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## Introduction

“When in the Kenai Mountains, Alaska, on the 23rd day of August 1897, Mr. Berg and myself while sitting together on the mountain side with the aid of a field glass counted 500 wild sheep, *Ovis dalli*, all within a radius of 6 to 8 miles, 10 here, 6 there, then 20 and 30 in another locality. Can a true hunter or a lover of nature imagine a more beautiful sight?”

This quote is from a letter written by Dall DeWeese in 1902, urging Congress to protect wildlife on the Kenai Peninsula. Thirty years later, reports still requested the protection of wildlife resources on the Kenai Peninsula, but the tone had changed. Quotes from various reports include: “Season should be completely closed on the Kenai Peninsula for mink, foxes, land otters, and beaver, and the closed season enforced for a period of five years. . . .” (Culver 1923); “death blow to furbearers took place some years ago when fur farming was at a boom. Even porcupines were largely killed out. . . . the last caribou was reported seen in 1912. . . . Wolves were destroyed by poison” (Palmer 1938). Statements like these come to mind when discussing human impacts on wildlife especially when a frontier is first explored and developed. During the development of every frontier, the history of wildlife exploitation seems to repeat itself. This portrayed image of human devastation of the environment is often a result of our perception of which species are important, the limited available data base, and the consequences of measuring ecological relationships in terms of a single human life span.

In this paper, we will discuss what has occurred to several wildlife populations on the Kenai Peninsula as the human population increased. By discussing historical impacts, management techniques, and potential human impacts, we intend to show the significance of what occurred and may occur as human populations expand, both on the Kenai and in Alaska.

## Study Site

The Kenai Peninsula (Lat. 60° North, Long. 150° West), 10,038 square miles (26,000 km<sup>2</sup>) in area, is located in southcentral Alaska, 31 miles (40 km) due south

of the city of Anchorage. Connected to the mainland by a 10-mile (16 km) isthmus of rugged mountains and glaciers, the Peninsula is insular. It is bounded by Cook Inlet to the west and north, and Prince William Sound to the south and east.

The rugged Kenai Mountains form the eastern two-thirds of the Peninsula. The southwest-trending peaks reach elevations of 3,000–6,000 feet (1,000–2,000 m) and are separated by valleys and passes 0.625–1.3 miles (1–2 km) wide. The entire mountain range has been heavily glaciated and higher parts of the range are buried in great ice fields from which valley and piedmont glaciers radiate.

The Kenai lowlands form the western third of the Peninsula. This area consists of ground moraine and stagnant ice topography with low ridges, rolling hills, and extensive areas of muskeg. Relief ranges from 60–240 feet (20–80 m) with most of the land less than 600 feet (200 m) above sea level. There are over 4,000 lakes and numerous interconnecting waterways. The two largest lakes, Tustumena, 116 square miles (30,000 ha), and Skilak, 38.6 square miles (10,000 ha), lie in ice-carved basins.

The climate of the Kenai Peninsula is a subarctic mixture of maritime and continental weather patterns. Annual precipitation averages 18.7 inches (48 cm), nearly half of which falls as rain in July, August, and September. Average annual snowfall varies from 54.6–138.4 inches (140–355 cm) at low elevations depending upon location. Snow generally covers the lower elevations from late October to late April, while in the high mountains, snowfall can be expected from September through May and snow-ice cover is, in many areas, permanent. Maximum snow accumulation at lower elevations is usually not over 39 inches (1 m).

The Kenai Peninsula encompasses examples of most other regions of Alaska in terms of vegetation and wildlife. The vegetation types range from coastal to alpine, but the two dominant types are birch-spruce lowland forest (Hudsonian life zone) and Arctic and Alpine life zone. Every native big game and furbearer species found in Alaska except muskox (*Ovibos moschatus*), polar bear (*Ursus maritimus*), and arctic fox (*Alopex lagopus*) are found on the Kenai Peninsula. There are over 146 species of birds occurring in the area, of which 101 nest locally. Fishery resources include five species of pacific salmon (*Oncorhynchus* spp.), lake trout (*Salvelinus namaycush*), rainbow trout (*Salmo gairdneri*), grayling (*Thymallus arcticus*), Dolly varden (*Salvelinus malma*), and whitefish (*Coregonus clupeaformis*).

