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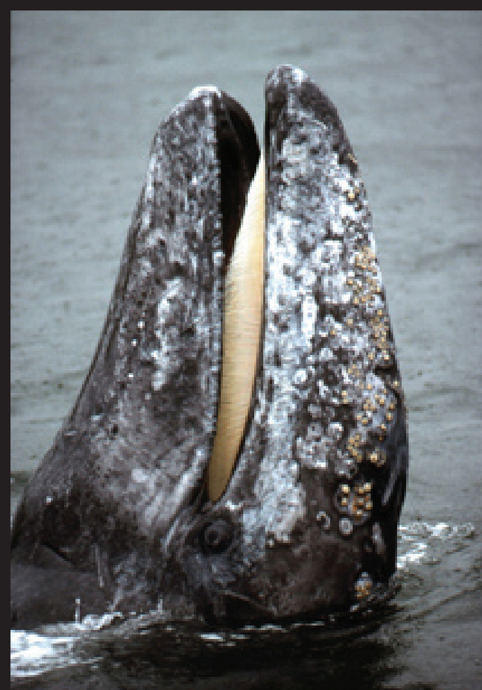

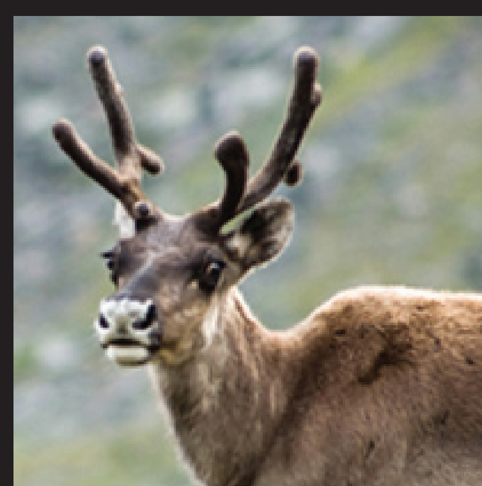

It's Not Just for Polar Bears.

A CENTER FOR BIOLOGICAL DIVERSITY AND
CARE FOR THE WILD INTERNATIONAL REPORT

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EXTINCTION.
It's Not Just for Polar Bears.

A Center for Biological Diversity and

Care for the Wild International Report

September 2010

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With the support of more than 255,000 members and online activists, the **Center for Biological Diversity** works through science, law and creative media to secure a future for all species, great or small, hovering on the brink of extinction.

Care for the Wild International is a charity dedicated to the conservation and welfare of wildlife around the world. Working with our partners, we aim to protect wildlife and its habitat, rescue and rehabilitate displaced wild animals, and act as a global voice for wildlife protection through campaigns, research and education.

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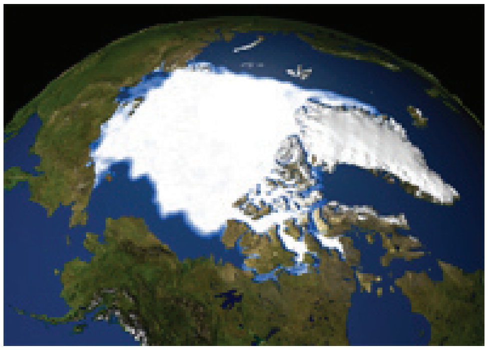
ARCTIC MELTDOWN

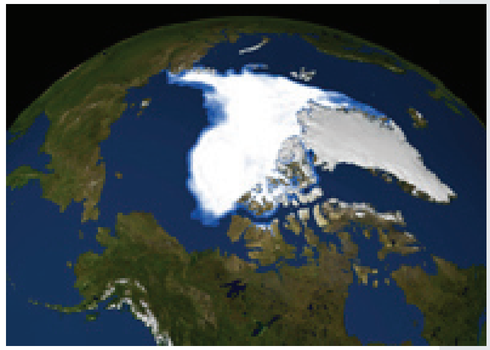
The impacts of climate change are unfolding far more rapidly and intensely in the Arctic than any other area of the planet. Soaring temperatures, rapidly melting ice and snow, rising sea levels and acidifying oceans are threatening the Arctic ecosystem, and it's not just the polar bear that is in peril. Climate change is affecting Arctic wildlife from great whales to tiny plankton, and threatens to unravel the entire ecosystem. This report chronicles the most profound climatic changes in the Arctic and the impacts those changes are already having on wildlife, and concludes with a roadmap of actions needed to protect the Arctic as we know it. Because the Arctic is the earth's early warning system, we must protect it from climate change to preserve the rest of the planet as well.

SOARING TEMPERATURES. The Arctic has warmed at twice the rate of the rest of the globe on average,[1] and some areas have warmed even faster. For example, temperatures overall in Alaska have increased by 1.9 degrees Celsius (3.4 degrees Fahrenheit) in the past 50 years, almost three times the global average over the same time period, and by 3.5 degrees Celsius (6.3 degrees Fahrenheit) in winter.[2] By the end of this century, the Arctic is expected to warm by an additional 3 to 5 degrees Celsius (5.4 to 9 degrees Fahrenheit) over land and up to 7 degrees Celsius (12.6 degrees Fahrenheit) over the oceans if current greenhouse gas emissions trends continue.[3]

PATRICK KELLEY/U.S. COAST GUARD

VANISHING ICE. One of the most dramatic signals of climate change is the rapid melting of one of the Arctic's defining features—the ice that covers the ocean and land. This ice cover, in the form of sea ice, glaciers and the Greenland ice sheet, helps keep the Arctic cold by reflecting incoming sunlight back into space. However, rising temperatures are rapidly melting this highly reflective ice, exposing the darker land and ocean surfaces that absorb more of the sun's energy and accelerate Arctic warming.





Summer sea-ice minimum in 1979 (far left) and 2007 (left). Sea ice is melting across the Arctic, and loss of summer sea ice has been particularly rapid. Images courtesy NASA Goddard Space Flight Center Scientific Visualization Studio.

SEA ICE. Sea ice is declining across the Arctic, and loss of summer sea ice has been particularly severe.[4,5] In 2007 summer sea ice plummeted to a stunning, unpredicted record low.[6] The 2007 September sea-ice extent was about 1 million square miles below the average between 1979 and 2000—a level that most climate models projected would not be reached until 2050.[7] Climate scientists now predict that sea ice will disappear completely in summer in the 2030s or before.[8,9] Not only is there less sea ice, but it is much thinner. Arctic sea ice is only half as thick as it was just a few decades ago,[10] and it is melting earlier in spring and forming later in autumn.[11] The disappearance and thinning of sea ice is devastating to the many Arctic species that depend on it to give birth and raise young, hunt, find protection from predators and move long distances.

