



PROTECTION OF THE ARCTIC NATIONAL WILDLIFE REFUGE: KEY TO MANAGING ONE OF THE WORLD'S MOST BIOLOGICALLY VALUABLE ECOREGIONS, THE ARCTIC COASTAL TUNDRA

SUMMARY

The coastal plain of the Arctic National Wildlife Refuge located in the remote northeast corner of Alaska is a key part of an ecoregion with globally outstanding biodiversity values. This area of gently rolling tundra, wedged between the Arctic Ocean and the foothills of the Brooks Range, is the biological heart of the Arctic Refuge. It is the center of activity for caribou, migratory birds, polar bears, and other wildlife. Together with two Canadian national parks adjoining the refuge, this intact ecosystem protects the migrations of the largest international caribou herd in the world—the Porcupine caribou herd—and contains the herd's sensitive birthing and nursery grounds.

But British Petroleum and other multinational companies continue to press the U.S. Congress to open the refuge coastal plain to oil and gas exploration and development. The coastal plain of the refuge is the only area of the arctic coastal tundra ecoregion in Alaska that is protected by law from oil exploration and development. (More than 90 percent of the North Slope is already available to the oil and gas industry for exploration or development.) Yet this critical 607,288 hectares (1.5 million acres) in the Arctic Refuge is vulnerable to pressure by the oil industry, as it is not yet fully protected as wilderness. Greater protection is needed to ensure a future for the full migratory cycle of the Porcupine caribou herd and effective management of the existing protected areas—the Arctic Refuge wilderness and adjacent Canadian national parks.

Under a global conservation strategy, permanent protection for the refuge's coastal plain is a necessary step to ensure conservation of the biological integrity of the arctic coastal tundra ecoregion. WWF opposes oil and gas development in the Arctic Refuge and supports designation of the coastal plain as wilderness to permanently protect this special place.

PROTECTING AN INTERNATIONAL RESOURCE—A LONG-TERM VISION

In the remote northeastern corner of Alaska lies one of America's great natural treasures, the Arctic National Wildlife Refuge. Its 8 million hectares (18.9 million acres) constitute one of the only places on Earth that protects the complete spectrum of subarctic and arctic habitats.

The refuge reaches north from boreal forests (taiga) to the tallest peaks in the Brooks Range, which arch toward the ice-filled Beaufort Sea. The foothills along the North Slope of the mountains sweep down to the coastal plain, which narrows dramatically within the refuge, thereby increasing its habitat diversity and productivity. The arctic coastal and foothills region is characterized by gently rolling tundra, river corridors, and thaw lake wetlands. The northern boundary of the refuge encompasses lagoons, barrier islands, and large bays. This diverse landscape juxtaposes mountains, braided rivers, coastal wetlands, seashore, estuaries, and barrier islands—a zone of exceptional diversity. The coastal plain provides internationally significant habitat for the Porcupine caribou herd, staging areas for snow geese and other migratory birds, and denning sites for polar bears.

In 1960, President Eisenhower established the Arctic National Wildlife Range "to protect its unique wildlife, wilderness and recreational values." In the Alaska National Interest Lands Conservation Act (ANILCA) of 1980, the original range was renamed and greatly enlarged to incorporate the wintering grounds of the Porcupine caribou herd. The purposes of the refuge were expanded to include conservation of natural diversity, to support subsistence uses, and to maintain international treaty obligations. The original refuge was included in the National Wilderness Preservation System, the most protective U.S. land designation, except for a critical 607,288 hectare (1.5 million acre) area of the coastal plain that was coveted by the oil industry. A total of 3 million hectares (8.9 million acres) out of the 8 million hectare (18.9 million acre) refuge is designated wilderness. Yet the critical area of the refuge with the highest biological productivity remains inadequately protected. Oil and gas leasing, exploration, and development are prohibited by law, but the oil industry continues to lobby the U.S. Congress to open this area to oil development.

More than 40 years ago, scientists and conservationists who fought to establish the Arctic Refuge envisioned preserving an undisturbed portion of America's arctic that was large enough to be biologically self-sufficient. Of particular concern was protection of the entire range of the Porcupine caribou herd, whose range is partly in the United States and partly in Canada. By 1953, a proposal for an Arctic International Wilderness focused on wildlife, wilderness, and scientific study in this transboundary area, and emphasized the provision of a continued land base for the Inupiat and Gwich'in indigenous cultures. New conservation proposals followed an Arctic International Wildlife Range conference in 1971.

