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The Big Melt

## Old Ways of Life Are Fading as the Arctic Thaws

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TIKSI, Russia - Freed by warming, waters once locked beneath ice are gnawing at coastal settlements around the Arctic Circle.

In Bykovsky, a village of 457 on Russia's northeast coast, the shoreline is collapsing, creeping closer and closer to houses and tanks of heating oil, at a rate of 15 to 18 feet a year. Eventually, homes will be lost, and maybe all of Bykovsky, too, under ever-longer periods of assault by open water. "It is eating up the land," said Innokenty Koryakin, a member of the Evenk tribe and the captain of a fishing boat. "You cannot do anything about it."

To the east, Fyodor V. Sellyakhov scours a barren island with 16 hired men. Mammoths lived here tens of thousands of years ago, and their carcasses eventually sank deep into sediment that is now offering up a trove of tusks and bones nearly as valuable as elephant ivory.

Mr. Sellyakhov, a native Yakut, hauls the fossils to a warehouse here and sells them for \$25 to \$50 a pound. This summer he collected two tons, making him a wealthy man, for Tiksi. "The sea washes down the coast every year," he said. "It is practically all ice - permafrost - and it is thawing."

For the four million people who live in the Arctic, in remote outposts and the improbable industrial centers built by Soviet decree, a changing climate presents new opportunities. But it also threatens their environment, their homes and, for those whose traditions rely on the ice-bound wilderness, the preservation of their culture.

A push to develop the North, quickened by the melting of the Arctic seas, carries its own rewards and dangers for people in the region. The discovery of vast petroleum fields in the Barents and Kara Seas has raised fears of catastrophic accidents as ships loaded with oil and, soon, liquefied gas churn through the fisheries off Scandinavia, headed to markets in Europe and North America. Land that was untouched could be tainted by pollution as generators, smokestacks and large vehicles sprout to support the growing energy industry.

But the thaw itself is already causing widespread anxiety. In Russia, 20 percent of which lies above the Arctic Circle, melting of the permafrost threatens the foundations of homes, factories, pipelines. While the primary causes are debated, the effect is an engineering nightmare no one anticipated when the towns were built, in Stalin's time.

Coastal erosion is a problem in Alaska as well, forcing the United States to prepare to relocate several Inuit villages at a projected cost of \$100 million or more for each one.

Across the Arctic, indigenous tribes with traditions shaped by centuries of living in extremes of cold and ice are noticing changes in weather and wildlife. They are trying to adapt, but it can be confounding.

Take the Inuit word for June, qiqsuqqaqtuq. It refers to snow conditions, a strong crust at night. Only those traits now appear in May. Shari Gearheard, a climate researcher from Harvard, recalled the appeal of an Inuit hunter, James Qillaq, for a new word at a recent meeting in Canada.

One sentence stayed in her mind: "June isn't really June any more."

### Changing Traditions

In Finnmark, Norway's northernmost province, the Arctic landscape unfolds in late winter as an endless snowy plateau, silent but for the cries of the reindeer and the occasional whine of a snowmobile.

A changing Arctic is felt there, too. "The reindeer are becoming unhappy," said Issat Heandarar Eira, a 31-year-old reindeer herder and one of 80,000 Samis, or Laplanders, who live in the northern reaches of Scandinavia and Russia.

Few countries rival Norway when it comes to protecting the environment and preserving indigenous customs. The state has lavished its oil wealth on the region, and Sami culture has enjoyed something of a renaissance. There is a Nordic Sami Institute, a Sami College, a state-sponsored film festival and a drive-in theater where moviegoers watch from snowmobiles.

And yet no amount of government support can convince Mr. Eira that his livelihood, intractably entwined with the reindeer, is not about to change. Like a Texas cattleman, he keeps the size of his herd secret. But he said warmer temperatures in fall and spring were melting the top layers of snow, which then refreeze as ice, making it harder for his reindeer to dig through to the lichen they eat. He worries, too, about the encroachment of highways and industrial activity on his once isolated grazing lands.

"The people who are making the decisions, they are living in the south and they are living in towns," said Mr. Eira, sitting inside his home made of reindeer hides. "They don't mark the change of weather. It is only people who live in nature and get resources from nature who mark it."

Other Arctic cultures that rely on nature report similar disruptions. For 5,000 years, the Inuit have lived on the fringe of the Arctic Ocean, using sea ice as a highway, building material and hunting platform. In recent decades, their old ways have been fading under forced relocations, the erosion of language and lore and the lure of modern conveniences, steady jobs and a cash economy.

Now the accelerating retreat of the sea ice is making it even harder to preserve their connections to "country food" and tradition. In Canada, Inuit hunters report that an increasing number of polar bears look emaciated because the shrinking ice cover has curtailed their ability to fatten up on seals. In Alaska, whale hunters working in unusually open seas have seen walruses try to climb onto their white boats, mistaking them for ice floes.