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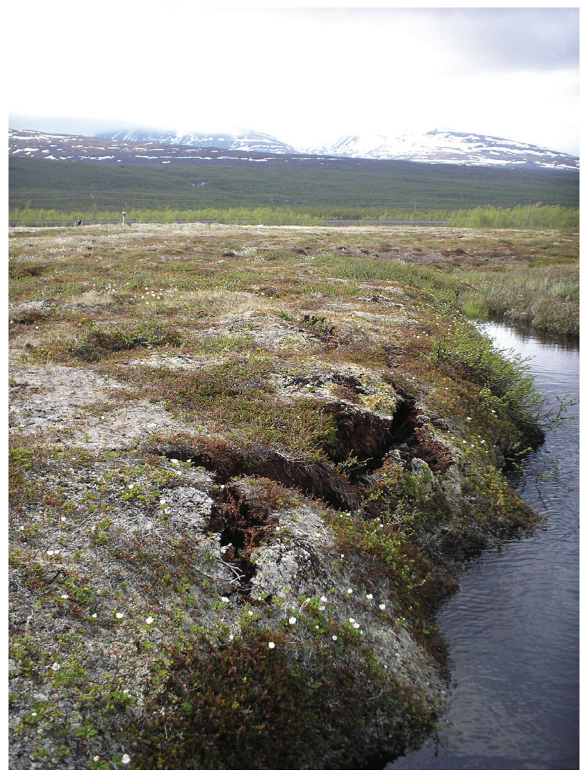
DISAPPEARING ICE SHEETS AND GLACIERS. Arctic mountain glaciers and the Greenland ice sheet are undergoing record amounts of melting. Meltwater is increasing sea levels around the globe.[12] The Greenland ice sheet—the vast slab of ice covering Greenland's surface—contains 12 percent of the world's land ice and if completely melted, would raise global sea level by approximately 7 meters (24 feet). The Greenland ice sheet is experiencing record amounts of surface melting, as great rivers of meltwater drain down to the bedrock through vast tunnels called *moulins*. The ice sheet is also discharging enormous chunks of ice from the glaciers that fringe its edges. As land ice melts, the summer water source for many terrestrial species is disappearing, and the runoff is adding decades of accumulated contaminants into the coastal marine environment.

CHANGING SNOW COVER. Snow cover is changing in many parts of the Arctic.[13] As temperatures rise, more precipitation is falling as rain instead of snow, which has reduced snow cover in many areas. Snow cover has decreased in spring and summer by 10 percent on average since the early 1970s over the northern hemisphere.[14] Rain-on-snow events, in which rain falls on top of snowfall, have increased significantly across much of the Arctic, with increases of 50 percent recorded over the past 50 years in Arctic Russia.[15] These events change the structure of the snow and create hard ice crusts that can hamper grazing by Arctic herbivores like the caribou. Scientists predict that the frequency and extent of rain-on-snow events will increase over the next 50 years in many parts of the Arctic.[16] In the northernmost latitudes of the Arctic, snow cover is becoming deeper in many areas.[17] In winter, warmer air masses which hold more moisture are depositing deeper snow in northern regions, making it difficult for grazers like caribou and muskoxen to reach forage under the snow.

THAWING PERMAFROST. Permafrost—the permanently frozen ground that underlies much of the Arctic land surface—is thawing in many parts of the Arctic.[18] As permafrost thaws, it releases the powerful greenhouse gas methane into the atmosphere, which contributes to further warming in a reinforcing feedback loop. Permafrost plays an essential role in the Arctic ecosystem by making the ground watertight and maintaining the vast network of wetlands and lakes across the Arctic tundra that provide habitat for animals and plants. The thawing of permafrost threatens to drain the wetland breeding sites for numerous species of waterfowl and shorebirds.



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RISING SEA LEVELS. Sea level rise in many regions of the Arctic is advancing much faster than the global average, with rapid increases in recent years.[19] Rising sea levels threaten to submerge and erode the Arctic shoreline at accelerating rates, jeopardizing species that use coastal habitats for breeding. In Alaska, coastal erosion rates have doubled in the past 50 years along the Beaufort Sea shoreline.[20]

Shell-building marine creatures like the pteropod Clione limacina *are particularly vulnerable to ocean acidification. Ocean acidification will impair young* Clione limacina *from building their protective, thimble-shaped shell armor.*

© ALEXANDER SEMENOV

ACIDIC OCEANS. Greenhouse gas pollution is changing the chemistry of the ocean and threatening Arctic marine life.[21,22] The ocean has absorbed about one-quarter of human-produced carbon dioxide from the atmosphere,[23] and as it does so, ocean waters are becoming more acidic, leading to global warming's evil twin—ocean acidification.

The oceans have become 30 percent more acidic since the industrial era began. A primary impact of ocean acidification is that it depletes seawater of the carbonate compounds—aragonite and calcite—that marine creatures need to build shells and skeletons.[24] As a result, ocean acidification hinders marine creatures such as corals, crabs, seastars, sea urchins and plankton from building the protective armor they need to survive. Rising acidity also affects the basic functions of many marine creatures, including metabolism, respiration and photosynthesis, which can thwart their growth and lead to higher death rates. Because of its serious impacts to so many species, ocean acidification threatens to disrupt the entire marine food web. Ocean acidification is affecting the Arctic most strongly. If current emissions trends continue, scientists predict that Arctic waters will be corrosive to the most sensitive shell-building creatures by 2050, with waters becoming corrosive to all shell-building creatures by 2095.[25] Declines and losses of these calcifying creatures at the base of the food chain would be disastrous for the Arctic food web.

ARCTIC FOX *Alopex lagopus*

RANGE: Circumpolar Arctic regions of Europe, Asia, North America, Greenland and Iceland, and islands of the Arctic, North Atlantic and North Pacific oceans

A TRUE ARCTIC DENIZEN. The Arctic fox inhabits two of the coldest places on the planet—the Arctic tundra and sea ice. Well adapted to its environment, the Arctic fox is shielded from sub-zero winter temperatures by its thick, white fur coat. To help it retain heat, the Arctic fox has a compact body shape with short legs and ears, and countercurrent heat exchange in the circulation of its paws to help maintain its body temperature while it walks on frozen ground. Foxes seek shelter in snow burrows during unusually cold weather, and can lower their metabolic rate during cold snaps and food shortages to retain heat. In summer, Arctic foxes become dark grey to brownish blue to blend into the tundra, and turn their attention to raising young. Fox pairs rear litters averaging six to seven pups in dens on the tundra, some of which have been used by foxes for several hundred years. Arctic foxes typically live three to six years in the wild but with luck can reach 10 years of age.

The Arctic fox specializes in eating tundra-dwelling rodents including lemmings and voles—so much so that fox population cycles often mirror those of their prey. When lemmings are plentiful, Arctic foxes tend to survive better and have large litters that lead to peaks in fox numbers. However, in years when lemmings are scarce, foxes are more vulnerable to starvation and resort to eating other foods from birds to fish to carrion. In lean years, the sea ice provides an important foraging ground offering food resources that can help foxes survive the winter. Foxes have been found to roam great distances over pack ice, often following polar bears to scavenge their seal kills. Some foxes are able to capture ringed seal pups in their snow dens on the sea ice as an extra food source.

POPULATIONS IN TROUBLE. European Arctic fox populations in Sweden, Finland and Norway were decimated by hunting for their fur in the early 20th century and have failed to recover despite total protection since 1940. Numbering around only 150 foxes, European populations are threatened with extirpation. Although the Arctic fox in the rest of its range is still considered fairly abundant, Arctic foxes have been disappearing from the southern edge of the tundra around the globe. This northward retreat raises cause for concern over the fox's future.