Today, the first large-scale wilderness reserve for wildlife ranging across international boundaries in the circumpolar arctic comprises the adjoining Arctic Refuge in Alaska, Canada's Ivvavik National Park (formed in 1986), and Canada's Vuntut National Park (established in 1993). Although these areas are managed as separate entities, an international conservation agreement signed by the two countries in 1987 established the International Porcupine Caribou Board to further the conservation of the Porcupine caribou herd. The primary goal of this agreement was to provide proper management of the sensitive habitats used by the herd. The Arctic Refuge also is required to fulfill other international treaty obligations of the United States with respect to fish, wildlife, and their habitats. These include the Agreement on the Conservation of Polar Bears and migratory bird treaties with Canada, Russia, and Japan.

ECOREGION OF GLOBAL IMPORTANCE

The Arctic National Wildlife Refuge covers a key part of the arctic coastal tundra ecoregion that stretches along the north coasts of Alaska and Canada. WWF scientists identified this ecoregion (Global 200 ecoregion #88, Alaskan North Slope Coastal Tundra) as having one of the world's most intact and diverse examples of arctic tundra. In WWF's North American Conservation Assessment, the ecoregion is further described as including both arctic coastal and foothills tundra (Ricketts et al. 1999).

This ecoregion preserves ecological processes that have disappeared from much of the rest of the United States. The entire arctic coastal tundra ecoregion is an important breeding and birthing ground for many species. It is one of the last places in the United States where intact large mammal assemblages and migrations can still be found.

The Arctic Refuge supports internationally significant caribou migrations and calving grounds. Around the world, large-scale migrations of large terrestrial mammals are disappearing as habitat dwindles. The arctic coastal tundra and boreal forest habitats of North America represent some of the last strongholds for this important ecological phenomenon (Ricketts et al. 1999). The coastal and foothills tundra on Alaska's North Slope provides annual calving and post-calving habitat for three caribou herds in the state. This includes the western arctic herd, the central arctic herd, which has been negatively affected by the Prudhoe Bay oil field development, and the Porcupine caribou herd. Of these, only the sensitive calving and post-calving habitats of the Porcupine caribou herd are contained within existing protected areas, albeit with insufficient protection in the United States. Ivvavik National Park in the northwestern Yukon Territory protects Canada's part of this herd's calving range. However, the coastal plain area in the Arctic Refuge where oil development is proposed is the most consistently and heavily used calving area for the herd year after year (Whitten et al. 1992; Whitten 1995). Expansion of oil development activity into the refuge coastal plain has the potential to interrupt the migration route through the existing natural "bottleneck" of the narrow coastal tundra strip—one area that provides important habitat at a crucial time in the annual life cycle of the herd.

Arctic tundra is a unique expression of biodiversity. Although it may not support the rich communities seen in tropical rain forests or coral reefs, it contains species assemblages adapted to distinct environmental conditions and reflecting different evolutionary histories. To lose examples of these assemblages—and the ecological processes and evolutionary phenomena they contain (e.g., caribou migrations, migratory bird staging areas, or polar bear denning habitats)—would represent an enormous loss of biodiversity. Representation of the full variety of North American habitat and ecosystem types is essential to the conservation of the continent's biodiversity. More than 90 percent of the arctic coastal and foothills tundra ecoregion is already available to the oil and gas industry for exploration or development.

INDUSTRIAL OIL COMPLEX AT PRUDHOE BAY

The continued expansion of the Prudhoe Bay oil field development is the primary threat to Alaska's arctic coastal tundra. Since 1968, Prudhoe Bay and 18 other producing oil fields have transformed a once vast arctic wilderness. Oil exploration and development activities and

infrastructure have had significant impacts on tundra wetlands and rivers on Alaska's North Slope and nearshore and marine habitats in the Beaufort Sea.

Prudhoe Bay and 18 other producing oil fields sprawl over more than 2,590 square kilometers (1,000 square miles) of arctic coastal plain in the mid-Beaufort area of the North Slope. Anticipated development of known fields will spread the industrial complex to the east and west of Prudhoe Bay, and include newly leased lands in the National Petroleum Reserve-Alaska and offshore into the Beaufort Sea. Located about 97 kilometers (60 miles) east of Prudhoe Bay, the Arctic National Wildlife Refuge is the only area on Alaska's North Slope where oil exploration and development is prohibited by law, but that protection is not secure.

