

Alaska's Frozen Frontier

1 x 60 High Definition Film
By Gianna Savoie and Mike Single



Zero Hours Daylight

The sun vanished months ago.

It is mid-January in Arctic Alaska, America's frozen frontier. As a blizzard screams down from the Brooks Range and across the tundra, a band of muskoxen huddle to brace against the brutal cold. The temperature has plummeted to 52 degrees below zero. A clan of snow-white Dall Sheep curl together on the leeward side of Mount St. Elias to avoid being battered by the wind.

After raging for five consecutive days, the storm subsides and the skies clear. Slowly, a pale green curtain spreads across the sky and begins to billow and shimmer. The lights of the Aurora Borealis dance in the solar winds, shifting in color from greens to purples to blues to reds.

Out on the ice of the Chukchi Sea, an arctic fox scavenges beneath the Northern Lights, while a polar bear feasts on a ringed seal. It's been six days since this bear's last seal and it's time to feed again.

And in the native village of Kotzebue, a grandfather shares with his grandchildren his tales of hunting on the ice. He promises his grandson that he will take him to see the walrus when the sun returns. And he quietly hopes that it's a promise that he can keep.

Soon, things will be very different here.

In this one-hour, high-definition film we will explore the hypnotic draw of one of earth's most stunning, yet treacherous landscapes – a wilderness whose raw, vast, and staggering beauty has been shaped and defined by ice . . .and is now on the cusp of colossal change.

A Story Etched in Ice

This film will capture Alaska's wild grandeur as never seen before by revealing the story that is etched in its ice: from its spectacular



snow-capped mountains, rising like cathedrals to bless the valleys below, to the massive glaciers that march thousands of square miles across its face, to the sea ice on which both wildlife and native communities depend, to the permafrost upon which 85 percent of the villages and towns are built. It is ice that defines the land, the wildlife, and the people here – every nuance of life is affected by it.

In Alaska, Ice is the god that blesses and the demon that destroys.

Glaciers have sculpted roughly one-third of the earth's entire landmass – and nowhere is that more evident than Alaska. Along the crescent of coastline between the Aleutian Islands in Southwestern Alaska and Wrangell-St. Elias in the east, over 25,000 square miles of land are buried in ice.

It is estimated that more than 100,000 glaciers glitter across Alaska, from those nesting high in the Brooks Range in the interior to those cascading through the cold stone valleys of the Chugach Mountains that hug the southern coast. With a deep, baritone groan, the glaciers rumble southward before calving into the Gulf of Alaska with a spectacular sound the native Tlingit people call "White Thunder."

Some are tiny and nameless, others are immense: The Bering Glacier - Bagley Icefield alone covers 2,250 square miles – nearly twice the area of Rhode Island.

It's the Juneau Icefield where glaciers are born and this is where our story begins. Juneau, Alaska's Capital city, is more than merely remote – tightly wedged between mountains and sea, it is only accessible by air or water. No roads connect it to the outside world; the mountains here rise sharply from shoreline to timberline. Above timberline are naked stone peaks, and beyond the peaks lies a vast broken field of ice, thousands of feet thick. It is here that the Mendenhall Glacier creeps through the mountains, steadily encroaching on the city below.

CGI will illustrate the formation of a glacier as it gets its start in the clouds. Over time, falling snow piles up in mountain recesses and ever so slowly the weight of the accumulating snow compacts lower layers into dense ice. When the ice becomes thick enough, it begins to move downhill.

We meet up with a team of glacial researchers pushing their skis across the fresh snow of the Juneau Icefield. They have been skiing for seven hours and as a late-afternoon snowstorm intensifies, the shifting, growling crevasses of the Vaughan Lewis Icefall threaten to swallow anyone who loses sight of the marked path. The team is comprised of members of the Juneau Icefield Research Program, founded and directed by veteran glaciologist, Maynard Miller. In addition to skiing over untracked ice, the team rappels into crevasses and climbs windblown slopes to poke, prod and learn the secrets of the ice. Miller combines the data being gathered with over 50 years of previous research in order to paint a picture of what is going on.