HOW DOES CLIMATE CHANGE THREATEN THE ARCTIC FOX? The Arctic fox faces a multitude of threats from climate change: its sea ice and tundra habitat are shrinking, its lemming prey are becoming less abundant in some areas, and it faces increased competition and displacement by the red fox which is moving northward as temperatures warm.

LOSS OF SEA ICE AND TUNDRA HABITAT. Because sea-ice habitat provides important winter food resources for Arctic foxes, especially in low lemming years, the loss of sea-ice foraging grounds is likely to result in lower winter survival and reproductive success for Arctic foxes.[26,27] Desperate foxes deprived of the sea ice may resort to searching for food in human settlements and industrial sites, which increases the potential for conflicts with humans and often ends in foxes being killed.

As temperatures warm, shrubs and trees are also moving into the tundra, converting the Arctic fox's lichen and moss-dominated habitat into shrublands and woodlands.[28] In the Alaskan tundra, dwarf birch, willow, and white spruce have increased markedly over the past 50 years.

LESS LEMMING PREY. Because Arctic foxes rely heavily on lemmings for food, climate change impacts on lemmings can have profound effects on foxes. During the winter, lemmings live in spaces under the snow that provide insulation from the cold, protection from predators, and access to plant foods. If snow conditions are good, lemmings prosper and can even get a head start in raising young. However, in Norway, scientists have found that rising temperatures and changing humidity in recent decades have created cycles of thawing and icing in winter that result in poor snow conditions for lemmings.[29] These poor snow conditions have dampened lemming population cycles, creating a new pattern where lemmings never reach peak numbers. Scientists believe that the absence of regularly occurring lemming peaks is likely responsible for the breeding failures and dramatic declines in Arctic foxes in Norway.[30] Future climate change is likely to dampen lemming population cycles across wider areas of the Arctic.

RED FOX COMPETITION. The Arctic fox has a fierce competitor—the red fox—a dominant, larger-bodied fox that can kill or expel the Arctic fox in areas of overlap. Red foxes historically lived south of the Arctic fox's tundra habitat. However, red foxes have been moving northward at the same time that Arctic foxes have been retreating from the southern edge of the tundra.[31] Climate change appears to be a leading factor driving the northward movement of the red fox. Warming is converting the tundra to shrublands, which are favored by the red fox. Warming-related reductions in lemming populations are also lowering lemming grazing pressure on the tundra, favoring the shrublands that encourage the northward invasion of red foxes.[32]

POLAR BEAR *Ursus maritimus*

RANGE: Circumpolar Arctic

CLIMATE CHANGE ICON. The polar bear has become a central icon of the impacts of climate change on the Arctic—and for good reason. This top Arctic predator relies on sea ice for all its essential activities: hunting seals, seeking mates, moving long distances over the ice, and in Alaska, building dens to rear cubs. The rapid melting and earlier breakup of sea ice has pushed the polar bear onto the front lines of extinction.

DESPERATE MEASURES. Polar bears need sea ice to successfully hunt their main prey: blubbery, energy-rich ringed seals and bearded seals. Polar bears hunt by catching these seals at openings in the ice where seals surface to breathe, and by breaking into the snow caves of ringed seals on top of the ice. The shrinkage and early breakup of the sea ice leaves bears with a vastly diminished hunting ground and less time to hunt. As they struggle to find enough food, polar bears in two of the most well-studied populations—the Hudson Bay population of eastern Canada and the southern Beaufort Sea population of Alaska and western Canada—are in poorer body condition and are dying earlier, leading to declining populations.[33,34,35,36,37,38] In the southern Beaufort Sea, scientists are finding that polar bears are starving, using unusual and desperate foraging behaviors to try to catch seals, and even resorting to cannibalism.[39,40,41]

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STRANDED ON LAND. Sea-ice loss has additional impacts on polar bears. As the sea ice dwindles, bears that would normally be on the ice are forced to come ashore. Although they are good swimmers, polar bears are drowning as they attempt to swim across greater expanses of open water.[42] Once stranded on land, polar bears have more contact with humans and are often killed in these encounters. As sea ice deteriorates, females in the southern Beaufort Sea are abandoning den sites on the ice and are building dens along coastal banks and barrier islands for giving birth and rearing young.[43] Females give birth to one or two tiny cubs, each weighing less than a kilogram (1 to 1.5 pounds), which rely on the insulation of the den for warmth. However, declining snow cover makes it difficult for females to build sturdy snow dens, and coastal erosion threatens to wash away den sites.[44]

HEADED TOWARD EXTINCTION. As sea ice melts away, eight of the world's 19 polar bear populations are declining.[45] If current emissions trends continue, scientists predict that two-thirds of the world's polar bear population will be lost by 2050, while the rest will near extinction by the end of the century due to the disappearance of sea ice.[46] Unfortunately, polar bears are being overhunted in many of the regions in Canada where sea ice is predicted to last the longest and where polar bears have the best chance of surviving.

PACIFIC WALRUS *Odobenus rosmarus divergens*

RANGE: Primarily Bering and Chukchi seas

BILL HICKEY/USFWS

TUSKED GIANT. With tusks like an elephant and weighing up 1660 kilograms (3650 pounds), the Pacific walrus is one of the most memorable Arctic inhabitants. Like the polar bear, it is heavily dependent on sea ice for survival. In winter, males and females gather on the sea ice of the Bering Sea to court, find mates and give birth. Females and their calves, which maintain a tight bond for two to three years, follow the sea ice year-round from the Bering Sea in winter, northward to the Chukchi Sea in summer, and back again. Since walruses cannot swim continuously, sea-ice floes over their foraging grounds provide walruses with safe havens for resting between dives to the seafloor to feed on clams and mussels. Sea-ice floes are especially important for walrus calves. While the mother dives to the seafloor to suction up clams, the calf naps on the ice protected from predators.

NO PLACE TO REST. Global warming is rapidly shrinking the summer sea ice over the walrus's foraging grounds. In recent years, sea ice has retreated completely from the walrus's feeding areas in the Chukchi Sea. With no ice floes for resting, females and calves are forced to abandon their food supply and come ashore. On the long journey to shore, walrus calves can drown from exhaustion or be separated from their mothers.[47] Once on land, calves are vulnerable to being attacked by predators or trampled to death. When alarmed by humans or predators, walruses will stampede to the water, and large males can easily crush calves in the chaos. An estimated 3,000 to 4,000 young walruses were killed in stampedes in Siberia in 2007, and 133 young walruses perished in a stampede in Alaska in 2009.

FOOD SHORTAGES. Shrinking sea-ice cover and rising temperatures are also threatening the walrus's food. Sea ice in the northern Bering Sea is important for sustaining a high abundance of animal life on the seafloor, including the walrus's clam and mussel prey. When sea ice in the Bering Sea melts in spring, nutrients released from the melting ice spark a bloom of small

USFWS

marine plants which rain down and enrich life on the ocean bottom. Without sea ice, the nourishing spring bloom does not happen, depriving life on the seafloor. As a result, the northern Bering Sea is shifting from an ecosystem rich in bottom-dwelling animals to a system dominated by pelagic fish.[48] On top of this, the rising acidification of Arctic waters is making it more difficult for the walrus's clam and mussel prey to build their shells.

