

Aleutian Islands Wilderness

Preventing the establishment of non-native caribou on Kagalaska Island

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Case Study of Ecological Restoration in Wilderness

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This case study is part of a collaborative partnership between the Aldo Leopold Wilderness Research Institute and The Wilderness Society to describe ecological restoration actions that have been implemented within the National Wilderness Preservation System. The specific case studies were selected to represent a mix of wilderness agencies, geographic regions, restoration issues and complexities. The case studies were written by staff at the Leopold Institute, in consultation with wilderness managers.



SUPPORTING GRAPHICS

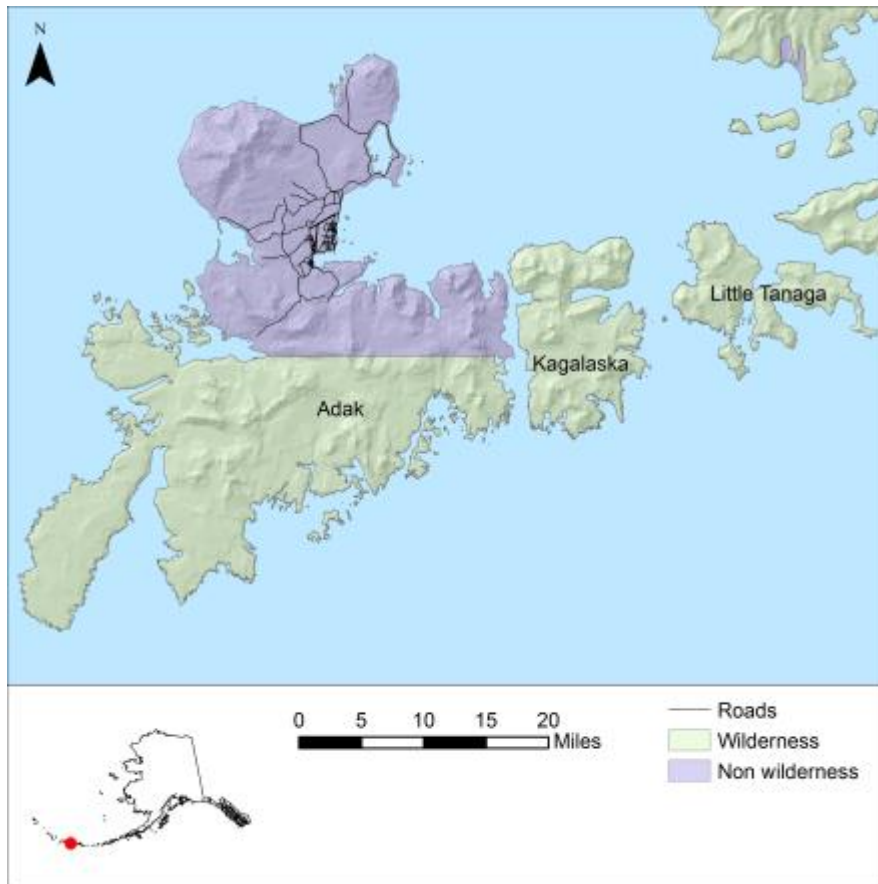


Figure 1 The red arrow indicates the strait where caribou from Adak Island are swimming across to Kagalaska Island and degrading the natural quality of the Aleutian Island Wilderness.

Year # Caribou

1993 750
1994 975
1995 1268
1996 1648
1997 2142
1998 900
2005 2751
2012 2696

INTRODUCTION

The passage of the Wilderness Act by Congress in 1964, followed by President Lyndon Johnson signing the Act into law, marked a new era in protected area designation and public land management for the United States. Under the newly established National Wilderness Preservation System (NWPS), wilderness was, “recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions...” (PL 88-577).

Fifty years after the passage of the Wilderness Act, a combination of major ecological stressors—including invasive species and climate change—are creating new and unprecedented challenges for wilderness managers. Today, ecological restoration has become one of the most important, ethically complex, and potentially litigious wilderness stewardship issues in the history of the Wilderness Act. More specifically, the legal mandate to preserve the natural quality of wilderness character is leading managers to consider increasingly intrusive management interventions in place of historically minimal management to preserve the untrammelled quality. The dynamics and uncertainties of this management shift call into question traditional planning approaches, such as the use of historic conditions to define management targets; and require the incorporation of diverse legal, scientific and ethical considerations into management planning.

