
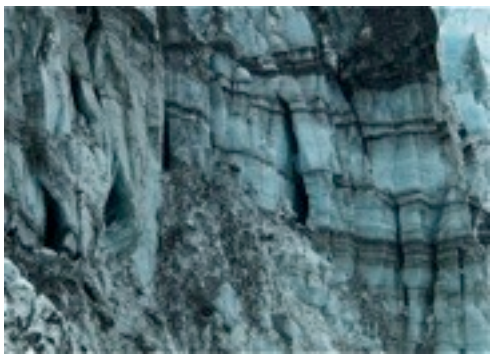


FIELD NOTES

Over the past 30 years, Cloud Ridge participants have spent time in many beautiful wilderness areas, guided by some of the world's finest scientists and naturalists. We've seen much—but we've learned far more. Each year, when I'm faced with the challenge of deciding where we go and what we focus on, I've tried to strike a balance between the environmental impact of our travels and the role of education in building a passionate constituency for environmental advocacy. One of last year's trips—to the Russian Arctic—very nearly stopped me in my tracks. Ultimately, I realized that the only way to make a difference is to portray—with solid science and strong visual images—the grim environmental realities we must face throughout the Arctic. Though this first annual installment of "Field Notes" is inspired my experiences in the Russian Arctic—it is dedicated to all the animals whose life-ways are inextricably interwoven with that of the ice. What follows is both ode and lament—my way of sharing what I've seen and learned.

The Arctic is undergoing a transformation on a colossal scale, greater than anything seen on Earth in human history. The great continental ice caps, the mountain glaciers, and the frozen seas are disappearing before our eyes. We now have 450,000 years of climate history—samples of ancient atmosphere—provided by ice cores taken from Greenland and the east Antarctic. These ice cores, encapsulating changes in atmospheric chemistry during the last four glacial and interglacial cycles, serve as "time machines" for the scientists who track climate change. We can compare the climatic fluctuations before the industrialization of our world and after—a mere 150 years. Humans have been pumping carbon dioxide and methane gas into the atmosphere at unprecedented rates, especially over the last decade —human-caused (anthropogenic) global warming overriding any caused by natural fluctuations. What few people realize, is that what's happening in the Arctic—right now—will change the world forever.

Flying across the Bering Sea to Anadyr, located on Russian Siberia's east coast, I harbored few illusions about what to expect. I'd done my reading—and I thought I was intellectually prepared. What I hadn't expected was that the reality-gulf between my reading of the latest scientific studies and actually seeing firsthand the accelerating impacts of global warming in Arctic regions would prove as vast as Siberia itself. We've all seen beautiful images of the Russian Arctic—the colorful tundra wildflowers, the indigenous Chukchi people in their embroidered "dancing" parkas, the teeming seabird colonies, the ivory-tusked walruses portrayed against a backdrop of crashing surf, sparkling-white beluga whales, and the Arctic's most iconic symbol, the polar bear. Did Cloud Ridge travelers truly see these wonderful things? Yes, we did—and so much more, lying just beneath the surface of all that fragile beauty.



Arctic Paintbrush (*Castilleja elegans*)

Northern Pika (*Ochotona hyperborea*)

In the Arctic, it all comes down to ice—in all its forms. Permafrost—permanently frozen ground—is melting at an ever-increasing rate throughout the Arctic—in the vast tundra regions, on the bottoms of Arctic lakes and ponds, and on the floors of shallow, warming Arctic seas. The melting of permafrost allows microorganisms to decompose the once-frozen peat and muck, releasing prodigious quantities of methane, a highly-toxic greenhouse gas, as a by-product of organic decomposition. It now seems as if Earth's ticking climate bomb may actually be the release of methane hydrates, the frozen form of methane. The Siberian tundra—and its characteristic soil, known as *yedoma*—has been an amazingly rich "sink" for carbon, from both plant and animal sources, throughout the Pleistocene and Holocene. Why Siberia? When most of the northern world was covered in glaciers and ice caps, much of eastern Siberia remained ice-free, accumulating great thicknesses of wind-blown loess (fine soil) and developing a verdant, savanna-like grassland. This vast grassland supported huge herds of grazing animals—mammoths, bison, horses, muskoxen, Siberian antelope, rhinoceroses—as well as predators such as the Siberian tiger. If only we could time-travel to those Pleistocene grasslands, so like the African savanna, and see what it must have looked like! Permafrost has kept much of that carbon sequestered in a deep freeze for thousands of years—until recently.

Melting permafrost...