HUMAN DISTURBANCE ON THE RISE. As sea ice melts, the walrus's most important foraging grounds in the Chukchi Sea are also being opened up to oil drilling to extract more fossil fuels that will further accelerate the melting of the Arctic. Oil drilling and the proliferation of shipping routes in the increasingly ice-free Arctic threaten the Pacific walrus with the heightened risk of oil spills, rising noise pollution and human disturbance.

RINGED SEAL *Phoca hispida*

© JOHN MORAN

THE ICE SEALS

Six Arctic seals rely on sea ice for their essential activities, from giving birth and nursing pups to resting to molting their fur. Because of their dependence on sea ice, the ringed, bearded, spotted, ribbon, harp and hooded seals are called the "ice seals." Scientists have already documented devastating impacts to many of the ice seals as the sea ice melts away. Because each species uses sea ice differently, climate change is having unique impacts on each of these ice seals, four of which are highlighted here.

RANGE: Arctic and subarctic oceans

FAST-ICE SPECIALISTS. The ringed seal, named for the small rings dotting its fur, is the smallest, most widespread, and most ice-adapted of all Arctic seals. Its unique behaviors allow it to use sea-ice habitats that other seals cannot. Only ringed seals can make breathing holes in the landfast ice—the sea ice that forms along Arctic coastlines each autumn and winter. Using their strong claws, ringed seals scrape open and maintain multiple holes in the landfast ice as it forms and thickens. This network of breathing holes allows ringed seals to make use of food-rich coastal waters under the landfast ice while still maintaining enough places to surface and breathe. Unlike other seals, the ringed seal also excavates caves in snow drifts over its breathing holes, which it uses for resting and giving birth. These hidden snow lairs on top of the sea ice provide dry shelters that conceal pups from predators and provide insulation from the extreme cold during the six weeks when pups are nursing.

PUPS IN PERIL. Arctic climate change is already resulting in devastating impacts to ringed seals. As snow cover decreases, it is becoming more difficult for ringed seals to build sturdy snow caves for rearing pups and resting. Earlier snowmelt is collapsing snow caves before the pups are weaned, exposing pups to death from hypothermia and to predation from hungry polar bears, Arctic foxes, gulls and ravens.[49,50] Earlier sea-ice breakup can also prematurely separate moms from pups before pups are old enough or strong enough to survive.[51,52] Declining sea ice has been linked to lower pregnancy rates and body condition for female ringed seals, likely due to reduced food availability and increased competition with other species moving northward.[53] And because the ringed seal is the primary prey of the polar bear, declines of ringed seals spell trouble for the polar bear.

BEARDED SEAL *Erignathus barbatus*

RANGE: Arctic and subarctic oceans

Named for its conspicuous and abundant whiskers, the bearded seal is the largest of the ice seals. Bearded seals give birth, rear pups, rest and molt on drifting pack ice in areas where the ice floes are in constant motion, creating openings for breathing. They prefer pack ice over shallow shelf waters less than 150 to 200 meters deep where their bottom-dwelling clam, crab and shrimp prey are most abundant. The loss of pack ice over shallow waters is leaving bearded seals without the sea-ice platforms needed for rearing pups and resting over their foraging grounds. Earlier sea-ice breakup threatens to separate moms and pups before the pup is weaned. In the Bering and Chukchi seas off Alaska, the early retreat of the sea ice is leading to reduction of the bearded seal's bottom-dwelling prey.[54]

HARP SEAL *Phoca groenlandica*

RANGE: North Atlantic and Arctic oceans

HUNTED SPECIES. The harp seal is perhaps the best-known ice seal because of the large-scale commercial hunt in Canada, Norway, Russia and Greenland that still kills hundreds of thousands of harp seals each spring.

SHRINKING "SAFE HAVEN." Harp seal females give birth on the pack ice to snowy white pups in February and March. During a brief 12-day nursing period, the pup rapidly plumps up to more than triple its birth weight and is then left to fend for itself. For the next two months, the sea ice provides a dry, safe haven for resting while the pup learns to swim and find food on its own. During this energetically stressful period, the pup loses half its body weight. Rapid reductions in sea ice combined with violent storms and early sea-ice breakup pose a serious threat to pup survival.[55] Shrinking sea ice makes it more difficult for females to find stable sea-ice floes for giving birth, and stressed females may be forced to abort their pups if they cannot find suitable ice. Early sea-ice breakup is leading to high pup mortality when pups are prematurely separated from their mothers before the end of nursing.

Even after weaning, pups need sea ice for resting while they learn independence, and the disappearance of sea ice during this crucial period jeopardizes their survival. In the poor ice year of 2010, many harp seal pups died off the Canadian coast by being separated from their mothers, drowning after slipping off shrinking ice floes and being crushed by moving ice. Pups born on beaches or shore ice were killed by coyotes and bald eagles. Despite the disastrous breeding season, Canada increased its quota for the harp seal cull to 330,000 animals in 2010.

FLICKR COMMONS/MARY ELLEN AND PAUL

RIBBON SEAL *Histriophoca fasciata*

FLICKR COMMONS/JOMILO75

RANGE: Bering, Chukchi and Okhotsk seas

The ribbon seal is perhaps the least-known but most visually striking of all the ice seals. Adults are cloaked in dark fur that is encircled in decorative white ribbons. During late autumn through early summer, ribbon seals haul out on ice floes at the edge of the sea ice in the Bering and Okhotsk Seas off Alaska and Siberia. The remote sea-ice edge provides a safe place for giving birth and nursing pups in March through May, far from polar bear and Arctic fox predators. However, the melting and early breakup of this sea-ice habitat is threatening the seal's ability to successfully rear its young. Sea ice in the Okhotsk Sea has declined dramatically during the breeding season during the past few decades.[56] Moreover, the ribbon seal's winter sea-ice habitat in the Bering and Okhotsk Seas is predicted to decline by 40 percent by mid-century.[57]

GRAY WHALE *Eschrichtius robustus*

© JIM BORROWMAN

RANGE: Shallow coastal waters of eastern North Pacific, Bering and Chukchi seas

LONG-DISTANCE SWIMMER. Each year, gray whales of the eastern North Pacific Ocean make an epic 16,000- to 23,000- kilometer (10,000- to 14,000-mile) migration between their Arctic summer feeding grounds in the Bering and Chukchi Seas and their winter calving grounds in the warm lagoons of Baja California, Mexico. In summer, gray whales bulk up in the Arctic waters between Alaska and Siberia, scooping up gigantic mouthfuls of mud from the ocean bottom and filtering out crustaceans and tubeworms with their baleen. Gray whales play an important role in the Arctic ecosystem due to their unique style of bottom-feeding. They create gigantic mud plumes that re-suspend large volumes of nutrients, which in turn enrich life on the seafloor and bring a bounty of bottom-dwelling crustaceans to the surface for seabirds to feast on.

RECOVERY IN PERIL. The eastern North Pacific gray whale was removed from the U.S. endangered species list in 1994 when the population reached 23,000 individuals and was thought to have recovered from decimation by commercial whaling. Subsequent genetic research concluded that the pre-whaling abundance likely ranged from 76,000 to 118,000 individuals, indicating that the current population is still far from full recovery.[58] In addition, since 1998 when gray whales reached a peak of 29,758 animals, the population has undergone a severe 40-percent reduction, a mass starvation event, and ongoing changes in migration patterns, calving locations and feeding behaviors.[59] Many of these changes have been linked to shifting ocean conditions, making ocean climate change a new challenge to the gray whale's recovery.