The four agencies that manage wilderness—the Department of the Interior Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), and the Department of Agriculture U.S. Forest Service (USFS)—receive hundreds of proposals to implement ecological restoration and other types of intervention actions within the NWPS every year now, including an increasing number of proposals generated by climate adaptation objectives. Ecological interventions that are currently proposed and implemented within wilderness include:

1. Actions that sustain, restore, or manage vegetation (e.g., chemical and mechanical removal of invasive plants, planting trees, spreading seed and fertilizer);
2. Actions that sustain or restore fish and wildlife, or manage insects and disease (e.g., biological control agents, fish stocking, animal removal, fish barriers, water guzzlers, introducing animals);
3. Actions that manage soil and water issues (e.g., diverting water for irrigation, mine site reclamation, spreading lime to buffer acid deposition); and,
4. Actions that manage fire (e.g., suppressing naturally-caused fire, mechanical fuels reduction treatments, prescribed fire).

Current laws and policies do not provide an explicit, decision-making framework for wilderness stewardship in the face of these new threats, but require wilderness managers to evaluate the effects of proposed restoration actions while simultaneously preserving wilderness character. Based on the legal definition of wilderness, National Wilderness Preservation managers agree on five fundamental qualities of wilderness character: (1) Untrammelled; (2) Undeveloped; (3) Natural; (4) Solitude or primitive and unconfined recreation, and, (5) Other features of value. As defined by the Wilderness Act, wilderness lands were intended to be protected in their “natural condition” (i.e. species, patterns, and processes that evolved in the area) and “untrammelled by man” (i.e. free from intentional modern human control and manipulation). Balancing the natural and untrammelled qualities of wilderness character is a persistent wilderness stewardship challenge that may force a decision tradeoff. In addition, the accumulation of seemingly small-scale decisions and management actions has the potential to change wilderness character over time.

In this document, we present a case study of an ecological restoration action that has been implemented within a designated wilderness area in an attempt to preserve its wilderness character. The intent of these case studies is to provide detailed information about the tradeoffs involved in making decisions that simultaneously affect the natural and untrammeled qualities of wilderness, characterize similarities in management activities across projects, learn more about the basis for proposed ecological restoration, and quantify the extent to which climate adaptation is cited as the motivation for taking action .

FRAMING THE ECOLOGICAL PROBLEM

History of the Aleutian Islands Wilderness

Kagalaska Island is 29,255 acres in size and is located in the central Aleutian Islands of Alaska, part of the Andreanof Island Group. In 1913, Kagalaska Island became part of the Aleutian Islands Reserve before being incorporated into the Alaska Maritime National Wildlife Refuge in 1980, and was subsequently designated as Wilderness through the Alaska National Interest Lands Conservation Act (FWS 2014). The Aleutian Islands archipelago includes more than 200 islands; some created by the peaks of 57 submarine volcanoes rising as high as 9,000 feet above sea level (Wilderness.net 1996). On Kagalaska Island, glaciated mountains tower over marine tundra, which is surrounded by 62.1 miles of rugged coastline. Throughout the islands, a variety of lichens, mosses and low-growing alpine plants cover the upper slopes, while tall herbaceous meadows in the lowlands add to the extraordinary biotic community of this extreme environment.



Rock sandpipers are one of many seabird species native to the Aleutian Islands Wilderness.

The islands in the Andreanof Island Group are extremely remote and experience severe weather patterns that limit permanent human habitation. There are no human residents of Kagalaska Island, though adjacent Adak Island has a community of roughly 200 people. Native Aleut or Unungan people occupied the island prior to Russian contact in the 1740s, but no evidence of permanent post-contact habitation is visible today (FWS 2014). These islands experience cool, wet, foggy summers typical of

marine environments, and mild winters with frequent storms. The soils are of volcanic origin and annual precipitation can exceed 70 inches (FWS 2014). Prior to Russian contact, there were no terrestrial mammals present on Kagalaska Island, and today the island is home to a wide variety of seabirds, waterfowl and land birds. Sea lions, harbor seals, and sea otters are present in near-shore waters; the seals and sea lions haul out on the island. The Aleutian Islands support millions of breeding seabirds, which contributed to its designation as a Globally Important Bird Area. The island also contains six streams supporting runs of sockeye and pink salmon (FWS 2014).