Land ownership patterns on the Kenai Peninsula are complex but the majority of the area is under Federal ownership (Figure 1). The breakdown is as follows: Kenai National Wildlife Refuge (USFWS), 3,078 square miles (7,972 km<sup>2</sup>); Kenai Fjords National Park (NPS), 1,030 square miles (2,268 km<sup>2</sup>); and Chugach National Forest (USFS), 1,679 square miles (4,350 km<sup>2</sup>). The remaining lands, 4,019 square miles (10,410 km<sup>2</sup>), are divided between State and local government and private ownership. Native corporations are the largest single private landowner.

The recorded history of the Kenai Peninsula began when Vitus Bering sighted it in 1741. The Kenai Peninsula was where much of the initial development on the Alaskan mainland occurred. The first Russian settlement on the Alaskan mainland was on the southern tip of the Kenai Peninsula, and the first gold located in Alaska was found on the Kenai by Russian miners about 1851. In 1882, salmon canneries were built in the Kenai area. Human population levels soared shortly after 1895 when commercial quantities of gold were discovered and hundreds of miners came to the Peninsula. The vast game herds were slaughtered by market hunters during

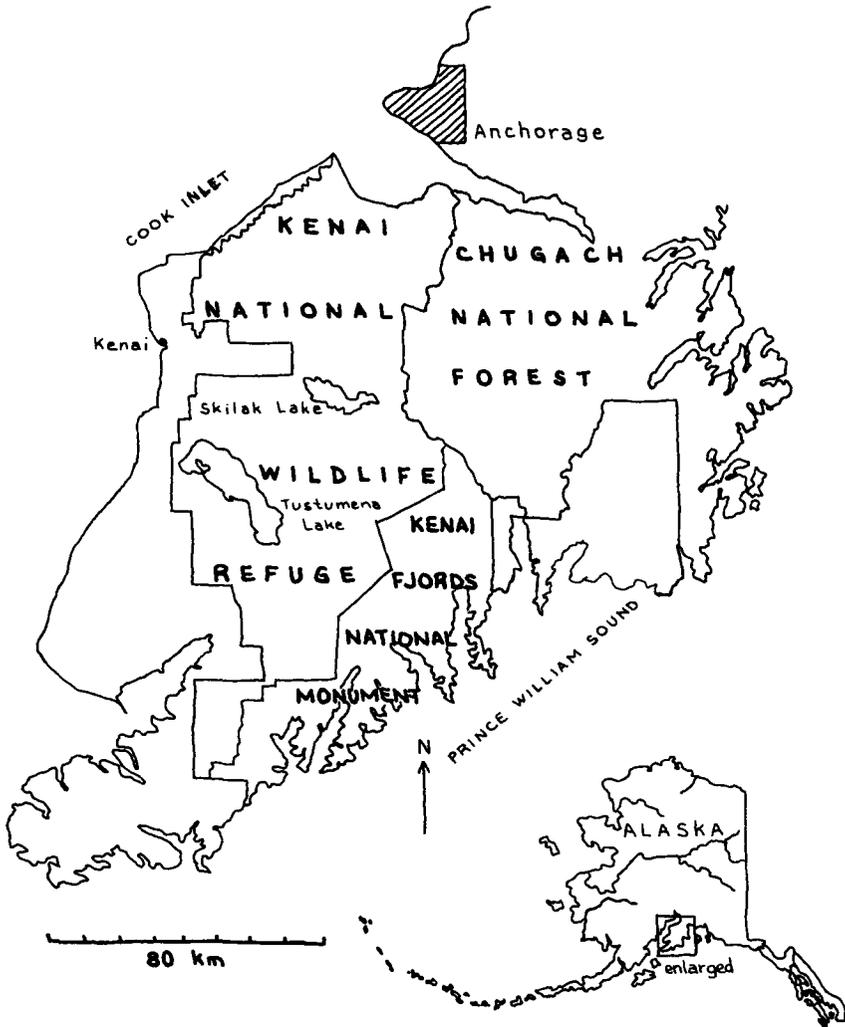


Figure 1. Federal land management patterns on the Kenai Peninsula, Alaska. Areas not labeled are State, borough, and private lands.

this period to provide meat for miners and railroad workers. The gold rush abated about 1905 and the population remained stabilized until the late 1940s, when the Peninsula was opened to homesteading.