The Trans-Alaska Pipeline System opened up America's arctic to development. On the North Slope of Alaska, roughly 8,910 hectares (22,000 acres) of coastal tundra have been lost due directly to the oil fields and Trans-Alaska Pipeline System. Across the landscape, indirect and secondary effects on wetlands lagged behind construction but exceeded the direct impacts (Walker et al. 1987). Already, the total area disturbed by oil development has exceeded the geographic extent of direct impacts predicted by the U.S. Interior Department in its 1972 Environmental Impact Statement (EIS).

The North Slope oil fields include more than 2,400 kilometers (1,500 miles) of roads and trunk and feeder pipelines, two refineries, the largest gas handling plant in the world, living quarters for hundreds of workers, landfills, water reservoirs, five docks and gravel causeways, and a total of 25 production plants, gas processing facilities, seawater treatment plants, and power plants. There are at least 22 gravel mines, which have mined 400 percent more gravel than the Interior Department predicted in its 1972 EIS (U.S. Fish and Wildlife Service 1987). More than 3,800 wells have been drilled in Alaska's arctic, four times as many as predicted, at 170 exploratory and production gravel drilling pads. On Alaska's North Slope, the oil industry annually emits approximately 56,427 tons of oxides of nitrogen, which contributes to smog and acid rain. This is more than twice the amount emitted by Washington, D.C. (EPA National Emissions Trends Database 1999). North Slope oil facilities release roughly 24,000 tons of methane, a greenhouse gas, a year (Jaffe et al. 1995).

Technological advances have reduced the size of individual drilling pads and eliminated the need for connecting roads to some of the newer oil fields. Most of the reduction in the size of drill sites is due to the elimination of reserve pits that were used for disposal of drilling wastes. BP Exploration (Alaska) Inc. pioneered use of a grind and injection technique to replace dumping into huge pits in the wake of many scientific studies showing impacts on tundra ponds from leaking fluids and a Clean Water Act lawsuit against ARCO Alaska Inc. filed by the Natural Resources Defense Council, a U.S.-based environmental organization.

Despite improvements, oil development unavoidably involves construction of many permanent industrial facilities and noisy operations spread across vast expanses of the landscape. The industrial network continues to expand across the coastal tundra each year as additional fields are developed with new drilling pads, roads, pipelines, processing plants, and other facilities and operations that add to the cumulative impact. No matter how well done, oil

development would industrialize a unique, wild area that is the biological heart of the Arctic Refuge.

Physical disturbance, such as heavy equipment tracks or spills of oil or other toxic substances have scarred and degraded the land for decades. There continues to be more than one spill a day of diesel, crude oil, and other toxic products. There was an average of 427 spills, most commonly diesel and crude oil, caused by oil industry activities each year between 1996 and 1998, according to an Alaska Department of Environmental Conservation database containing industry-reported spills of one gallon or more. Over 1.2 million gallons of roughly 40 different substances, from acid to waste oil, are spilled during routine operations. A study of diesel spills in Alaska's arctic showed that 28 years following a spill there were still substantial hydrocarbons in the soil and little vegetation recovery (Walker et al. 1987b). Even relatively small spills can harm wildlife. A polar bear died after ingesting ethylene glycol, which is used in marking ice airstrips (Amstrup et al. 1989). There have been no studies of most spills on the North Slope.

Many of the spills are on the gravel drilling or production pads and are cleaned up by the oil companies. However, others severely contaminate the gravel and pose long-term rehabilitation problems, including chronic leaking around production wells where the permafrost is melting.

Despite advances in spill prevention and waste disposal techniques over the years, some recent examples show continued need for improvement.

- During horizontal drilling of the Colville River pipeline crossing for ARCO's Alpine field in 1998, 2.3 million gallons of drilling muds disappeared under the river; it is still unknown where they ended up and whether they will ultimately pollute Alaska's largest arctic river (*Fairbanks Daily News-Miner* 1998).
- At BP Exploration (Alaska) Inc.'s Endicott field, a drilling contractor dumped hazardous waste oil and solvents containing benzene and other toxic substances into unsealed outer well shafts over a period of at least three years. This problem came to light due to a whistleblower coming forward, not due to an environmental monitoring program. In February 2000, a federal court ordered BP Exploration (Alaska) Inc. to pay \$15.5 million in criminal fines and to implement a new environmental management program, in addition to \$6.5 million in civil penalties (*Anchorage Daily News*, February 2, 2000).
- From nine ARCO wells where drilling wastes are ground and injected below the ground, 3.7 million liters (994,400 gallons) of seawater spewed out at the drill site in 1997 (EPA 1997; Alaska Department of Environmental Conservation).