Ecological Restoration Issue

The closest island to Kagalaska, Adak Island, is separated by a narrow strait that is merely a few hundred meters away at its narrowest point to roughly two miles (three kilometers) at its widest point. Both a Naval operating base and Army base were active on Adak Island during World War II, and in 1958 and 1959, 23 non-native caribou were brought to Adak Island to provide recreational hunting opportunities for residents of the base. These caribou from the Nelchina herd, located in interior Alaska in the foothills of the Talkeetna Range, were trans-located 500 miles outside of their native range. It is estimated that sport hunting kept the herd population at 200-400 animals until the base closed in 1997, when the caribou population skyrocketed to over 2,500 animals in the absence of continued hunting pressure (FWS 2014).

Beginning in the late 1990s, caribou began to swim across the narrow strait from Adak Island to Kagalaska Island along an eight mile (13 kilometer) channel, at unknown times and at unknown frequencies. Caribou and caribou sign were frequently spotted on the ground in 2011, and in 2012 an aerial survey revealed three adults and one calf present on Kagalaska; this was the first observation of caribou reproduction on the island. All four caribou were shot during the survey to prevent the establishment of a resident breeding population on the island (FWS 2014).



Caribou are agile swimmers capable of swimming across the narrow strait from Adak to Kagalaska Island.

Caribou grazing poses major adverse impacts to native plant communities on Kagalaska Island. Of utmost concern is the depletion of lichen, which is the main source of winter forage for caribou, which has serious adverse effect on the health of the ecosystem if destroyed. Caribou also feed on sedges, horsetail, cranberry, blueberry, arctic willow, cottonsedge, Labrador tea, bog birch and leatherleaf (FWS 2014). Studies have shown that caribou can completely remove lichen from comparable islands when left to forage freely in the winter, with extremely long periods required for lichen and the biological communities that depend on them to recover (Klein). “A recent study (Ricca 2013) found that [caribou grazing causes] significant alteration of plant communities and soil nitrogen cycling has already occurred on Adak Island and has not yet occurred on Kagalaska Island where native ecosystem processes appear to be still intact” (FWS S 2014, p. 11). According to refuge managers, soil compaction by caribou, and the trampling and consuming of native plants are also highly likely to degrade the natural character of Kagalaska Island, as well as diminish habitat for native wildlife.

Year	Number of caribou
1993	750
1994	975
1995	1,268
1996	1,648
1997	2,142
1998	900
2005	2,751
2012	2,696

The number of caribou on Adak Island has been increasing steadily since they were brought to the island in 1959.

RESTORATION PROPOSAL & IMPLEMENTATION

In this section we review the legal and political framework guiding the restoration actions of Aleutian Islands Wilderness managers, along with the restoration objectives, ecological criteria for restoration, monitoring plans, management alternatives, values and ethics, and the effects analysis.

Law and Policy

The Aleutian Islands Wilderness is managed in accordance with the provisions of the following laws and policies.

Laws

The Wilderness Act of 1964¹ (P.L. 88-577)

Section 4(b) of the Wilderness Act says that “each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character.” Section 2(c) defines wilderness and states that “An area of wilderness...which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable” (PL 88-577).

Alaska National Interest Lands Conservation Act of 1980² (ANILCA) (P.L. 96-487)

Of the five major purposes establishing and managing the Alaska Maritime National Wildlife Refuge, the first states, “Conserve the refuge’s animal populations and habitats in their natural biodiversity...including, but not limited to marine mammals, marine birds and other migratory birds, the marine resources upon which they rely, bears, caribou and other animals.”

National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57)

The 1997 Refuge Improvement Act amended the National Wildlife Refuge System Administration Act of 1966 in a manner that provides a fundamental organic act for the National Wildlife Refuge System. The Act identifies priority public uses, clarifies and strengthens a requirement that refuge uses be compatible with fundamental refuge and refuge system purposes, and establishes a need for maintaining the biological integrity, diversity, and environmental health of national wildlife refuges. It also reiterates the singular wildlife conservation mission of the Fish and Wildlife Service.