ALTERED MIGRATION. The rapid loss of sea ice appears to be lowering the abundance of gray whales' bottom-dwelling prey on its traditional Arctic feeding grounds in the northern Bering Sea.[60] Some researchers have warned that this region will be able to support fewer whales as the food supply declines.[61] Gray whales are also beginning the southbound journey to their calving lagoons later, perhaps because they need to travel farther and feed longer in the Arctic before embarking on their energy-intensive migration.[62] As a result, more whales are giving birth while in route to the calving lagoons, and are spending less time in the protected lagoons nursing their young.[63] More whales are also cutting their northbound route short and spending more time in heavily trafficked and polluted waters off the U.S. coast where food supplies may not be sufficient.

BELUGA WHALE *Delphinapterus leucas*

RANGE: Arctic and subarctic oceans

The snowy white beluga is a highly social whale that lives and hunts in pods of a few to hundreds of animals and communicates with an advanced repertoire of whistles, moos, chirps, squeals and clicks. Belugas spend the summer in coastal waters of estuaries and fjords where warmer waters and plentiful food help in rearing calves, and where coarse sand and rocks provide favorite scrubbing surfaces for rubbing off old skin. While some beluga populations remain relatively local year-round (Cook Inlet, Cumberland Sound, Svalbard and the Gulf of St. Lawrence), others migrate to separate wintering grounds, often into offshore areas with heavy ice. Like the narwhal, diminishing sea ice means that belugas are likely to contend with more frequent predation by killer whales in addition to competition from temperate species moving northward and exposure to new pathogens. Warming waters and shrinking ice are also likely to affect the beluga's fish food supply. For example, rising temperatures threaten to diminish Cook Inlet salmon runs which are a mainstay for the isolated Cook Inlet beluga population.

ARCTIC RESIDENTS

While some whales migrate to Arctic feeding grounds in summer, three species of whales occupy Arctic waters year-round—the beluga, bowhead and narwhal. As shrinking sea ice makes Arctic waters more accessible to human activity, all of these whales are at risk from increasing offshore oil drilling and shipping activity which heighten threats from oil spills, ship strikes and noise. Ocean acidification threatens the whales' fish and zooplankton food supply, and makes Arctic waters a noisier place by allowing sound to travel farther.

FLICKR COMMONS/JAMES GRIMMELMANN

BOWHEAD WHALE *Balaena mysticetus*

RANGE: Bering, Chukchi and Beaufort seas in the western Arctic Ocean; Baffin Bay, Davis Strait and Hudson Bay in the Canadian Arctic; Okhotsk Sea in Russia; and far North Atlantic Ocean

The bowhead whale is superlative in many ways; it is the largest Arctic resident and is thought to be the planet's longest-lived mammal, perhaps surviving 200 years or more. The bowhead spends the winter at the southern edge of the sea ice and moves north in spring as the sea ice breaks up. The bowhead can navigate through areas of nearly solid sea-ice cover, and can break through ice at least 20 centimeters (8 inches) thick with its massive skull. Intensive whaling reduced the bowhead to near extinction by the early 20th century, and four of the five remaining bowhead whale populations still have fewer than 400 whales each. As sea ice vanishes, the expansion of oil drilling and shipping traffic poses serious risks of oils spills, ship strikes and heightened vessel and industrial noise. Bowheads are sensitive to noise from offshore drilling platforms and seismic surveys and will abandon noisy areas. Adding to this impact, ocean acidification will intensify noise pollution. As the oceans become more acidic, changes in ocean chemistry allow low-frequency sound to travel much farther. With a doubling of carbon dioxide in the atmosphere, sound at frequencies important for the bowhead and other marine mammals will travel 70 percent farther, making the Arctic ocean a much noisier place.[64]

RICK LEDUC/NOAA

NARWHAL *Monodon monoceros*

WIKIMEDIA COMMONS/BLACK STRIPE

RANGE: Primarily Canadian Arctic and western Greenland

The narwhal—the unicorn of the sea—is best known for the fabled, spiraling tusk of the male which likely signals his social rank. In summer, narwhals rear their calves in nearshore bays and fjords, while in winter narwhals move to traditional offshore areas covered with heavy pack ice, relying on few-and-far-between cracks in the sea ice to breathe. On their wintering grounds, narwhals dive to incredible depths of up to 1,400 meters (4,590 feet) to gorge on two main prey items: Greenland halibut and polar cod. The narwhal is particularly vulnerable to climate change due to its restricted range, specific habitat needs and narrow diet. Decreasing sea-ice cover over its feeding grounds threatens to reduce the abundance of its two primary prey species. As sea-ice cover dwindles, one of the narwhal's main predators—the killer whale—is increasing in waters that were previously inaccessible due to heavy ice cover. Killer whale sightings have risen exponentially in Hudson Bay, Hudson Strait and Foxe Basin as sea ice has declined.[65] The melting ice is also exposing some narwhal populations to more human hunting. Hunters in West Greenland have been catching significantly more narwhals since 2002 in areas that were previously inaccessible to boats in early summer.[66] In addition, in the presence of killer whales, narwhals will move to shallow waters to avoid being killed, where they are more susceptible to human hunting.

SEA BUTTERFLY *pteropod; Limacina helicina*

RANGE: Arctic and Southern oceans

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ELEGANT SWIMMER. The pteropod *Limacina helicina* is a tiny shelled marine snail that swims using a pair of converted feet as wings. It has earned the name "sea butterfly" because of its elegant swimming style, and "potato chip of the sea" because of its importance as a food source for so many Arctic marine species from zooplankton to seabirds to fish. *Limacina helicina* starts life as a male and becomes female when it reaches a larger size. It captures its prey by casting a web of mucus that traps tiny plankton.

DISSOLVING IN ACIDIC OCEANS. Pteropods are among the marine creatures most vulnerable to ocean acidification. Ocean acidification lowers the availability of the mineral aragonite that pteropods use to form their shell, hindering this snail from building its protective armor. Scientists have found that *Limacina helicina* individuals that are exposed to the acidic ocean conditions expected at the end of the century are significantly less able to build their shells.[67] Acidic ocean conditions may be lethal for *Limacina helicina* in parts of the Arctic Ocean in the next few decades and across the Arctic Ocean before mid-century if current emission trends continue.[68] The decline of these key organisms would result in dramatic impacts for the entire marine food web.