"It's all here," he says. "Nature is screaming at us. You just have to learn to understand what it's saying."

From the bottom of a 16 foot hole, Miller's colleague, Toby Dittrich and his team excavate a pit in the ice. "I am the only tenured ditch-digger in Alaska," says the physicist. The work is sheer drudgery, but it is some of the most important research being conducted today. Dr. Dittrich's team digs into glaciers to measure the depth and water content of each year's snowpack. "It's the annual mass budget of the glacier," he quips. And the higher the annual budget, the more likely the glacier will advance.

Thirty-seven of the thirty-eight glaciers that have their source on the field are losing the battle to atmospheric conditions and more than 90 percent of Alaska's glaciers are thinning and receding. "Temperate glaciers as those in the Juneau Icefield are some of the most sensitive indicators of climate change in the world," says Miller. "We see things first out here because we are not looking at outdated textbooks or computer models. We are looking directly at nature. The ice doesn't lie."



Miller and his team take us into the gaping blue jaws of the glacier and traces for us Alaska's ice-sculpted history. He testifies to the bracing glory and ecological significance of cold places, and what it is that we risk losing if Alaska's great ice melts away.

(CGI of "evolution" of Alaska; glaciers advancing and retreating through the millennia)

"It's so important what we do out here," says Miller. "It's also a pleasure, and a joy, and a whole lot of fun. As long as you don't get yourself killed!"

Wild Things

Though a glacier moves like a living thing, it can seem starkly lifeless. Panning the white on white canvas of ice a mile thick, one may not see anything that appears alive.

Planes have fallen here, never to be found. Hikers and skiers have slipped into unseen crevasses and vanished. There are places on this ice where no human voice has ever been heard, where silence is as old as the ice itself.

But take a closer look and you will find that the glaciers in fact abound with life. Animal tracks imprinted in the ice chronicle the journeys of wolves, lynx, mountain goats, and grizzlies as they use the flat surface of the glaciers as highways through the peaks.

Though many are just passers through, others have found their comfort zone here. Meet one of Earth's most peculiar creatures – the Ice Worm. Discovered in 1887 and then having disappeared off the scientific radar for more than 100 years, there is a renewed interest in the creature because of the extreme habitat in which they live. Burrowing down to 30 feet below the surface of the ice, they reside in colonies of a few hundred thousand to 20 million, covering an area as large as 30 acres.

"Ice worms are just remarkable creatures," says Daniel Shain, an evolutionary biologist at Rutgers University, who is studying the worms. "But they are very fragile and can only survive in sub-zero temperatures." When they are exposed to temperatures even a few degrees above zero, their membranes melt and liquefy.

Though they will avoid the sun at all cost, at night they emerge from beneath the ice to feed. "You could be walking along a glacier at around 7 at night and the glacier is perfectly white. At around 7:30, there are so many ice worms coming up to the surface that they change the color of the glacier to a sort of black plaid, as if you had put thousands of black threads on a white surface."

Learning how ice worms evolved, and what adaptations they made to survive in such extreme conditions, could lead to breakthroughs in space travel, advances in tissue preservation for organ transplants, and insight into the possibility of life on other planets.

"Alaska's coastal glaciers are right on the edge, at about 32 degrees Fahrenheit, and most are retreating," says Shain. "If it gets any warmer, they're going to start melting even more quickly. As their habitat goes, so too will the ice worms."

But ice worms are not the only creatures that are at home on the ice. There is one that glacial biologist, Nozomu Takeuchi refers to as "the king of beasts." He kneels down on the glacier and points to a tiny snow flea called a springtail. "This little guy is at the top of the food chain out here," he tells us.

The springtail is a tiny wingless insect that can jump a hundred times its length. It subsists on algae, the key to life on the surface of glaciers. While many scientists have blamed the increased warmth of the air for the shrinking of Alaska's glaciers, the sun absorbed by algae also plays a part. Takeuchi is searching for clues as to just how the microscopic world on the surface of the glacier maybe affecting these giant sheets of ice.