The Kenai Peninsula now has approximately 25,000 residents, most of whom live in or near major towns on the western lowlands. Most communities were small and fishing-oriented until oil and gas were discovered in the late 1950s. The population has tripled since 1960. At current growth rates, the population will double by 1995 or sooner, depending on the rate of oil development. The Kenai Peninsula is within 62 miles (100 km) of over one-half of Alaska's total population,

is easily accessible by road, and provides the major outdoor recreation area for Alaskan residents and tourists. The Kenai Peninsula receives over 35 percent of the total sport fishing effort in Alaska (Mills 1980). Use of the Kenai as an outdoor recreation area will undoubtedly increase.

## Methods

Although the Kenai Peninsula probably has one of the most extensive wildlife information bases in Alaska, data are restricted to mainly game species. Much of the historical information discussed in this paper is taken from early reports by biological survey biologists and are generally limited to observations and general impressions. The first detailed surveys (on a few selected species) began in the late 1950s. Survey, harvest monitoring, and research efforts have steadily increased since that time. Because most of the information was gathered on the western Kenai mountains and lowlands, the Kenai National Wildlife Refuge (formerly the Kenai National Moose Range 1941–1981) will be the focus of discussion. Information is limited to big game species, species of commercial interests, and species once threatened in a portion of their range. Public interests, funding, and personnel levels have determined the level of wildlife monitoring that has occurred on the Kenai Peninsula. Recently, the information base has been expanded by monitoring passerine birds, raptors, and small mammals, with more extensive research conducted on bears and various furbearers, but most of this new information is too recent to be useful in discussing long-term human impacts on wildlife.

## Results and Discussion

The history of the Kenai Peninsula appears typical of most frontiers; rapid exploitation resulting in a “boom and bust” economy and sudden changes in the plant and animal communities. Whether these impacts are good or bad is a moral judgment dictated by society’s values at the time and subject to change as personal values and commonly held opinions shift.

The perceived impacts to wildlife of the Kenai Peninsula as the human population expanded are undoubtedly biased. Analysis of historical changes relies heavily upon limited data, often gathered in an unobjective manner, on a few species, by a few men who came upon the scene after tremendous impacts had already occurred. With this in mind, we used the best information available to illustrate the wildlife resource problems and solutions that occurred on the Kenai Peninsula as human populations increased.

Caribou (*Rangifer tarandus*), moose (*Alces alces*), wolf (*Canis lupus*), and salmon are examined to assess the impact of consumptive use and habitat disturbance on wildlife. The status of bald eagles (*Haliaeetus leucocephalus*) and trumpeter swans (*Cygnus buccinator*) on the Kenai illustrates how habitat changes and disturbance affect some species.

By examining impacts that have occurred among these species, we demonstrate the limited impact of overharvest, the longer term impacts of habitat changes, and the impacts that can be expected as the human population increases throughout Alaska.

## *Caribou*

Historical records indicate that caribou were once common, but probably not abundant, on the Kenai Peninsula before the 1900s. With an influx of gold miners about 1890, large man-caused forest fires converted vast tracts of mature forest into early successional stages. With much of the important climax vegetation gone, caribou numbers were reduced and the remaining pockets of animals were eliminated by commercial and unregulated hunting (Davis and Franzman 1978). The last recorded sighting of a caribou on the Kenai was in 1912 (Lutz 1956).

Forty-four caribou were reintroduced to the Kenai Peninsula in 1965 and 1966 by the Alaska Department of Fish and Game (ADF&G). These transplants resulted in the establishment of two herds. A herd of approximately 300 animals now inhabits a limited alpine area of public land in the Kenai Mountains near Hope. This herd exhibited excellent production and recruitment initially, but productivity declined sharply during the mid-70s as the herd reached carrying capacity. Sport hunting of these caribou was initiated in 1972 to maintain the herd within the estimated carrying capacity of the area.