The full consequences of improved practices such as waste injection still need to be born out over time; for example, thawed soils may provide a migration pathway for injected toxic wastes which could become more of a concern with increased melting of the permafrost from global climate change.

Although industry has conducted some pilot studies of rehabilitation techniques for gravel pads and other disturbances in the arctic oil fields, the technical or economic feasibility of restoring the tens of thousands of acres of roads and drilling sites has yet to be proven. Hundreds of abandoned exploratory wells, waste pits, and contaminated sites across the North Slope tundra have yet to be cleaned up or restored.

There has never been a comprehensive environmental impact statement for the development of North Slope oil fields located onshore. Some analysis was conducted as part of the EIS done for the Trans-Alaska Pipeline System (U.S. Department of the Interior 1972), but it was very qualitative and brief. The impacts from most of the current oil fields, including Niakuk, Milne Point, Endicott, Point McIntyre, and most of Kupurak were not predicted nor discussed in that EIS. EISs have been done for offshore development projects, but their analysis of cumulative impacts has been extremely limited, and has failed to address the combined effects of onshore and offshore activities and infrastructure. British Petroleum and Trustees for Alaska, a public interest environmental law firm, were influential in prompting the U.S. Congress to fund an information review—conducted by the U.S. National Research Council and scheduled for completion in 2002—on the cumulative impacts of North Slope oil development.

THE THREAT: OIL EXPLORATION AND DEVELOPMENT IN THE REFUGE

Americans support protection of the Arctic Refuge

For more than 20 years, BP Amoco and other oil companies have been lobbying for the right to build hundreds of miles of pipelines, roads, drilling pads, gravel mines, and other industrial facilities in the coastal plain of the Arctic National Wildlife Refuge. The week before the Exxon Valdez oil spill in 1989, a key U.S. Senate committee passed a bill to open the Arctic Refuge to oil leasing and development. But the legislation died in the aftermath of the tanker disaster in Prince William Sound. After the Persian Gulf War in 1991, President George Bush's National Energy Bill contained Arctic Refuge drilling provisions but a filibuster in the U.S. Senate stopped this initiative. In 1995, a drilling provision was slipped into the federal budget bill but President Clinton vetoed it. This year, Senator Frank Murkowski and Representative Don Young from Alaska introduced legislation calling for leasing and development in the refuge. Enactment of the bill is unlikely, however, as a presidential veto is almost certain.

In the course of these high-pitched battles over the future of the Arctic Refuge, the American people have become more aware of the vulnerability of this special place. Opinion polls show approximately 70 percent of Americans support protecting the refuge coastal plain from oil drilling. Currently, a wilderness bill in the U.S. Congress has a record number of cosponsors endorsing permanent protection for the coastal plain. A recent statewide opinion poll conducted by Ivan Moore Research for the Alaska Conservation Alliance shows Alaskans are closely divided on the question of whether "the Arctic National Wildlife Refuge should be protected from BP's oil development plans" (41% agreed, 43% disagreed, and 16% were neutral; November 1999). As described below, the majority of the residents in the village of Kaktovik on the northern boundary of the refuge support drilling onshore in the refuge, although they oppose offshore leasing and development in the adjacent waters of the Beaufort Sea. However, most

Alaska residents in rural areas, Southeast Alaska, and Fairbanks, and women by a wide margin, agree that the refuge should be protected from oil development.

Oil potential

The most likely estimates of commercially recoverable oil from the coastal plain of the refuge predict that the area would yield only about six months worth of oil for the United States—if oil were found there at all. Alternative energy sources, such as solar energy, offer far greater untapped resources that would have more certainty, lower economic and environmental costs, and much earlier results.

There have been numerous geological studies of the oil potential in the coastal plain in the past 15 years. A major study mandated by the U.S. Congress included a one-time seismic oil exploration program (Department of the Interior 1987). That study reported a mean estimate of 3.2 billion barrels of economically recoverable oil, if oil was found, in the coastal plain ("1002 area"). In 1998, the U.S. Geological Survey (USGS) published a new petroleum resource assessment and similarly estimated that 3.2 billion barrels of economically recoverable oil may be found in the refuge coastal plain. It provided a mean estimate of 7.7 billion barrels of technically recoverable oil from the refuge coastal plain.