Hank Rogers, a 54-year-old Inuvialuit who helps patrol Canada's Far North, said the pelts of fox, marten and other game he trapped were thinning. As for the flesh of fish caught in coastal estuaries of the Yukon, "they're too mushy," he said. Slushy snow and weaker ice has made traveling by snowmobile impossible in places.

"The next generation coming up is not going to experience what we did," he said. "We can't pass the traditions on as our ancestors passed on to us."

Even seasoned hunters have been betrayed by the thaw, stepping in snow that should be covering ice but instead falling into water. And on Shingle Point, a sandy strip inhabited by Inuvialuit at the tip of the Yukon in Canada, Danny A. Gordon, 70, said it was troubling that fewer icebergs were reaching the bay. It has become windier, too, for reasons people here cannot explain.

"In the summer 40 years ago, we had lots of icebergs, and you could land your boat on them and climb on them even in summer," Mr. Gordon said. "Now in the winter they are tiny. The weather has changed. Everyone knows it. It's global warming."

### **Sinking Cities**

Vorkuta, a coal-mining city of 130,000, is crumbling.

Many of the city's homes and factories were built not on hard rock, but on permafrost, a layer of perpetually frozen earth that covers 65 percent of Russia's territory. If the permafrost underneath melts, the ground turns to mush.

"Everything is falling apart," said Lyubov I. Denisova, who lives in a cramped apartment on Lokomotivnaya Street. The ceiling has warped, the walls cracked, the window frames splintered. Some buildings have been declared unsafe and abandoned.

Vorkuta lies on the edge of Russia's permafrost boundary, and some scientists predict that continued warming could advance that border hundreds of miles northward, weakening the earth beneath the vast infrastructure built during the days of the Soviet Union's industrialization of the Arctic. According to the Permafrost Institute in Yakutsk, the average temperature of the permafrost has already increased a degree or two.

While most Arctic climate experts say the warming trend is driven by heat-trapping emissions and is unlikely to reverse, many scientists and officials in Russia predict the warming of the last 30 years will give way to a new period of cold. Vorkuta's mayor, Igor I. Shpektor, hews to that line. He said the damage in the city - 80 percent of all buildings show signs of it, one study found - resulted from faulty construction or maintenance, not a general thaw.

Still, Mr. Shpektor acknowledged, "the permafrost is unforgiving."

Any significant warming, said Anatoly A. Chumashov, the city's chief engineer, would leave officials like him scrambling to save the city. "It is an example of how fragile it is and how careful we should be," he said. But he added: "If the permafrost melts, this city will not collapse overnight. There is time to adjust, but it requires very serious investments in labor and money."

### **Spills and Depredation**

"One oil spill would be the end of us," said Borge Iversen, a fisherman on the Lofoten Islands, a striking archipelago north of the Arctic Circle in the Norwegian Sea.

As recently as 2000, Russian tankers were rarely spotted passing the jagged peaks and sheltered inlets, surrounded by seas with the world's largest stocks of cod and herring, as well as killer and sperm whales. So far, there has not been a major accident, but the ships appear more and more, a harbinger of Russia's expanding efforts to extract oil and, increasingly, gas in the Arctic.

As much as a quarter of the world's remaining oil and gas resources are believed to exist in the Arctic. And as technology improves, oil prices rise and the seasonal ice cap retreats, countries like Norway and Russia are acting with startling speed.

Oil shipments from the White Sea and the coast of the Barents Sea have soared, said Mikhail M. Kalenchenko, director of the World Wildlife Fund's branch in Murmansk, the Russian port.

"It was supposed to increase over the next 10 years, up to 20 million tons of oil," he said. "It's 20 million this year," or 146 million barrels. At this rate, he said, "we can expect up to 100 million tons, over 10 to 20 years, to be transported through our area."

Russia's history of environmental protection is a poor one. The Soviet drive for industrial development paid little heed to the natural spaces around its mines, factories and ports. Its disregard is evident in the poisoned wasteland around the nickel smelter in Monchegorsk, south of Murmansk, where hundreds of square miles of what was once forest is now almost entirely devoid of life.

Western countries have paid millions to help Russia dismantle its aging fleet of nuclear submarines in the area and safely store the nuclear material aboard them, but Mr. Kalenchenko said far less attention had been paid to the environmental risks of expanding oil shipments in the same area, most in single-hull tankers.

"What has never happened before is a big accident in the high seas in the Arctic," he said. For the entire Barents region, he said, Russia has only two bases with the equipment necessary to fight an oil spill. "In Norway, they have at least 50 bases of this kind," he said.

David Dickins, an engineer from San Diego who has spent 30 years studying how to clean up oil spills in icy waters, said that while the ice impeded the use of tools like booms that hold a slick in place, the ice also naturally contained the oil, giving response teams more time to act before environmental damage occurred.