The second herd became established in a sedge-grass wetland that surrounds the Kenai airport and is often seen within the Kenai city limits. This herd travels about 25 miles (40 km) east to winter in a large muskeg area. There are between 60 and 80 animals in the lowland herd and it has not increased since 1975. Available data indicate that low recruitment is the most likely cause of the herd's poor growth rate. Predation is suspected when poor recruitment is noticed, especially when initial calf production appears normal. Although black bear (*Ursus americanus*) and wolves are common in this area, results of recent studies (Schwartz and Franzman 1980, Peterson and Woolington 1981) indicate neither is responsible for the majority of calf mortality. A likely cause of calf mortality among caribou is the large number of domestic dogs that roam the area. Dogs have been observed killing both adults and calves and are probably responsible for the low recruitment in this herd.

Kenai Peninsula caribou populations, which were apparently dependent on old age forest, were unable to recover from earlier overharvest and habitat alteration. Although introductions have resulted in two viable herds, both occupy relatively small areas atypical of caribou habitat in other portions of Alaska. The lowland herd, which is exposed to continued human disturbance, has not done as well as the more remote alpine herd. While the problem of past overharvest was corrected, the slow successional rate of boreal forest ecosystems and non-consumptive human activity continue to affect caribou distribution. Caribou are examples of species that use sensitive habitats and are affected by habitat disturbance for several decades.

## *Moose*

"Kenai Peninsula is said to be the best hunting ground for moose in the world." This quote by Milton Whitney in 1916, conveys a different image of the Kenai than the one portrayed by Andrew Berg in 1890. Mr. Berg, a hunting guide in the Tustumena Lake area, stated that, before 1890, "Caribou were plentiful and wolves numerous, there were practically no moose." The difference in moose numbers witnessed by these two men and others (Lutz 1960) was a result of the numerous

wildfires around 1900. While wildfires were detrimental to caribou, moose flourished. The moose population, free of wolf predation, virtually unhunted, and having an abundant food supply, increased steadily. By 1920 the Kenai was famous for both the numbers and size of its moose.

The population was reduced in the mid-1920s due to severe overuse of the winter range and harsh winter weather. Moose hunting north of the Kenai River was legally closed in the 1930s, but moose continued to decline. In 1941, primarily due to sportsman and public concern for the declining moose population, the Kenai National Moose Range, now the Kenai National Wildlife Refuge, was established. In 1947 a man-caused fire burned 308,750 acres (125,000 ha) in the northwest portion of the Peninsula and the moose population began to increase. By the early 1950s a limited moose hunt was allowed. The moose population increased steadily throughout the 1950s and 1960s, and by 1970 the population was estimated at nearly 9,000 moose on the refuge. Range quality deteriorated as vegetation in the burn matured. The moose population severely overbrowsed its range (Oldemyer et al. 1977) and, during a series of severe winter weather from 1971 through 1975, declined to approximately 3,500 moose (Bangs and Bailey 1980). Another large wildfire in 1969 (86,450 acres [35,000 ha] has resulted in a current moose population increase. This pattern of growth and decline of moose populations resulted from man's activities and the early successional stages that were created as wildfires and land clearing practices occurred.

The negative impacts of increased human development primarily result from increased incidental mortality. Poaching was a potential problem until effective enforcement and costly penalties controlled it. From 1970 through 1980, approximately 150 moose were reported accidentally killed annually along the road system. This type of mortality will increase as road improvements increase vehicle speed and as the number of vehicles increase. Domestic dogs are reported to kill moose calves near towns each year, but actual numbers are unknown. Sport hunters harvested over 600 bull moose in 1981 during the 20 day season. Despite these mortality factors, moose populations on the Kenai are at moderately high levels and habitat conditions suggest a stable population for the next few years.

A problem in the long term management of moose on the Kenai is that of plant succession. The 1947 fire burned for over a month without attempts to control it. In contrast, the 1969 fire burned for several weeks during which over \$20 million were spent for control, and it still burned into the Kenai city limits. Increased development on private land surrounding public land has limited the practice of allowing wildfires to burn. The potential damage to personal property and cost of control efforts has made land management agencies aggressively control all wildfires. Small controlled burns have been successfully conducted on public lands in areas away from settlements and hold some promise as a means of habitat manipulation in remote areas. Mechanical and chemical habitat treatment was conducted on the Kenai National Wildlife Refuge for about 15 years, but increasing costs, changing funding priorities, and other concerns suspended these operations. Habitat disturbance on private land will provide some early successional vegetational stages that benefit moose. Management for moose and other early successional species on government lands will be affected by the high level of fire control needed to protect private property and the relatively high costs of other forms of habitat manipulation.

