to the concentration of reindeer in areas with good snow conditions. By tradition, reindeer herders cannot deny another reindeer herder access to a given area, if all the other areas are blocked. The issue is whether the modern governmental regulations of reindeer herding will interfere with traditional responses to changes in snow grazing conditions.

When spring comes earlier and the melting period is shortened, it will have a positive effect on reindeer grazing. The period with Skoavdi (5), comes earlier and the period with Moarri (10), and Seavlla (11), is shortened. Potentially this will allow the reindeer earlier access to snow-free grazing and plants available during the early growing season. For the herders this means herding intensity during the melting period decreases.

Warmer summers will create drier mountain areas and the perennial snow patches will melt with two adverse results: female reindeer won't be able to produce enough milk for their calves, causing decreased growth, a delay in ear marking and a reduction in slaughter weights the following autumn. It also means the reindeer can't seek out those cool snow patches for relief from parasitic flies and excessive heat. ○

Long distance learning

The rapid pace of advancing technology and its impact on teaching has opened up a new world of educational possibilities for those living in, or interested in, the Arctic. PHILIP BURGESS says a unique, online course on reindeer herding is an excellent example of how a broad array of students, teachers, researchers and stakeholders can share ideas, knowledge and solutions on global issues, no matter what country they may be in.

ON A RECENT OCCASION, I was sitting in Toronto, Canada while a professor was delivering a lecture in Tromsø, Norway. Students were participating from Russia, Norway, Finland, Sweden, the UK, the US and Canada. But we were all together in a shared digital room (although perhaps it should be called a digital *lavvu*, or *chum*). The professor was showing slides from his recent field work on the Yamal Peninsula and discussing the loss of pastures to oil and gas development on the peninsula.

Suddenly, a young reindeer herder following the course from Salekhard, Russia, piped in. "That's my uncle!" he excitedly told the virtual class as a slide of one of the herders flashed across screens.

The scene is a unique online Masters level course, Adaptation to Globalisation in the Arctic – the Case of Reindeer Husbandry. It is a collaboration between the University of the Arctic, the International Centre for Reindeer Husbandry, the Sami University College, the Thule Institute of the University of Oulu and the Arctic Portal in Iceland.

A HUNGER FOR EDUCATION

The range of students is impressively diverse. There are reindeer herders from Norway and Russia enrolled in the course, as well as university students from across Scandinavia, Russia, Canada and the USA – including one Native American student. There are grad students from the renowned Scott Polar Research Institute taking part along with numerous others who are not students per se, but who have a special interest in the topic such as heads of hunting and fishing organizations and other university lecturers.

It is this broad range of participants from various disciplines and backgrounds that illustrates the hunger across the Arctic for new approaches in sharing information, educating and problem solving. The flexibility of the online environment allows students to follow the course according to their own schedules (and time zones!) through a weekly live lecture which is also archived for later viewing.

There are many good reasons for a course that focuses on a single, traditional livelihood in a region as vast as the Arctic. Despite significant differences in environmental niches, languages, cultures, political and economic systems and recent histories, reindeer herders have an enormous amount in common. Reindeer husbandry is practiced in remarkably similar ways wherever it is found while reindeer herding is an excellent umbrella topic to discuss the effects of globalization, for example. The rush for resources in the Arctic fuelled by rising prices and climate change presents challenges that affect all reindeer herders: loss of pastures due to oil and gas development; related installation of new infrastructures such as pipelines, roads and dwellings; the effects of forestry activities across Eurasia. Likewise, nearly all herders face economic challenges, difficulties accessing markets and recruitment issues.

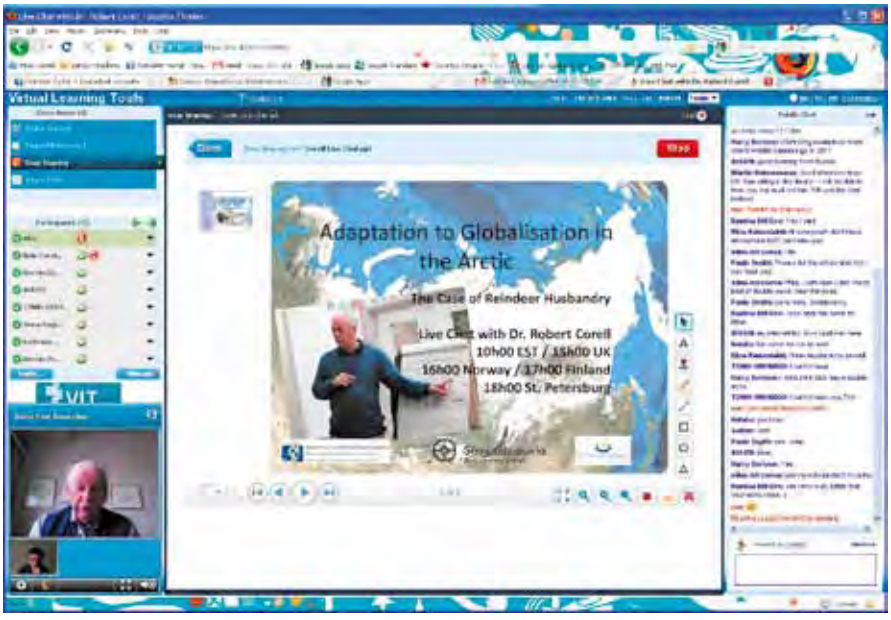
"REINDEER HUSBANDRY IS PRACTICED IN REMARKABLY SIMILAR WAYS WHEREVER IT IS FOUND WHILE REINDEER HERDING IS AN EXCELLENT UMBRELLA TOPIC TO DISCUSS THE EFFECTS OF GLOBALIZATION."