The USGS study concluded that there is not a Prudhoe Bay-size oil field in the refuge—the opposite of what the industry claims. Whereas the giant Prudhoe Bay oil field has already pumped more than 10 billion barrels, and the state of Alaska estimates 3 billion more will be produced by 2020, USGS estimated (at 50 percent probability) the largest potential field size that may occur in the refuge at just 1 billion barrels. Most potential fields in the refuge are considerably smaller; if they were developed, the required infrastructure would be scattered in many industrialized zones spread across the area.

To date, all of the North Slope fields together have produced a total of 12.5 billion barrels of oil. The state of Alaska projects that another 5.7 billion barrels of oil will be produced from 1999 to 2020 from Prudhoe Bay, seven other nearby oil fields, and new development of 50 satellite fields. This additional production alone roughly doubles the most likely economically recoverable oil that may be found in the Arctic Refuge. The state's projection does not take into account significant production that may take place from the 15 billion barrels of oil known to exist in-place in the West Sak field overlaying the Kuparuk and other fields (U.S. Department of Energy 1991).

Potential impacts on fish, wildlife, and their habitats

Oil exploration and development in the Arctic Refuge would have major impacts on all the refuge purposes, according to the Department of the Interior's Environmental Impact Statement (1987) and more recent biological studies, even considering potential mitigation measures and leasing stipulations. The Interior Department concluded that oil development in the coastal plain would have serious impacts on the Porcupine caribou herd, muskox, water quality and quantity, subsistence hunting by Inupiat and Gwich'in communities, and wilderness.

Native Alaskan communities

Gwich'in (Athabaskan Indian) *“Oil development in the calving grounds of the Porcupine caribou herd—the coastal plain of the Arctic National Wildlife Refuge—threatens our Gwich'in culture and the ecosystem we depend on. This is a simple issue. We have the right to continue our way of life.” --Faith Gemmill, Gwich'in Steering Committee*

For thousands of years, the Gwich'in people of Northeast Alaska and Northwest Canada have depended upon the Porcupine (River) caribou herd to sustain their culture. The 7,000 Gwich'in people live in 14 villages located in strategic places along the herd's migratory route. Central to the Gwich'in way of life, the herd provides food, clothing, and a critical link to traditional ways.

The Gwich'in are one of the most traditional of surviving native cultures, and to them the coastal plain is a sacred birthplace that should never be disturbed in any way. They are united in support of permanent protection of the coastal plain as wilderness. Their position is endorsed by the National Congress of American Indians, which represents over 200 tribes. Additionally, the Canadian government has staunchly opposed oil drilling in the coastal plain, in support of the Gwich'in and other communities dependent on the Porcupine caribou herd.

Inupiat (Eskimo) The Inupiat living on the North Slope of Alaska are primarily dependent on the bowhead whale and resources of the sea as the basis of their subsistence culture. Therefore, for decades they have strenuously opposed offshore oil and gas development in the Beaufort Sea, including off the coast of the Arctic Refuge, due to the impacts that drilling and seismic exploration have had on the bowhead whale migration and the Inupiat's subsistence harvest. About 250 Inupiat live in the village of Kaktovik, located on an island on the north side of the refuge. Although the Inupiat community of Kaktovik supported wilderness protection for the Arctic Refuge until the early 1980s, they have come to support onshore drilling. The Kaktovik lands are private, and therefore would not be designated wilderness under proposed legislation.

On the North Slope, there are about 6,300 Inupiat stockholders in the Arctic Slope Regional Corporation (ASRC), which owns nearly 5 million acres on the North Slope, most of which is available for oil leasing and development. They have leased lands in the Alpine oil field, which will begin production soon, and in adjacent areas within the National Petroleum Reserve-Alaska. ASRC is a Fortune 500 Corporation with \$887 million in revenues in 1998. ASRC received the subsurface title to land beneath the Kaktovik village in a 1983 land exchange signed by former Interior Secretary James Watt. The exchange agreement expressly prohibits oil development of ASRC lands unless the federally managed coastal plain area is opened to the oil industry. When ASRC signed the agreement, it was clearly aware of this limitation and the high risk that Congress might not open the area to oil and gas development. Under the terms of the Alaska Native Claims Settlement Act, regional corporations had been precluded from selecting subsurface lands within national wildlife refuges existing at that time, including the Arctic Refuge, due to the extraordinary wildlife and subsistence values that could be compromised by mineral extraction. The North Slope Borough is one of the richest local and regional

governments in the United States and will continue to have the power to tax the oil industry as it further develops known fields in the vicinity of Prudhoe Bay.