KITTLITZ'S MURRELET *Brachyramphus brevirostris*

RANGE: Alaska, Siberia, Gulf of Alaska, Bering and Chukchi seas

GLACIER LOVER. The Kittlitz's murrelet is a small, cryptically colored seabird that nests on rocky ground near the tops of the coastal mountains of Alaska and Siberia. Known as "glacier murrelets," Kittlitz's murrelets forage in summer in coastal waters next to tidewater glaciers and glacier outflows which concentrate high abundances of energy-rich fish and plankton food. The murrelets' large eyes help them find food in the cloudy glacial waters, giving them an advantage over other seabirds. Kittlitz's murrelet numbers have been plummeting in many regions, prompting the International Union for the Conservation of Nature to list this species as critically endangered. Key populations in southern Alaska—including Prince William Sound, Kenai Fjords, Malaspina Forelands, and Glacier Bay—declined by 80 to 90 percent during the past 20 years.[69,70,71,72,73] Prince William Sound supported approximately 57,000 birds in 1972 and only 2,000 in 2001.[74]

RETREATING GLACIERS. The Kittlitz's murrelet's dependence on coastal tidewater glaciers makes it highly vulnerable to climate change.[75] More than 98 percent of Alaska's glaciers are retreating as temperatures rise.[76] The loss of coastal glaciers is rapidly eliminating the murrelet's specialized marine foraging habitat in glacial outflows,[77,78] putting them at a competitive disadvantage with other seabirds like the closely related marbled murrelet. Because glaciers act as reservoirs for many pollutants, melting glaciers threaten to add large volumes of contaminated meltwater to the murrelet's coastal foraging habitat. On land, glacier retreat is thought to be leading to an increase in predators in the murrelet's nesting habitat in the coastal mountains.[79]

OIL-SPILL DANGER. Melting sea ice is also making Alaskan and Siberian waters more vulnerable to intensified shipping traffic as shipping routes remain open longer and new sea routes become navigable. Increased shipping traffic will heighten the risk of oil spills for the Kittlitz's murrelet, which is particularly vulnerable to lethal oiling. The 1989 *Exxon-Valdez* oil spill in Alaska is estimated to have killed up to 10 percent of the worldwide population of Kittlitz's murrelets.

NICHOLAS HAJDUKOVICH/USFWS

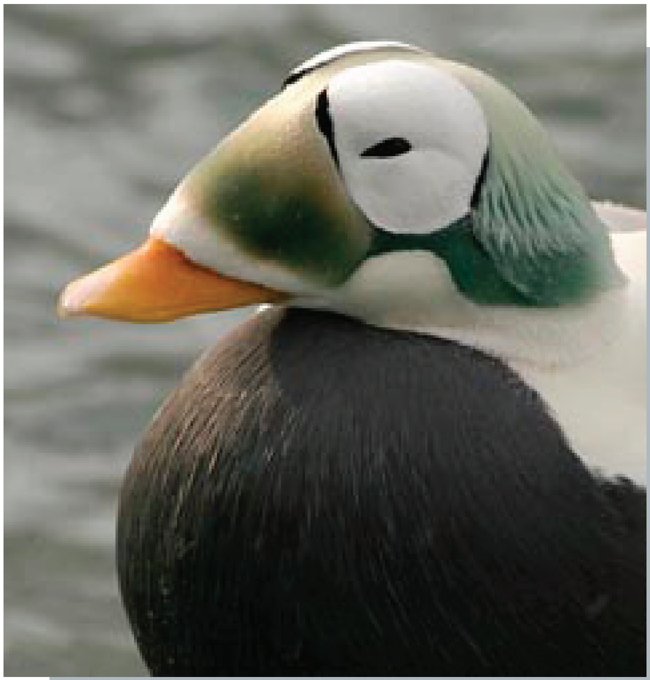
SPECTACLED EIDER *Somateria fischeri*

RANGE: Alaska, Russia and the Bering Sea

WINTER DIVER. The spectacled eider is a large seaduck that is aptly named for the distinctive white patches around the male's eyes that resemble a pair of goggles. Due to a dramatic decline of breeding populations in Alaska, the spectacled eider was declared a threatened species in the United States in 1993. This seaduck is particularly vulnerable to changes in the sea ice since the entire world population spends the winter months in openings in the pack ice in the northern Bering Sea. A spectacular sight, as many as 10,000 eiders can concentrate in a single large gap in the ice. Eiders use the ice openings to dive more than 60 meters (200 feet) down to the ocean bottom where they feed on dense beds of clams, snails and worms. When eiders are not diving, they save energy by resting on the sea ice.

FOOD SHORTAGES. Decreasing sea-ice cover, warming temperatures and acidifying waters in the Bering Sea threaten the eider's food supply. The loss of the sea ice in the northern Bering Sea is reducing the abundance of the eider's bottom-dwelling prey.[80] As competitors like fish and crabs move northward with warming ocean temperatures, they invade the eider's foraging grounds and eat its food. Acidifying waters are making it more difficult for clams and snails to build their shells, and the disappearance of sea ice may deprive eiders of dry places to rest, causing them to burn more energy.[81]

WETLANDS IN PERIL. Climate change also threatens the eider's nesting grounds on the coastal tundra of Alaska and Siberia. Eiders nest amidst the tundra wetlands near shallow ponds and lakes that provide them with plentiful insect and plant food. However, rising temperatures are melting the permafrost—the frozen layer of ground that maintains the tundra wetlands by preventing water from draining. Melting permafrost threatens to dry up the eider's nesting grounds and transform the tundra into shrublands and forests. Moreover, Alaskan coasts are being heavily battered by erosion, which is wearing away the eider's coastal habitat and inundating it with saltwater.



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IVORY GULL *Pagophila eburnean*

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RANGE: Arctic Canada, Greenland, Svalbard and Russia

The ivory gull, named for its completely white plumage, spends the entire year in the Arctic and rarely ranges far from the sea ice. Ivory gulls forage on small fish and invertebrates along the edges and openings in the pack ice, and have been known to follow polar bears and other predators over the sea ice to scavenge from their kills. An uncommon species, ivory gulls may number only 6,000 to 11,500 breeding pairs worldwide. Ivory gull populations in Canada declined by about 80 percent between the early 1980s and early 2000s,[82] while its status in Russia, Svalbard and Greenland is as yet uncertain. Already threatened by hunting, oil spills, gold and diamond mining, and the accumulation of contaminants in its food supply, the ivory gull now faces growing threats from climate change. Because the ivory gull feeds in association with the sea ice year- round, the dramatic shrinking and thinning of sea ice jeopardizes the gull's ability to find food and threatens this already rare species with further declines.[83]

CARIBOU/REINDEER *Rangifer tarandus*

RANGE: Arctic and subarctic

ARCTIC WANDERERS. Most caribou today roam the Arctic tundra, although a few herds inhabit the boreal forests of North America. In the last remaining large-scale ungulate migrations in the northern hemisphere, migratory caribou herds move seasonally along traditional pathways to reach areas with the most plentiful food and fewest predators and insects. Caribou play an important role in Arctic ecosystems by helping to cycle nutrients and structure plant communities in addition to supplying food to subsistence hunters. Many caribou herds are in decline across the Arctic.[84] At least four-fifths (34 out of 43) of the major herds that have been monitored during the past decade are declining, and caribou numbers have fallen an average of 57 percent from historical highs.[85] Climate change, habitat fragmentation, and mineral and oil extraction are thought to be the primary causes for these declines.