PHILIP BURGESS has worked as an Adviser to the International Centre for Reindeer Husbandry in Kautokeino, Norway since 2007. He holds a Masters in Arctic Studies from the University of Lapland, Finland and has worked for the Sami Council, the Indigenous Peoples Secretariat, and the Association of World Reindeer Herders amongst others on Arctic related issues. He currently lives in Toronto, Canada.

A NOVEL COMMITMENT TO EDUCATION

The course is coordinated by the University of the Arctic Thematic Networks. Its goal is to focus on issues-based cooperation by strengthening northern institutions through sharing resources, facilities, and expertise.

Facilitating an online course on this



New technologies bring herders, scientists and students together in a virtual classroom

topic has meant collaborating with multiple institutions and organisations such as the Association of World Reindeer Herders, Arctic Centre, Rovaniemi (Finland), the Norwegian Meteorological Institute and the University of Manitoba (Canada). This network of expertise was made possible through the IPY EALÁT project, a vulnerability study examining reindeer pastoralism in light of climate change and the recent establishment of the UArctic Institute for Circumpolar Reindeer Husbandry in Kautokeino, Norway. It is a signal that this collaboration, work and novel commitment to education will continue and thrive.

There is no question that globalisation is bringing complex and significant challenges to reindeer herders in all places they are found. Confronting these complexities will require new thinking, new expertise and new tools. New technologies will certainly play a role and by bringing herders, scientists and students together in a virtual classroom, we hope to make new contributions to the search for solutions in the Arctic.

- For more information about the course contact Philip Burgess (philip.burgess@reindeercentre.org)
- Virtual Learning Tools Homepage http://www.vlt.is
- More information on the UArctic Thematic Networks: http://www.uarctic.org/SingleArticle.aspx?m=56&amid=68

'Nobody knows the way of the wind and the caribou.' *Old Chipewyan Proverb*

CaptainThierry Mallet's 1930 memoir contains a chapter "When the Caribou Failed." A veteran fur trader, he recounted one dramatic episode of what was to become all too familiar in the Canadian Arctic in the depression years and after World War II: starvation among the inland Inuit. During a trek northeast from the Ennadai Lake area, he wrote, "...we were in plain sight of the whole band of Eskimos*. The igloos were built on a rocky point, while the entire tribe seemed to be scattered a mile or so out on the ice. "Fishing," was our thought, and at once we knew that our friends were in a bad way. No Eskimo fishes inland through the ice in winter unless he has missed the herds of caribou in the fall and has been unable to stock up with meat and fat until the next spring."

*Eskimos was once the common name applied to Inuit by outsiders. t is now generally considered impolite.

Wild reindeer and caribou on the circumpolar Arctic

The severe Arctic climate has shaped the appearance and behavior of arctic island caribou and reindeer to differ substantially from their southern cousins.

THESE SMALL but tough denizens of the Arctic have a whiter winter coat, smaller stature and distinctly shorter faces and legs. They thrive in polar conditions despite the brief six- to eight-week plant growing season, sparse vegetation and the long winter which can periodically restrict foraging to the point of death from malnutrition. High arctic caribou are typically dispersed in small groups across the thinly vegetated ranges close to the climatic edge for plant growth.

Novozemel'sk reindeer – *Rangifer tarandus pearsoni* – are Russia's distinct breed of arctic island reindeer and are found on the Novaya Zemlya archipelago range.

Norway's Svalbard reindeer – *R.t platyrhynchus* – are noticeably dwarfed with a marked propensity to fatten up for the long winter. The Svalbard archipelago range has reindeer on most non-glaciated areas.

Greenland has lost its distinct form of reindeer which ranged along the east coast. *R. t. egroenlandicus* were small and short-faced with a white winter coat. By 1920, they had disappeared and the few remaining museum skulls and dried hides aren't offering any clues into their extinction.