Caribou

The Arctic Refuge provides critical calving and post-calving habitat for the 129,000 animal Porcupine caribou herd; there is no alternative area. Over the past 25 years, the most consistently and heavily used calving area for the herd has been in the coastal plain area proposed for oil development. Nearly every year, all females and calves in the herd use the coastal plain area for post-calving, and in most years the majority of males join them.

The U.S. Fish and Wildlife Service predicts that oil exploration and development will have a major effect on the Porcupine caribou herd by causing up to a 40 percent decline or displacement of the herd from the cumulative effects of reduced access to habitat providing preferred forage, predator avoidance, or insect relief.

Female caribou generally avoid the North Slope oil fields where there is a network of roads, pipelines, and other facilities. Caribou numbers in the central arctic herd have significantly increased over the past 30 years, as have populations throughout the arctic during this period, but this regional trend has masked significant changes in habitat use, disruption of their movements, and reproductive success. The Alaska Department of Fish and Game (ADF&G) reported that during aerial surveys from 1978 to 1984, the lowest caribou calving densities within the calving grounds of this herd were within the Prudhoe Bay oil fields area. During the early 1990s, biologists from the Alaska Department of Fish and Game found that caribou inhabiting the oil fields had lower calf productivity compared with members of the same herd that seldom encountered oil-related facilities. This herd has been largely split into two groups by the Trans-Alaska Pipeline, and a sharp decline in population recorded in 1995 surveys occurred entirely in the part of the range in the vicinity of oil fields, with a 41 percent decline found in the Kuparuk oil field area (U.S. Fish and Wildlife Service 1995a). Caribou use of preferred habitat declined exponentially as the density of oil field roads increased, according to a 1998 study. This loss of habitat continues to increase as new roads and pipelines expand across the North Slope.

The potential impacts of oil exploration and development on the Porcupine caribou herd, which relies so heavily on the coastal plain of the Arctic National Wildlife Refuge, could be far greater. The industry's argument that the Prudhoe Bay experience indicates little reason for concern ignores important differences between the two different herds, and disregards concerns raised by scientists about the growing evidence of the effects of North Slope oil development on the herd in that area. The refuge coastal plain area provides essential calving and post-calving habitat for the Porcupine caribou herd—a herd that is nearly ten times as large as the central arctic herd—in a birthing and nursery grounds that is one-fifth the area. There is no alternative habitat for the herd to move to, according to the International Porcupine Caribou Board.

Polar bears

The coastal plain of the Arctic Refuge is the most important onshore denning habitat for the entire Beaufort Sea polar bear population in the United States and Canada.

Increasingly, permanent developments by the oil industry are encroaching on polar bear habitats along Alaska's Beaufort Sea coast. Polar bears are especially sensitive to disturbance during denning. The Agreement on the Conservation of Polar Bears committed the arctic nations to "protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns." Females may abandon their dens if disturbed, and early den abandonment can be fatal to cubs unable to fend for themselves. In 1985, a female polar bear abandoned her maternity den in the Arctic Refuge coastal plain after seismic exploration vehicles tracked within 700 feet of it—even though regulations at the time required a 0.8 kilometer (0.5 mile) buffer from known dens. This occurred despite the most extensive monitoring program ever in place for seismic exploration on the North Slope. Most maternity den sites are never known, and therefore cannot be avoided.

Their natural curiosity and keen sense of smell often places polar bears in harm's way—they can be attracted to drill rigs, garbage dumps, and contaminants. Polar bears are especially sensitive to oil spills because they search for food in the open leads or broken ice where oil accumulates. Interactions between polar bears and humans are often lethal. A young bear was shot in Prudhoe Bay by an oil industry employee during the winter of 1968-69, and in 1990 a bear was killed when it approached an offshore rig in Camden Bay, off the Arctic Refuge.

Muskox

Muskox disappeared from Alaska's arctic more than 100 years ago. They were reintroduced to the Arctic Refuge in 1969. Their numbers have grown to approximately 350 in this area and their range has expanded to the east and west. The only large mammals to live year-round in the refuge, they feed along rivers in summer and windblown ridges in winter.

Major impacts on muskox populations are predicted to result from oil development. Muskoxen would be subjected to cumulative impacts in both summer and winter. Disturbance from industrial operations would increase the energy needs of this species that typically moves little in winter, and result in reduced calving rates and higher winter mortality. Mining along rivers for gravel extraction would displace muskox from limited, preferred feeding areas and cause permanent habitat loss.