Moose continue to be the dominant ungulate species on the Kenai, both in terms of numbers and public interest. Although moose populations have been at low densities and experienced the same overharvest problems of other ungulates, they have always recovered rapidly when good habitat was available. Moose have been extremely successful on the Kenai because they are a generalist species that readily adapted to the Peninsula's rapidly growing human disturbance and associated habitat changes.

### *Timber Wolf*

Wolves were reportedly common on the Kenai Peninsula before 1900, but early miners, fearing rabies, immediately set out to eradicate them. The widespread use of poison, along with unregulated hunting and trapping, apparently caused the extirpation of the Kenai wolf by 1915 (Peterson and Woolington 1979). Recolonization by wolves was hampered by the relative isolation of the Peninsula and widespread predator control during the 1940s and 1950s. With the reduction of control efforts in the late 1950s, wolf populations adjacent to the Peninsula increased. In 1962, there was a confirmed wolf sighting and all wolf hunting and trapping was closed on the Kenai Peninsula.

Large packs were sighted in several locations on the Kenai Peninsula by the late 1960s. The wolf population expanded rapidly in the early 1970s, and by 1975 had probably occupied most of the available wolf habitat on the Kenai Peninsula (Peterson and Woolington 1981). Wolf hunting and trapping were opened in 1974 and have remained open since that time. Current harvests are closely monitored by ADF&G and appear to be about 25 percent of the early winter population annually; close to the maximum allowable harvest recommended by Peterson et al. (1981). Man's activities also impact wolves by causing indirect mortality. At least one wolf pack, close to the city of Kenai, was believed to have been reduced by contacting canid distemper from domestic dogs.

Canid abundance on the Kenai appears to have shifted considerably since the 1900s. At the time of initial human development, fox (*Vulpes fulva*) and wolves appeared common, but after 1915 both became rare and coyotes (*Canis latrans*) colonized the Peninsula (Palmer 1938). Wolves and coyotes are now common on the Kenai, but foxes remain rare. Apparently the habitat changes and elimination of wolves during the 1900s benefitted coyotes and were detrimental to foxes (Peterson and Woolington 1981).

Wolves were eliminated from the Kenai by overexploitation, but populations recovered rapidly when given protection. Wolf habitat on the Kenai Peninsula is probably more restricted than in the past because intensively developed lands appear to be avoided by packs. Wolves are an example of a low-density species that can readily colonize available habitat but are susceptible to both consumptive use and non-consumptive human disturbance.

### *Salmon*

Salmon are the most important species of fish for sport, commercial, and subsistence fishing in Alaska. Salmon populations throughout Alaska were heavily exploited by commercial fishing, and salmon runs on the Kenai Peninsula were no exception. Generally, the history of salmon on the Kenai closely parallels that of

salmon stocks elsewhere in Alaska (Pennoyer 1979). Starting about 1900, a series of laws were enacted to regulate the salmon fishing industry in Alaska. A limited attempt to have hatcheries increase fish for harvest failed, and the last two Federal hatcheries in Alaska closed in 1934. Predator control measures were also implemented in the 1900s and bounties placed on eagles, seals (*Phoca* spp.), and predatory fish. Poor enforcement of existing laws, limited information on the resource, and lack of gear limitations all resulted in a declining salmon resource. By the early 1950s, runs declined to such low levels that portions of Alaska were declared disaster areas by Presidential decree.

At this time, the importance of sound fishery management became obvious and funds were made available for salmon management and research. Today, many regulations control commercial salmon takes by both foreign and domestic fishermen, and salmon stocks have made a strong recovery.

Sport fishing is a major recreation on the Kenai Peninsula and has increased rapidly since 1970. The Kenai Peninsula provides over 35 percent of the total annual sport fishing effort in Alaska. Due to the tremendous sport pressure, regulations have been implemented to control and more widely distribute the harvest. Examples of the types of regulations include: reduction in daily and yearly limits, elimination of snagging, limited gear (single hook, fly fishing), and reduction in seasons.