The hills and basins of the high Arctic are home to a bounty of wildlife for which you need no microscope to appreciate. Here, the largest concentrations of Dall sheep

cling to the coastal ridges, while moose, muskoxen, and caribou roam the plain in search for roots and vegetation buried in the frozen earth.

Survival here is demanding and risky. But the animals of Arctic Alaska have developed sophisticated means for dealing with the extremes of the climate. We will explore the behavioral and physiologic adaptations that enable the wildlife to survive temperatures that plunge to 50 degrees below zero.

Some animals “layer” to survive. Walruses are able to retain body heat even while digging for clams along the bottom of frigid ocean waters. Under its inch-thick hide, is a six-inch layer of blubber. During deep-sea dives, warm blood shifts away from the skin surface to inside the body. This helps the walrus keep its body heat stable at about 99°F. When the walrus moves ashore, its blood flows back to the skin.



The muskox's shaggy outer coat covers everything but its feet. Beneath this outer layer of long, coarse hair is even more hair—a soft, woolly coat. Muskoxen also have curved hooves with sharp rims to give them solid footing on icy slopes.

The Arctic fox maintains a special blood-flow system that helps it maintain its normal body temperature. Warm blood flowing toward the fox's legs heats up the cool blood returning from its feet. That means that the arctic fox has a warm body and cold feet. But in the Arctic, having cold feet is a positive trait -- ice doesn't stick to cold toes.



Perhaps the most puzzling adaptation of all belongs to that of the Arctic ground squirrel. For up to 8 months, these rodents sleep away the bitter cold of winter, curled deep in their burrows. But their extreme form of hibernation is unique, and it's one that scientists still don't completely understand.

Researchers at the University of Alaska at Fairbanks have found that arctic ground squirrels adopt the lowest body temperature ever measured in a mammal – as low as minus three degrees Celsius, in a condition called “supercooling.” Insects and some amphibia are known to supercool in this way, but the arctic ground squirrel on the tundra of Alaska is the only mammal ever to be shown to do so.

Every two to three weeks they begin to shiver and shake, creating heat and warming their bodies all the way back up to normal mammalian body temperatures of around 98 degrees Fahrenheit. Without waking, they remain in that high body temperature for about 15 hours.

We'll hear from Professor Brian Barnes who studies the "supercool" arctic ground squirrel at the University of Alaska in Fairbanks. "They don't leave their nest," he says. "They stay curled in a ball for most of the time, asleep, doing something -- we're not sure what, something that allows them to stay alive." At the end of that 15 hour period, the shivering stops and they cool slowly back down, all the way to those lowest body temperatures where they'll remain for another three weeks.

Some animals are not only able to "get by" in the brutal extremes, but in fact *depend* on the ice and snow for their survival. Large animals such as polar bears, walruses and seals rely on the sea ice to enable them to hunt, while some small mammals, such as tundra voles, lemmings, ermine, and shrews rely on the snow layer to insulate their tunnels and nests. In some places, snow insulation is so good that tundra-dwelling lemmings are actually able to breed in the winter.



Out to Sea

Along the coast, steep-walled fjords slice deep into the body of the mainland and long blue tongues of tidewater glaciers lap at the sea. The gravitational pull of the passing moon sometimes raises sea levels 25 feet in just 6 hours, subjecting these passages to some of the world's most extreme tides and currents.

(We watch the tides rise and fall in timelapse, and CGI illustrates shift in ocean/wind currents)

Out on the sea ice, things are "heating up" as global warming is putting the crystalline realm of polar bears, walruses, whales, and ringed seals at risk. As the sea ice melts, the animals and the subsistence livelihoods of people who depend on them are becoming profoundly impacted.

Various Arctic wildlife populations have already been forced to adapt to changes in their habitats. According to scientists, the retreat of sea ice has reduced the platform that seals and walruses traditionally use to rest between searches for fish and mussels and they now must abandon their young and head for deeper water, where the sea ice is thicker.

Polar bears now must swim up to 60 miles across open sea to find food. They are being forced into the long voyages because the ice floes from which they feed are melting, becoming smaller and drifting farther apart. Although polar bears are strong swimmers, they are adapted for swimming close to the shore. Their sea journeys leave them vulnerable to exhaustion, hypothermia, or being swamped by waves.