"People ought not paint the Arctic in some sort of raving sense where a spill is somehow going to be catastrophic," he said.

But he added: "A spill is always serious. In the Arctic it will naturally take longer to clean up because there is less wave action, and breakdown is slower in colder temperatures."

That is what worries Mr. Iversen, who sails each morning from the village of Ballstad, into the coastal waters around the Lofoten Islands. The village's history, islanders say, reaches back to the Vikings, and fishing is central to the region's social and economic life.

"We've fished these waters for centuries, and while it's a hard life, we've survived in doing so," he said.

Although the fishing industry accounts for less than 1 percent of Norway's gross domestic product, as against the nearly 18 percent brought in by oil and gas, the fisheries are Norway's second-largest earner of foreign exchange and are viewed as a more sustainable resource.

"We need a policy for the Arctic that considers the next 100 years, not just the next 10 years," Mr. Iversen said.

Such sentiment goes far in Norway, where fishing is still part of the oil-rich nation's soul. On Oct. 13, a new leftist coalition upheld a ban on drilling in the waters around the Lofoten Islands until 2009, while allowing exploration to proceed further north in the Barents Sea. As for the tanker traffic, Oslo is looking at other ways of advancing its concerns.

Norway and the seven other Arctic nations have started to discuss ways to protect the environment they share in a forum called the Arctic Council, established nine years ago. In 2002, the council issued guidelines for offshore oil drilling, calling for drilling projects to be preceded by studies on environmental effects and the availability of cleanup equipment.

The guidelines come with no enforcement powers, but several experts say they think they will have some effect, particularly because Russia is preparing for entry into the World Trade Organization and seeking closer ties with the European Union.

#### **A Less Wild Future**

One day last summer, the 1,200 residents of Pangnirtung, a windswept outpost on a fjord in Nunavut, Canada's Inuit-administered Arctic territory, were startled to see a 400-foot European cruise ship drop anchor unannounced and send several hundred tourists ashore in small boats.

While small ships have stopped in the Canadian Arctic, visits from large liners are increasing as interest grows in the opening Northwest Passage, said Maureen Bundgaard, chief executive of Nunavut Tourism, a trade association.

Ms. Bundgaard has been training villagers how to stage cultural shows, conduct day tours and sell crafts and traditional fare - without being overrun. "We're not prepared to deal with the huge ships, emotionally or in other ways," she said.

Inuit leaders say they are trying to balance tradition with the inevitable changes that are sweeping their lands. The Inuit Circumpolar Conference, which represents 155,000 Inuit scattered across Canada, Greenland, Russia and the United States, has enlisted lawyers and movie stars like Jake Gyllenhaal and Salma Hayek to draw attention to its imperiled traditions.

The group's leaders hope to submit a petition to the Inter-American Commission on Human Rights in December, claiming that the United States, by rejecting a treaty requiring other industrialized countries to cut emissions linked to warming, is willfully threatening the Inuit's right to exist.

The commission, an investigative arm of the Organization of American States, has no enforcement powers. But legal analysts say that a declaration that the United States has violated the Inuit's rights could create the foundation for a lawsuit either against the United States in international court or American companies in federal courts.

But some Inuit question the wisdom of the petition. They ask, how can they push countries to stem global warming when the Inuit's own prosperity in places like Nunavut is tied to revenues from oil and gas, which are sources of greenhouse gases when burned?

Sheila Watt-Cloutier, the elected chairwoman of the group, said the goal was not to stop development but to make sure that native cultures had a say in how development was carried out.

"It's how we do the business that's more important," she said. "There are more environmentally friendly ways in which we can do development and still live a certain way, with a way of life and business that can balance both." While it is the people of the Arctic who will feel the melt and the rush for development most directly, the world, too, will have to give up something - its treasured notion of the Far North as a place of wilderness, simplicity and unspoiled cultures.

In a report on Arctic development, the United Nations Environment Program estimated that 15 percent of the region's lands were affected in 2001 by mining, oil and gas exploration, ports or other industrial incursions. But that figure is likely to reach 80 percent in 2050, it said. The Arctic, then, is probably making the same transition that swept the coastal plains of the North Slope of Alaska starting 38 years ago when the first oil was struck in Prudhoe Bay, said Charles Wohlforth, an Alaskan and author of "The Whale and the Supercomputer," describing Arctic climate change.

Since then, a lacework of pipelines and wells has steadily spread west and east from that central field, ending the sweeping sense of emptiness that defined the Arctic landscape through the ages.

"Even if you support oil development and think it makes sense, there's a point at which it becomes West Texas or the Gulf of Mexico and is not really the Arctic any more," Mr. Wohlforth said.

Craig Duff contributed reporting for this article.