Hatchery stock and stream rehabilitation have been used in an effort to satisfy the ever increasing public demand for fish. Most of the salmon spawning and rearing areas on the Kenai are on public lands and are protected from disturbance or development.

Salmon were reduced by commercial harvest occurring on and off the Kenai Peninsula. The high monetary value of this public resource overrode concern for long term population health. When harvest was managed, populations recovered rapidly since the critical spawning and rearing habitat was unaltered. Salmon are an example of species that were once reduced but, through habitat protection and effective management, now provide huge benefits to large numbers of commercial and sport users.

### *Bald Eagle*

Bald eagle nest tree selection, productivity, and food habitats have been examined annually on the western Kenai Peninsula since 1979 (Bangs et al. 1981). Forty-two nest sites have been located, consisting of 48 eagle nests. Trees selected by bald eagles on the Kenai are typical of nesting trees selected by bald eagles throughout North America. Nest trees are typically close to water, have a clear view of water, and are usually the oldest and largest living members of the dominate overstory. The absence of eagle nests in large portions of what appears to be suitable habitat in the Kenai lowlands is most likely attributable to loss of old age trees by fire.

Two years of data (1979 and 1980) on the productivity of bald eagles on the western Kenai lowlands suggest overall eaglet production comparable to other areas in Alaska and above that reported from other areas of North America (Sprunt et al. 1973). The effect of human disturbance on bald eagle nesting success was determined in 1980 by comparing the success of nests subjected to human distur-

bance to those subjected to little disturbance. Of 13 nests in locations subjected to disturbance, only 3 (23 percent) produced eaglets in either 1979 or 1980, while 16 (88 percent) out of 18 nests subjected to little disturbance produced eaglets in either 1979 or 1980 (Bangs et al. 1981). This information suggests that bald eagles on the Kenai Peninsula are susceptible to human disturbance and that eagles will not reproduce as successfully in areas of high human activity as they will in more remote sites. Hensel and Troyer (1964) reported that nest abandonment was a major factor in influencing nesting success on Kodiak Island. Corr (1978) also commented on bald eagle nest abandonment and suggested that disturbance during egg laying and incubation may have been an important reason for nest abandonment. Most of the human activity on the Kenai classified as disturbance was occasional recreational use such as boating, canoeing, and camping rather than development-oriented activities. Most of the human activity on public land occurs from the end of May to late September and coincides with bald eagle incubation and rearing.

In 1981, two concentrations of bald eagles were located on the Kenai Peninsula lowlands. The largest staging area was below Skilak Lake along the Kenai River. In March, a minimum of 93 eagles (75 adults and 18 immatures) were seen along a 10-mile (16 km) stretch of river. These data indicate that the upper Kenai River is an important staging and/or feeding area for bald eagles. This area is being intensively developed for housing and receives a great deal of boating and fishing activity. In May, over 50 eagles (28 adults and 22 immatures) were seen in a 3-mile (4.8 km) stretch of the lower Fox River at the head of Kachemak Bay. At the same time, 31 active (adult present) nests were surveyed. The high proportion of immatures suggest the Fox River may be an important feeding area for immatures and nesting pairs. This area may be affected by road and transmission lines from the Bradley Lake power project and is currently the site of limited cattle grazing and nearby homesite selection. Since feeding and staging areas are not protected under the Bald Eagle Act, impact of future development on these areas is difficult to predict.

Bald eagles are a nationally significant species whose last secure nesting habitat is in Alaska and Canada. Populations were undoubtedly reduced during the predator control era of the 1900s, but have recovered with protection. This species appears to be tolerant of human activity during certain periods of the year, but not during nesting activities. The bald eagles are examples of species that require specialized conditions to nest successfully and, although protected from consumptive use, are intolerant of human activity while raising young.