Wolves, wolverines, brown bears

These magnificent animals thrive in remote wilderness. Wolves and bears primarily den in the foothills and mountains south of the coastal plain in the refuge. Wolverines are infrequently observed but travel in all types of arctic terrain, and females may use snowdrifts along small tundra streams for dens. During spring, wolves and bears roam out to the coastal tundra where they prey on newborn caribou.

Population declines or changes in distribution of brown bears and wolves are results predicted from the increased mortality, decreased prey, harassment, and disturbance in denning

areas caused by oil development. The cumulative effects of displacement, avoidance, and reduced food resources could result in long-term changes in wolverine distribution.

Migratory birds

Over 135 species of birds from four continents nest, feed, or migrate to the refuge coastal plain. The greatest concentrations occur in coastal lagoons, tundra wetlands, and along rivers. The coastal plain provides essential fall staging habitat for up to 300,000 snow geese that nest in Canada. Feeding ravenously, the geese increase their body fat by 400 percent in a few weeks in order to survive migration.

Permanent habitat losses would result from gravel drilling and development of more production pads, roads, airports, and gravel mining. Loss of bird nesting and feeding habitats would be caused indirectly by road dust, hydrological alteration, delayed snow melt along roads, and ice roads. In Prudhoe Bay, the nesting populations of eight shorebird species along oil field roads were found to be decreased in number.

An oil spill in the refuge lagoons during peak molting, staging, or migration periods is predicted to have major impacts. Aircraft use and other industrial activity from oil exploration and development would have widespread effects on snow goose distribution. Snow geese, especially young birds, need large undisturbed areas so they can get enough food to survive the 1,930-kilometer (1,200-mile) non stop migratory flight before they rest and feed again.

Vegetation

The arctic coastal tundra consists of thaw lakes and wetlands near the Beaufort Sea coast and along river deltas. The foothills tundra, a transition between this and the Brooks Range, is dominated by sedge tussock (Eriophorum vaginatum), which provides the lush, new growth needed to feed caribou calves and energize staging snow geese. Riparian areas have willow shrubs that are important nesting habitat for migratory birds.

Studies have documented extensive cumulative impacts to coastal tundra vegetation from oil development at Prudhoe Bay. These impacts cover a greater area than the surface areas of the roads, drill sites, and other development. Successful rehabilitation techniques have yet to be developed for these areas. Despite extensive and expensive rehabilitation experiments, there has been only limited success in small areas. The short, cool growing season and the presence of permafrost serve to inhibit revegetation of arctic coastal tundra.

Even during the winter, seismic oil exploration caused significant damage to vegetation from the heavy tracked vehicles used for the seismic studies, despite regulations and permit stipulations developed to minimize impacts to vegetation. Congress mandated a one-time seismic exploration program in the Arctic Refuge that was conducted during the mid-1980s. Even a decade later, recovery of disturbed vegetation was not complete. U.S. Fish and Wildlife Service research concluded that the impacts that remained on medium and highly disturbed trails—such as changes in thaw depths, trail subsidence, changes to wetter conditions, distinct ruts, invasion of grasses, and decreases in shrubs—may easily persist for another decade.

Arctic char, grayling, and other fish

Overwintering habitat for arctic char (Dolly varden), arctic grayling, and other fish is extremely limited in rivers and lakes in the refuge. Coastal waters contain marine and anadromous species including arctic char, arctic cisco, and arctic cod.

Major effects on limited overwintering habitats are predicted to result from water withdrawals. There could be major effects from oil spills in fish habitats. Anadromous fish habitat degradation in nearshore coastal waters would be expected from causeways, docks, and other facilities.

Water

There are 237 miles of rivers flowing through the refuge coastal plain. The Arctic Refuge has far fewer lakes than the Prudhoe Bay area because much of the area is gently rolling. Most lakes in the refuge are less than 7 feet deep and freeze to the bottom in winter. There are several springs along the foothills—including Sadlerochit Spring, which has been nominated as a National Natural Landmark.