OUT OF SYNCH. Climate change is threatening caribou in numerous ways. Caribou time their migration to spring birthing grounds so that their arrival corresponds with the flush of nutritious plant growth. Ample food in spring and summer is important for the entire herd. Calves need nutritious food to put on enough weight to survive the winter, females need to produce milk for young calves and conceive in autumn, and males need to bulk up to compete for females. Although the spring growing season is starting earlier due to rising temperatures, caribou are not changing the timing of migration to keep pace, causing a mismatch between caribou and their

food. In West Greenland, the onset of plant growth has advanced by two weeks as mean spring temperatures have risen by more than 4 degrees Celsius (7.2 degrees Fahrenheit). Because caribou time their migration based on changes in day length and not temperature, they are arriving past prime plant growth. Due to lower food availability, more calves are dying and offspring numbers have dropped fourfold.[86]

BITING INSECTS. As temperatures warm, biting flies and mosquitoes that harass caribou are emerging earlier and increasing in abundance and activity. As insect harassment increases, caribou spend less time foraging and more time trying to escape, which results in poor physical condition. Biting insects do make a difference. Scientists have found that severe insect harassment can lead to decreased pregnancy rates among females and increased mortality during winter.[87]

IMAGES VIA WIKIMEDIA COMMONS/NATTFODD

EXTREME WINTER WEATHER. Caribou, especially at the northernmost latitudes, are also being hard hit by the increasing frequency and intensity of extreme winter weather events that are characteristic of climate change—including freezing rain events and deeper snow. “Freezing rain” or “rain-on-snow” events, where rain falls on snow and then freezes, create ice crusts that can lock the caribou’s lichen food under impenetrable frozen layers. Deeper snow makes it more difficult for caribou to find lichen and more energy-costly to move, and also increases their vulnerability to predators. Extreme weather events have been the primary cause of catastrophic population losses of Peary caribou from the Canadian High Arctic islands and of the Svalbard reindeer.[88]

MUSKOX *Ovibos moschatus*

© TAYLOR MCKINNON

RANGE: Canada, Greenland and Alaska

MAMMOTH LOOKALIKE. The muskox, which is closely related to sheep and goats, was a contemporary of the mammoth during the ice ages and is one of the few large mammals capable of living year-round in the severe Arctic environment. Its thick outer coat of coarse hair reaches almost to the ground and protects it from snow and rain, and the soft, brownish, wool-like underhair is prized for its warmth. Muskoxen graze in moist lowlands and river valleys during summer and move to upland slopes and plateaus in winter, where high winds prevent the accumulation of deep snow and make foraging easier. When the herd is threatened by wolves or bears, adult muskoxen face outward to form a tight circle around the calves, which is an effective defense against predators but not human hunters. Due to overhunting in the 1800s and 1900s, muskoxen were exterminated in Alaska, northern Europe and Siberia and remained only in Greenland and Canada. Regulated hunting and reintroductions of muskoxen into their former range have helped them recover in some areas. However, climate change and increased human activity in the Arctic pose new threats.

FROZEN FOOD. Muskoxen are not well adapted to breaking through snow or ice to reach moss and lichen forage food. As a result of climate change, increasingly frequent extreme winter weather events, including deep snow and freezing rain events that form ice crusts, are


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creating conditions that hinder muskoxen from reaching their food. Dramatic population crashes resulting from dense snow and freezing rain have hit herds in northern Greenland and Canada. For example, on Banks Island in the Canadian High Arctic, freezing rain—rain that percolated through snow cover and later froze—formed a thick ice layer that prevented muskoxen from reaching their forage plants. As a result, an estimated 20,000 animals starved to death in 2003. On Bathurst Island in the Canadian High Arctic, dense snow cover during three consecutive winters resulted in an 80-percent decline in the muskoxen population. Scientists predict that freezing rain events will increase in frequency and area in many parts of the Arctic,[89] raising concern for the muskox's future.

PARASITES ON THE RISE. Muskoxen also face increasing risks from parasites and predators as temperatures warm. Warmer temperatures speed up the larval development of a harmful lungworm parasite of the muskox, and increase the likelihood of infection since the slug that harbors the lungworm stays active longer on the muskox's forage plants.[90] The muskoxen may also face higher predation risk by grizzly bears as bears move northward into the muskox's tundra home.

IMPACTS AT THE ECOSYSTEM LEVEL: DAMAGING THE ARCTIC WEB OF LIFE

Climate change is having profound impacts not only on individual species but also on the ecosystems to which they belong—the interconnected assemblages of species and their physical environment. Observed ecosystem-level changes in the Arctic include the disappearance of essential habitats, shifts in species' timing and ranges, disruption of species' relationships, declines in abundance, and looming extinctions. Unless we reduce greenhouse gas emissions rapidly, we will lose the Arctic as we know it.

VANISHING HABITATS. Climate change is triggering the rapid loss of entire Arctic habitats, most notably sea ice and glaciers, and is leading to the degradation of others. For example, ocean acidification is making Arctic waters unlivable for many calcifying creatures, melting permafrost threatens to drain tundra wetlands, and erosion is degrading coastal habitats.

MOVING EARLIER. As the onset of spring arrives earlier, some Arctic species are advancing the timing of important activities to try to keep pace. The flowering of plants, egg-laying of birds, and emergence of insects have shifted by up to 30 days earlier per decade in some Arctic regions.[91] However, species may not shift their timing in synch with each other, which can disrupt important relationships. For example, the plant-growing season in Greenland is beginning earlier, but caribou have not advanced the timing of migration and calving to keep up, creating a mismatch between caribou and their food.

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MOVING NORTHWARD. Many Arctic species, from shrubs to insects to mammals, are moving northward to keep pace with rising temperatures.[92] However, as species enter new areas, communities are altered and disrupted. For example, the red fox has been moving northward into the tundra, following the expansion of shrubs, which has been linked to declines of the smaller, less dominant tundra-dwelling Arctic fox.

CHANGING SPECIES INTERACTIONS. Climate change is altering relationships among species in the Arctic by changing the availability of food resources and exposing them to new predators, competitors and pathogens as species shift their ranges. For example, as temperatures warm and sea ice vanishes, ringed seals are facing pressure from reduced availability of ice-associated prey, a heightened risk of predation from killer whales moving into once inaccessible ice-covered areas, increased competition for food from harbor seals moving northward, and exposure to novel pathogens.[93,94]

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DECLINES AND EXTINCTIONS. Climate change has already been linked to lower survival or population declines of Arctic species from the sea-ice dependent polar bear, to the glacier-affiliated Kittlitz's murrelet, to the tundra-dwelling caribou, to the marine sea butterfly. Researchers have forecast that at least one species, the polar bear, will be faced with extinction within this century if sea-ice loss is not halted. The loss of species can have far-reaching effects on the functioning of entire ecosystems.

MULTIPLE LAYERS OF IMPACT. Climate change is having multilayered, synergistic impacts on Arctic ecosystems, including threats from increasing human use. As previously ice-covered areas become more accessible, human activities like shipping, oil and gas exploration, commercial fisheries and tourism are on the rise, putting more pressure on already stressed systems. Ecosystem impacts will only worsen the longer greenhouse gas pollution goes unchecked.