### *Trumpeter Swans*

Trumpeter swans were identified on the Kenai during the 1940s and serious investigation began in 1957. At that time, 20 nesting pairs were found during aerial surveys. Nearly all of the trumpeter swan habitat is located on the Kenai National Wildlife Refuge and 80 percent of all nests are located in the northern portion of the Refuge (Richey 1978). The number of nesting pairs fluctuated from 39 in 1965 to 21 in 1972, but has remained at approximately 30 pairs since that time. Trumpeter swan populations in other parts of Alaska have increased several fold during this same time period. Cygnet survival on the Kenai to flight stage has fluctuated yearly

for unknown reasons, but has averaged about 70 percent. It is suggested the Kenai swan habitat is fairly well saturated and little growth potential remains for this range. We regularly observe new nests without recording an increase in nesting pairs. Swans are apparently shifting their nest sites, which could be a result of marginal habitat, some unidentified disturbance, or other related factors such as unstable water levels.

On the Kenai, the trumpeter swan population can expect to face continued human disturbance. Since our survey includes some areas adjacent to the Kenai refuge, some loss of nesting sites appears to be associated with increased human disturbance. Some nest site locations in the developing industrial North Kenai area seem to have been displaced eastward onto public land. This movement may provide nesting pairs temporary security from human disturbance. One pair of swans in this area relocated to eight different sites, probably in an attempt to escape human disturbance and find suitable habitat. Observations indicate that when human activity intrudes into swan nesting habitat, swans will move to less disturbed areas.

Swans on the Kenai Peninsula were common at Skilak Lake outlet until 1966. The increased human activity in that area may be the reason that swans abandoned that spring staging area. One of the most important known spring and fall staging areas on the Kenai for swans is near the junction of the Kenai and Moose rivers. The area was declared a critical habitat by the ADF&G and waterfowl hunting is prohibited. Lands surrounding the area are under private ownership and are currently being subdivided for housing development. Many swans that nest on the Kenai winter near the Skagit River in Washington and on Vancouver Island. Birds banded on the Kenai have been illegally shot in Alaska and lead poisoning of Kenai swans has been diagnosed in Washington.

Trumpeter swans were once an endangered species due to commercial overharvest on their wintering areas. Much of the swan's nesting habitat has remained undisturbed, and swan populations have recovered when given protection. Trumpeter swan nesting habitat seems to be affected by human activities and development. Trumpeter swans are examples of species that were almost reduced to extinction by overharvest, but recovered after protection because their nest sites were in areas protected from human disturbance.

## **Conclusions**

Resource problems experienced on the Kenai Peninsula are similar to those that resulted from development of other frontiers. The typical patterns of unplanned habitat alteration and wildlife exploitation dramatically altered plant and animal communities on the Kenai Peninsula. Species of immediate value to man, such as caribou, salmon, or trumpeter swans, were overexploited. Species believed to compete with man for resources, such as wolves and eagles, were persecuted. Generalist wildlife species, such as moose, benefitted from unplanned habitat alterations, but species with specialized habitat requirements or that are intolerant of human activity declined as the Kenai Peninsula was developed. Of the changes that occurred to wildlife on the Kenai Peninsula, those related to habitat alteration have had the most lasting effect. Changes in wildlife communities caused by past exploitation were generally corrected within a short time span. Currently, there are no known endangered or threatened species on the Kenai Peninsula.

Adequate legal mechanisms exist to regulate exploitation, human caused disturbances, and habitat quality. These should control man's impact on resident and some migrating wildlife species on public lands and avoid the dramatic changes of the past. However, management of public lands is constrained by funding levels, appropriate management planning, the surrounding private land, and demands for other non-wildlife-oriented uses, such as logging, energy and mineral development, hydroelectric development, and numerous recreational pursuits.

Wildlife management practices were eloquently described by Aldo Leopold (1946) when he stated: "The practices we now call conservation are, to a large extent, local alleviations of biotic pain. They are necessary, but they must not be confused with cures. The art of land doctoring is being practiced with vigor but the science of land health is yet to be born." Wildlife management programs on the Kenai Peninsula are currently evolving into more enlightened, scientifically based management schemes that will ultimately lead to land health.

Problems likely to develop in the future are more complex than those identified in the past. Besides the anticipated political tradeoffs that will require lands to be intensively managed for maximized human benefits, other problems currently outside resource management authority will arise. How will increased industrial development affect water quantity and quality and fish production? Are the population levels of low density species high enough to maintain genetic integrity? What are the long term impacts of the species specific enhancement programs that society demands? How can species that travel outside protected habitats be best conserved? How can disease and predation from domestic animals be controlled on public lands? Solutions to these types of problems will primarily depend upon innovative resource management techniques and the importance that society places upon the value of wildlife and wildlands.