Arctic Cottongrass (*Eriophorum scheuchzeri*)

Coastal tundra, Wrangel Island (71°14'N)

Katey Walter, a scientist with the University of Alaska, has focused her attention on the "methane-bubbling" lakes of the Alaskan Arctic and Siberia. Walter estimates that these lakes are adding about 25 teragrams of methane (1 tera=1 trillion) to the atmosphere each year. Given that the total methane entering the atmosphere annually from all worldwide sources is estimated to be about 560 teragrams, Walter's numbers are significant. We must also be concerned about the melting of permafrost that lies beneath the sea floor, which appears to be accelerating due to the thinning and loss of sea ice. Igor Semiletov, an oceanographer with the Russian Academy of Sciences, reports huge bubble clouds of methane in water columns in the Laptev Sea and the East Siberian Sea. Semiletov estimates that at least 500 gigatons of methane hydrates (1 giga=1 billion) are stored in the subfloor permafrost of the Siberian Arctic shelf area—a potentially catastrophic situation should this ancient permafrost "vault" melt. In fact, Semiletov suggests

that if just 10% of the Russian Arctic's now-sequestered methane hydrates were released over the span of a few years, it would be roughly equivalent to increasing atmospheric carbon dioxide concentrations tenfold.

The thinning, changing distribution pattern, and loss of sea ice poses a significant threat for many sea-ice-dependent species—including the polar bear, the walrus, the ringed seal, beluga, narwhal, and bowhead whale. Why is the polar bear, the Arctic's top predator, so vulnerable? Is it specialization? The polar bear is descended from the brown bear (or grizzly), an evolutionary divergence that occurred during the last great glacial period, when brown bears became trapped in the High Arctic by the expanding glaciers. Separated from their traditional foods of caribou, fish, and berries, the "polar" bears adapted over time, their fur turning a reflective, camouflage-white, their skin becoming black to better to absorb heat energy, their paws becoming broader and better insulated for swimming, and their metabolism "reconfigured" to survive colder, High Arctic temperatures by relying on a diet of omega-oil-rich seal blubber. For polar bears, sea ice provides a platform that allows it to walk on the sea and hunt seals—especially the ringed seal, another sea-ice-dependent species. For the ringed seal, sea ice provides a place to rest, hide, and raise its pups while giving access to the food-rich waters below. Ringed seals and polar bears both require stable ice—land-fast ice or large free-floating pack ice that isn't going to crush them or their young. So, with sea ice thinning in many parts of the Arctic, or not forming at in some areas, what does the future hold?

Research by Steven Amstrup and his colleagues, at the U.S. Geological Survey in Alaska, suggests that for every week earlier that the sea ice breaks up, survival rates for polar bears decline between 3 and 8 percent. In the spring, mother bears with new cubs are especially dependent on a consistent supply of ringed seal pups as food. In fact, a polar bear may kill forty to fifty ringed seals a year, and at least half those kills are pups still in their birth lair on the ice or naive young pups taken in early summer. Though the ability of polar bears to withstand long fasts exceeds that of any other mammal, the critical period for building the fat reserves necessary for survival remains the spring seal-hunting period, when polar bears must essentially triple their body mass. In the Beaufort Sea, Amstrup's research shows that female bears are coming ashore earlier and weighing less when they do arrive at their denning sites. Light bears produce light cubs—and lighter weight cubs apparently don't survive as well. In fact, fewer and fewer cubs are surviving their first year of life. Adult healthy polar bears are strong swimmers, but cubs are initially poor swimmers and are much more vulnerable to drowning or hypothermia. Unlike sea mammals, the sea is not the polar bear's true home—the farther the sea ice retreats from shore, the greater the risk that polar bears will drown trying to reach it. Storms encountered at sea also pose a threat, even at moderate distances. In 2008, the USGS predicted that two-thirds of the world's current polar bear population would be lost by 2050—if not sooner.

The weary gaze of the northward-swimming polar bear you see below, already 90 km north of Wrangel Island and desperately trying to reach the retreating sea ice, will stay in my mind's eye forever. This was the second swimming bear I spotted from the ship's bridge in the space of two hours. I suspect, though I will never be sure, that this bear eventually drowned. I'll shall never forget it...

By the end of our voyage, for me, the Crayola-bright paint that enlivened the drab, cement reality of most Siberian coastal towns became analogous with the “veneer,” the defensive mechanism, that has so often shielded me from truly seeing the environmental and cultural degradation that lies just beneath my consciousness. The collection of images below should speak for themselves...

Anadyr—the old and the new...

Arakamchechen Isl., “Whale Alley;” Chukchi archeological site...

Uelen (Ankalyn Chukchi village)

Uelen, Chukchi dancers

Uelen—a village home...

Provideniya—ever hopeful...

Abandoned Siberian gulag prison and watchtowers—and below, a road built atop the bones of fallen prisoners...