THE WAY FORWARD: A ROADMAP FOR PROTECTING ARCTIC WILDLIFE FROM CLIMATE CHANGE

As documented in this report, climate change in the Arctic is already having profound impacts on wildlife, from vanishing Arctic foxes to drowning seal pups to starving muskoxen and caribou. Without rapid and bold action to slow climate change, these impacts will only worsen. Because many aspects of Arctic climate change are self-reinforcing, strong action today to cut greenhouse gas pollution is critical to preventing catastrophic and irreversible changes. Today, it is still possible to make the changes necessary to slow and then reverse warming in the Arctic. In fact, scientists have set forth the necessary actions. The way forward is clearly signposted and a few of the most important steps are summarized below. If society continues to delay, however, the precious window of opportunity we have today will slam shut.

Step 1: Reduce carbon dioxide to below 350 parts per million. Deep and rapid reductions in carbon dioxide emissions must be the core of any plan to save the Arctic. Scientists have concluded that we must reduce the level of carbon dioxide in the atmosphere from its current level of approximately 390 parts per million (ppm) to at most 350 ppm to avoid catastrophic impacts from climate change and ocean acidification.[95] Ultimately reducing carbon dioxide below 325 ppm may be necessary to restore Arctic sea ice to its area of 25 years ago.[96]

EMBRACING ENERGY EFFICIENCY. The amount of energy we use, and therefore the amount of greenhouse pollution we produce, can be slashed dramatically through simple energy efficiency improvements in buildings, including improving insulation and upgrading appliances and fixtures, as well as minor lifestyle changes. The first step to solving the climate crisis is taking advantage of the abundant, low-hanging energy-efficiency fruit.

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INVESTING IN CLEAN, RENEWABLE ENERGY GENERATION. We must rapidly transition away from coal, oil and other fossil fuels to truly clean and renewable energy sources. This challenge is surmountable but will require ending massive and ubiquitous subsidies for dirty energy, investing in existing clean energy sources and technology development, and ultimately overcoming the political stranglehold that polluters hold on political systems around the world.

While this is perhaps our greatest challenge, doing so is not only necessary to preserve the Arctic and the planet, but will create a safer, healthier and more equitable society for all of us.

PROTECTING FORESTS AND MAKING OTHER POSITIVE LAND-USE CHANGES. About one-quarter of net global warming is due to deforestation. Protecting existing forests, reforesting areas as appropriate and making other positive land-use changes will not only slow the increase of greenhouse gases in the atmosphere but will provide large co-benefits for biodiversity.

REVOLUTIONIZING OUR TRANSPORTATION AND FOOD-PRODUCTION SYSTEMS. Real changes are needed to reduce the amount of transport needed in our daily lives, and to reduce the carbon intensity of necessary travel. Similarly, reducing the carbon footprint of our food production systems—through measures like reducing reliance on industrial agriculture and meat-intensive diets—are part of the overall solution. Such changes can greatly improve our overall quality of life and health while paying enormous dividends for the climate and planet.

Step 2: Reduce short-lived greenhouse pollutants including black carbon, methane and ozone. Because carbon dioxide remains in the atmosphere for centuries, the benefits of reductions made today will not be fully felt for some time. It is also essential to reduce other potent greenhouse pollutants like black carbon (soot) and methane that are responsible for a large portion of the warming in the Arctic. Because black carbon and methane are much shorter-lived than carbon dioxide, immediate reductions in these pollutants can buy some desperately needed time to slow and then reverse the Arctic melting before it is too late.


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CONTROLLING BLACK CARBON FROM DIESEL ENGINES, BIOMASS BURNING AND COOKING FIRES. Black carbon produced from diesel engines, biomass burning and cooking fires in other parts of the world is carried to the Arctic by wind currents and greatly accelerates warming and the melting of snow and ice. Implementing the solutions which exist today to reduce black carbon from all these sources will not only yield enormous climate benefits but also protect public health.

REDUCING METHANE. Methane is an extremely potent and important gas but also one of the most readily and cost-effectively reduced. Large amounts of methane from landfills, agriculture, coal mines, natural gas systems and other sources around the world can be reduced at low cost, and in many instances at a net cost savings for the pollution source.

Step 3: Helping Arctic wildlife survive unavoidable climatic changes. While cutting greenhouse gas pollution is ultimately necessary to save the Arctic, we must also implement strong conservation measures that help wildlife better survive changes that are happening now as well as the unavoidable changes that are already in the pipeline.

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ENDING OIL AND GAS DEVELOPMENT IN THE ARCTIC. This dangerous activity acts as a double-edged sword by creating greenhouse emissions that accelerate climate change while also subjecting animals to oil spills and other industrial disturbance. As shown by an endless series of accidents from the 1969 well blowout off the coast of Santa Barbara, California, to the 1979 Ixtoc I disaster in the Gulf of Mexico, to the 2009 Montara blowout off the north coast of Australia, and finally to the 2010 BP disaster on the Deepwater Horizon in the Gulf of Mexico, oil spills are inevitable where oil drilling is carried out. As we transition away from this and other fossil fuels, we will also eliminate the deadly threat of oil contamination.

PROTECTING THE ARCTIC FROM INCREASED SHIPPING. Today's ships burn some of the dirtiest fuel used on the planet and introduce black carbon emissions directly into the Arctic in addition to increasing the risk of shipping related oil spills. If we are to protect the Arctic, it must be protected from increased shipping activities in newly ice-free waters.

ENDING OVERHUNTING OF AND TRADE IN IMPERILED WILDLIFE. Species from the polar bear to the narwhal continue to be hunted at very high levels in parts of their range, often for trophies and for trade. Unsustainable hunting practices must be ended to increase the resilience of these populations. Protection under domestic laws, such as the U.S. Endangered Species Act, as well as international agreements such as CITES, can help reduce this threat.

REDUCING OTHER TOXINS WHICH POISON THE ARCTIC. Controlling the manufacture and use of contaminants including mercury, pesticides and PCBs that are transported to the Arctic by wind and water currents will protect both the human and non-human residents of the Arctic from these poisons which bioaccumulate in the food chains of the far north.

Step 4: Political action is needed at all levels. We have the knowledge and technology to protect the Arctic from the most devastating impacts of climate change and ultimately reverse the currently inexorable warming. We also have the legal and policy tools: At the international level, the United Nations Framework Convention on Climate Change and the Kyoto Protocol address the climate crisis, and are supplemented by other agreements including the United Nations Convention on Biological Diversity. Ironically, the United States, which to date is the sole developed country to fail to ratify the Kyoto Protocol, has the strongest domestic environmental laws in the world. Successful programs under the existing Clean Air Act are available to reduce greenhouse gas emissions nationwide. The barriers we face are political, not legal or technological, and must be overcome with a massive increase in grassroots activism.

MAKING YOUR VOICE HEARD. Tell your elected representatives—loudly and often—that you support action at the local, national and international levels to reduce greenhouse pollution and protect the Arctic.

GETTING INVOLVED AND GETTING ACTIVE. Join the organization or movement which most appeals to you and learn how you can maximize your impact. www.biologicaldiversity.org and www.careforthewild.com provide resources to get you started.

BECOMING THE CHANGE YOU WANT TO SEE. Simple actions like insulating your home, reducing carbon-intensive travel, and switching to a vegetarian, local-foods or low-meat diet all reduce your carbon footprint. Talking to others about the challenges we face will help create the political momentum that is desperately needed to solve the climate crisis and save the Arctic and other most vulnerable regions of our planet.

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