Canada's Peary caribou – *Rangifer tarandus pearyi* – are found on the north and central arctic islands, including the northwest side of Victoria Island in the Arctic Archipelago. However, most of Victoria Island is the calving and summer range of the

Photo: Wim van Passel/WWF-Canon

Svalbard reindeer – *Rangifer tarandus platyrhynchus*

Photo: Paul Nicklen/National Geographic Stock/WWF-Canada

Young Peary caribou – *Rangifer tarandus pearyi*

Dolphin and Union caribou which then migrate across the sea ice to winter on the nearby continental mainland. The crossing of sea ice to seasonal ranges is typical of arctic island caribou either between islands or to the continental mainland.

Arctic island caribou contend with a short plant growing season, but gain from cool summers which means fewer or even no parasitic and biting insects. Svalbard reindeer have the additional advantage of no wolves on their ranges and only the occasional predatory polar bear. However, arctic island caribou do periodically have to contend with difficult foraging due to ice from fall rains leading to malnutrition and deaths.

Trends for Svalbard and Novaya Zemlya reindeer now indicate those herds are increasing following earlier declines. A steep decrease on Svalbard was reversed when hunting was stopped in 1928, although the herds still suffered occasional setbacks, again due to freezing rain and ice restricting access to forage. By 2007, numbers were perhaps 10,000 with re-occupation of ranges. Novozemel'sk reindeer declined from about 20,000 to 1,000 by 1933 and to a handful by 1950. Hunting was banned in 1934 and herds recovered despite setbacks from winter icing. By the 1990s numbers had rebounded to between 10,000-15,000 reindeer.

The most abundant of this distinctive group of arctic island reindeer or caribou were the Peary caribou – a reflection of the far greater land mass which could support greater numbers. But the overall trend for these herds is steep decline. From 1961, their numbers have dropped from about 48,000 Peary to roughly 6,000 in 2010. While there were some recoveries aided by Inuit restricting their hunting, those gains were lost during severe winters.

On the Banks and Northwest Victoria islands, local hunters also restricted their hunting. Declines halted but numbers are only stable at about 90 per cent less than the previous peak. One large herd of approximately 6000 Peary on Prince of Wales and Somerset islands disappeared altogether between 1980 and 1995. The Dolphin and Union caribou, once about 100,000 strong, declined to a few hundred by the mid 1920s. They slowly recovered about 27,000 caribou by 2007.

The numbers are not encouraging. Despite the efforts of Inuit and Inuvaluit hunters, recovery is slow or not happening at all, while the threats to these sturdy arctic rangifers are growing. Increased human presence is on the horizon and not just from oil and gas exploration, mining or tourism on the land. Increased marine traffic will also compound risks to caribou and reindeer.

When there is a single threat, the herds are resilient, proven by some of the recoveries that followed hunting restrictions. An exception to that is the Peary caribou on Banks and Northwest Victoria islands where recovery did not follow hunting restrictions. This suggests greater complexity in factors driving that decline and the need for close monitoring.

ANNE GUNN

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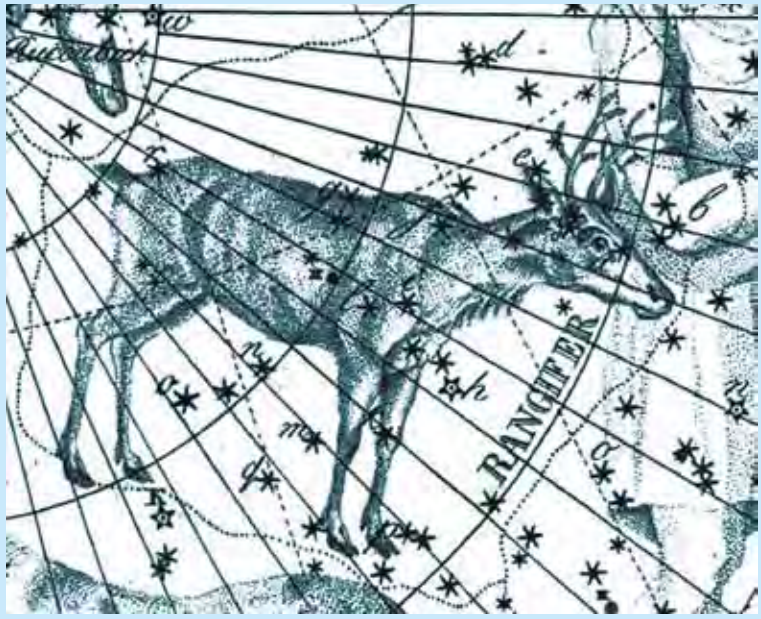
The picture

Rangifer in the sky

THE FAMOUS FRENCH astronomer Pierre Charles Le Monnier (1715-99), introduced the constellation Tarandus vel Rangifer to international star charts of the time. It was perhaps most notably present in the Uranographia published in 1801 by Johann Elert Bode. “Constellation of Tarandus vel Rangifer in Bode's Uranographia (1801)” was later removed from star charts as the constellation system was adapted to reflect Greek mythology.



Why we are here
To stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature.

www.panda.org/arctic