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### Literature Cited

- Bangs, E. E., and T. N. Bailey. 1980. Interrelationships of weather, fire, and moose on the Kenai National Moose Range, Alaska. Proc. N. Amer. Moose Conf. and Workshop 16:255-274.
- Bangs, E. E., T. N. Bailey, and V. D. Berns. 1981. Ecology of nesting Bald Eagles on the Kenai National Wildlife Refuge, Alaska. Pages 47-54 in Proc. Symposium and Workshop on Raptor Manage. and Biol. in Alaska and Western Canada.
- Corr, P. O. 1974. Bald Eagle (*Haliaeetus leucocephalus alaskanus*) nesting related to forestry in Southeastern Alaska. M.S. Thesis. Univ. Alaska, Fairbanks. 144 pp.
- Culver, W. G. 1923. Report of moose on Kenai Peninsula. Unpubl. Report, Kenai National Wildlife Refuge files, 18 pp. typewritten.
- DeWeese, D. 1902. Protect Alaska Game. Congressional Record, House. 3843-3844.
- Davis, J. L., and A. W. Franzmann. 1979. Fire-moose-caribou interrelationships. Proc. N. Amer. Moose Conf. and Workshop 15:80-118.
- Hensel, R. J., and W. A. Troyer. 1964. Nesting studies of the Bald Eagle in Alaska. Condor 66(4):282-286.
- Leopold, A. 1949. A Sand County Almanac. Ballantine Books. New York. 295 pp.

- Lutz, H. J. 1960. History of the early occurrence of moose on the Kenai Peninsula and in other sections of Alaska. Misc. Publ. No. 1. Alaska Forest Research Center, U.S. Forest Service. 25 pp.
- Mills, M. J. 1980. Alaska State-wide Harvest Study. Federal Aid and Restoration and Anadromous Fish Study, Vol. 22, July 1980–June 30, 1981. 107 pp.
- Oldemeyer, J. L., A. W. Franzmann, A. L. Brundage, P. D. Arneson, and A. Flynn. 1977. Browse quality and the Kenai moose population. *J. Wildl. Manage.* 41(3):533–542.
- Palmer, L. J. 1938. Kenai Peninsula moose. Research Project Report, Bureau of Biological Survey—Sept.–Oct. 1938. Unpubl. report, Kenai National Wildlife Refuge files, 24 pp, typewritten.
- Pennoyer, S. 1979. Development of management of Alaska's fisheries. *Proc. Alaska Science Conf.* 29:17–25.
- Peterson, R. O., and J. D. Woolington. 1979. The extirpation and reappearance of wolves on the Kenai Peninsula, Alaska. *Proc. Portland Wolf Symposium*. In press.
- . 1981. Wolf-moose investigations on the Kenai National Wildlife Refuge. Final Report. USFWS Contract No. 14-16-0007-81-5202.
- Peterson, R. O., T. N. Bailey, and J. D. Woolington. 1980. Wolf management and harvest patterns on the Kenai National Wildlife Refuge, Alaska. *Proc. Wolf Symposium*. In press.
- Richey, R. A. 1978. Status of the trumpeter swan on the Kenai National Moose Range. Presented at 6th Trumpeter Swan Society Conf. Anchorage, Alaska. Sept 7–12.
- Schwartz, C. C., and A. W. Franzmann. 1980. Black bear predation of moose. Vol I. Project Progress Report. Federal Aid in Wildlife Restoration Projects. W-17-11 and W-21-1, Job No. 17.3R.
- Sprunt, A., IV, W. B. Robertson Jr., S. Postupalsky, R. J. Hensel, C. E. Knoder, and E. J. Ligas. 1973. Comparative productivity of 6 bald eagle populations. *Trans. N. Amer. Wildl. and Natur. Resour. Conf.* 38:96–106.
- Whitney, M. 1916. Reconnaissance of the Kenai Peninsula, Alaska. USDA Field Operation of the Bureau of soils. 18th Report. Government Printing Office, Washington, D.C. 1921. P. 35.