Because water in the refuge is so limited, the U.S. Fish and Wildlife Service predicts major impacts from oil exploration and development. The area receives less than 10 inches of precipitation each year. During late winter, only 34 million liters (9 million gallons) of water are available in the rivers in the coastal plain—this is enough to build and maintain only 10.6 kilometers (6.6 miles) of ice roads. It takes 5.11 million liters (1.35 million gallons) of water per mile to build ice road, and as much as 56.8 million liters (15 million gallons) to drill one exploratory well. The ice roads to be built for construction of BP Amoco's proposed offshore Northstar development are requiring 379 million liters (100 million gallons) of water to be removed from lakes and gravel mines and water reservoirs in a single year.

Coastal/marine environment

Lagoons, barrier islands, deltas, shorelines, and coastal waters provide shelter, feeding, and staging areas for migratory fish and wildlife populations, including endangered bowhead whales and millions of migratory birds. There is a critical feeding area in the Beaufort Sea off the coast of the refuge that is used by bowhead whales on their fall migration.

Major adverse effects to the coastal and marine environment are predicted in the event of a major offshore or coastal spill. Oil spills, support infrastructure such as pipelines, and activities associated with offshore development threaten the integrity of the coastal plain of the refuge. These factors also threaten to disturb and alter calving and post-calving habitats of the Porcupine caribou herd, polar bear denning, and migratory bird staging, feeding, and nesting.

BP Amoco is currently constructing the first-ever subsea oil pipeline in the Arctic Ocean for its Northstar oil development project located north of the Prudhoe Bay oil fields. The U.S. Army Corps of Engineers predicted an 11 to 24 percent chance of a major spill from the

Northstar oil development alone, and a 95 percent chance of a major spill resulting from cumulative North Slope and offshore oil development (Northstar Final Environmental Impact Statement 1999). Buried beneath the sea ice, leaks from the pipeline will be impossible to clean up, especially in broken ice conditions. BP Amoco's Liberty Development is a second proposal for an offshore development using buried subsea pipelines from which there would be additional risk of spills. Many unanswered questions persist regarding oil spill risks from well blowouts and subsea pipelines, cleanup technologies in sensitive marine habitats, and pipeline technology. Needless to say, there is no track record of safe performance for buried subsea oil pipelines in the Arctic Ocean.

Offshore oil and gas seismic exploration and drilling by drill ships in the Beaufort Sea waters beyond the refuge has already disturbed bowhead whales during their fall migration and negatively affected the subsistence hunting activities of the Inupiat people who live on the North Slope. Development activities in this region pose increased cumulative threats to bowhead whale feeding and migration areas, polar bear denning, migratory routes, and other marine and coastal components of the ecoregion.

Wilderness

The refuge, including the coastal plain, is a world-class natural area with incomparable and irreplaceable ecological, scientific, historic, and educational values for the American people.

If oil exploration and development occurred in the wildlife refuge, its wilderness values would be eliminated. Displacement and reduction of wildlife populations and natural processes would cause a major reduction in the value of the area as a pristine, natural scientific laboratory, according to the U.S. Interior Department.

CONCLUSIONS

...The Arctic Refuge coastal plain is unique among the refuges and parks of the United States... Impacts from development would be major, and measures to reduce or remediate those impacts are uncertain. For its biological richness, undisturbed vastness, and fragility as an arctic ecosystem, the coastal plain of the Arctic National Wildlife Refuge is a national treasure, and would be irreparably altered by development.
-- U.S. Fish and Wildlife Service, 1995.

Decisions to protect biodiversity in the arctic must consider protecting arctic resources at the landscape scale, pay special attention to diverse landscape regions, and carefully manage the genetic wealth of glacial refugia, according to Alaska ecological reserves coordinator Dr. Glenn Patrick Juday. An essential first step in meeting those criteria is protecting the coastal plain of the Arctic National Wildlife Refuge. It is an integral part of the existing protected area that conserves a diversity of arctic and subarctic species and habitats.

The existing biodiversity values of the arctic coastal plain are sufficiently known and so globally outstanding that it is clearly inappropriate to open this area to exploration and

development. Despite many technological advances since the discovery of oil at Prudhoe Bay, and despite the potential for continuing advances, it is clear that the alterations across the arctic coastal tundra and foothills ecoregion will continue to be significant. No matter how well it might be managed, further oil exploration and development would have a permanent impact on the intact refuge landscape. The habitat fragmentation and degradation due to construction of hundreds of miles of pipelines, roads, and other infrastructure would be unavoidable.

Opening the intact coastal plain of the Arctic National Wildlife Refuge to the oil industry would destroy this diverse area of the arctic coastal tundra ecoregion and the wilderness values of this internationally significant sanctuary for arctic wildlife.

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