And what affects the wildlife, also affects the people. Eugene Brower, a Native Inuit from the coastal arctic village of Kotzebue, is packing for a trip to the ice with his grandson. Eugene used to hunt walrus to feed his family. But for Eugene, the days of the hunt have melted away.



"The ice is thinner. The air is warmer," he tells us. "When you are out on the ice, you can see the steam rising, and that's something you don't want to see behind you. The walrus has gone," he says sadly. "Sometimes you catch a glimpse of one, but they are far away, now. My grandson has never seen the walrus and I think it is important that he meets the animal that has sustained us for so long." We will accompany Eugene as he brings his grandson to see the walrus for what he believes may be the last time.

Some native communities are joining forces with government officials to protect the marine mammals for future generations. Also in Kotzebue, Willie and John Goodwin, life-long hunters of bearded seals, a staple of the tribe's diet, meet with other tribal members to discuss a study they are embarking on with the US Fish and Wildlife Service. They will be capturing and fitting the seals with satellite tags that will record movement, diving and hauling out behavior. This will help them to assess the viability of the population.

Edwin Weyiouanna lives in an Inuit community of about 600 people in the Chukchi Sea just north of Bering Strait. They are battling both the melting sea ice and permafrost thawing that is causing the ground to subside 16-33 feet in parts of Alaska.

"It's hard at times trying to comprehend what's going on out there," says Edwin. "It's like we have no control over what's happening to us." Here, seven houses have had to be relocated, three have fallen into the sea, and engineers predict that the entire village of 600 houses could disappear into the sea within the next few decades. No

longer protected by early winter sea ice or ground that's permanently frozen, the community has been pounded and eroded by storms. Because sea ice forms a natural breakwater against storm wave action, the melting ice allows larger storm surges to develop, causing erosion, sedimentation, and coastal inundation.

Weather is no "small talk" in Alaska. That's because it can change in an instant. What may begin as a few streamers of snow blowing up into the atmosphere from the peaks can within minutes gain Katabatic strength. In a Katabatic wind, or "williwaw" as many Alaskans call it, moving air masses that encounter a steep-walled valley or fjord squeeze and accelerate until they explode into highly localized, storm force winds that can rage to 180 mph. As a testament to their raw power, wind-sculpted cornices hang like breaking waves from high ridges.

Through CGI, we explore weather patterns in Alaska such as the "Aleutian Low" – a semi-permanent low-pressure weather system that moves in between Sept. and April and spawns the most severe weather than anyplace else on earth. During this time, storms erupt an average of every 5 days with waves in excess of 100 feet!

Sea of Hope

Eugene stands at the ice's edge holding his grandson's small hand in his. He pans the blue-white sea in front of him. For days, they have camped in hope to catch a glimpse of the walrus – Aivik, to the Inuit. "Can you see him?" he asks. "No," answers the boy. "I don't either," he says sadly. Before them is a vast world of melting ice and uncertainty. Eugene takes the binoculars and pans the horizon. Then, finally -- movement. "There! The walrus, there!" The boy struggles to see. Eugene gives him the binoculars and as the child squints through them, a broad smile washes over his face. "Aivik, I see it," the boy exclaims. A lone walrus drifts on a berg miles away. Eugene and the boy watch in reverent silence as the animal commands its small vessel of ice and then slips into the frozen sea to feed. Eugene has tears in his eyes. "Come back," he whispers. "We will be waiting."

The Final Frontier

To the lover of pure wilderness, there is no other landscape anywhere on the planet that can match it. With over 100 million acres of protected lands, it's no wonder that Alaska has been called *America's Serengeti*. No matter how you measure it – by its tallest mountain, longest coastline, or largest concentration of wildlife, its call pierces the place that is primal in each of us.

In a film that is both celebration and cautionary tale, **Alaska's Frozen Frontier** paints a vivid portrait of wilderness at its most elemental -- rugged yet fragile; treasure and testing ground. And as we chip away at its crystal façade, we find that deep within the core of Alaska's icy heart, beats the inexorable and resilient spirit of Nature.