Regulations

Title 50 CFR Part 31, Section 14: Official Animal Control Operations³

(A) Animal species which are surplus or detrimental to the management program of a wildlife refuge area may be taken in accordance with Federal and State laws and regulations by Federal or State personnel or by permit issued to private individuals. (B) Animal species which are damaging or destroying Federal property within a wildlife refuge area may be taken or destroyed by Federal personnel.

¹ http://www.wilderness.net/NWPS/documents//publiclaws/PDF/16_USC_1131-1136.pdf

² http://www.nps.gov/legal/parklaws/Supp_V/laws1-volume1-anilca.pdf

³ [http://www.ecfr.gov/cgi-bin/text-](http://www.ecfr.gov/cgi-bin/text-idx?SID=819b685566b56f82634ab35213592441&tpl=/ecfrbrowse/Title50/50cfr31_main_02.tpl)

[idx?SID=819b685566b56f82634ab35213592441&tpl=/ecfrbrowse/Title50/50cfr31_main_02.tpl](http://www.ecfr.gov/cgi-bin/text-idx?SID=819b685566b56f82634ab35213592441&tpl=/ecfrbrowse/Title50/50cfr31_main_02.tpl)

Policy and Management Directives

Fish and Wildlife Service: Manual 600, Series 610 Wilderness Stewardship 610, Chapter 2⁴ (USDOI Fish and Wildlife Service 2008)

2.16 How does the Service conserve wildlife and habitat in wilderness?

A. We conserve fish, wildlife, and plant resources and their habitats (including water resources) in wilderness in a manner consistent with the Administration Act and refuge purpose(s), including Wilderness Act purposes. Fish, wildlife, plants and their habitat are essential and inseparable components of wilderness. On wilderness areas within the Refuge System, we conserve fish, wildlife, and plants by preserving the wilderness environment.

2.19 May the Service control invasive species, pests, and diseases in wilderness?

A. We may control invasive species, pests, or diseases when:

(1) We have demonstrated that they have degraded or there is a high probability they will degrade the biological integrity, diversity, environmental health, or wilderness character of a wilderness area; (2) They pose a significant threat to the health of humans, and the U.S. Public Health Service (which includes the Centers for Disease Control) has advised us to control them; or (3) We have demonstrated that they pose a significant threat to the health of fish, wildlife, plants, or their habitats. B. We will follow an integrated pest management (IPM) approach to prevent, control, or eradicate invasive species, pests, and diseases subject to the criteria in section 2.16.

601 FW 3 Biological integrity and diversity and environmental health⁵ (USDOI Fish and Wildlife Service 2008)

3.14 How do we manage populations to maintain and restore biological integrity, diversity, and environmental health?

B. We maintain, or contribute to the maintenance of, populations of native species. We design our wildlife population management strategies to support accomplishing refuge purpose(s) while maintaining or restoring biological integrity, diversity, and environmental health. We formulate refuge goals and objectives for population management by considering natural densities, social structures, and population dynamics at the refuge level, and population objectives set by national plans and programs-- such as the North American Waterfowl Management Plan--in which the System is a partner.

3.16 How do we manage non-native species to maintain and restore biological integrity, diversity, and environmental health?

A. We prevent the introduction of invasive species, detect and control populations of invasive species, and provide for restoration of native species and habitat conditions in invaded ecosystems. We develop integrated pest management strategies that incorporate the most effective combination of mechanical, chemical, biological, and cultural controls while considering the effects on environmental health.

Executive Order 13112 on Invasive Species⁶ (1999)

⁴ <https://www.fws.gov/policy/610fw1.html>

⁵ <http://www.fws.gov/policy/601fw3.html>

⁶ <http://www.invasivespeciesinfo.gov/laws/execorder.shtml>

Section 2: Federal Agency Duties. (a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, (1) identify such actions; (2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.

701 FW 5 Collections, Donations and Disposals⁷ (1997)

C. Disposal of Products of Animal Control Activities or Accidental Death may occur in accordance with 50 CFR 12.33

(1) Animal products resulting from control activities, confiscation, or accidental death, which meet requirements of health and sanitation, may be disposed of in accordance with guidelines of paragraph 5.8D below as appropriate. Permits and authorizations must be obtained no matter what the circumstance of acquisition of material. Public relations or health considerations may require, however, that animal remains be burned or buried. This would be particularly true if evidence of disease were present. (2) The facility manager may require that carcasses of accidentally or intentionally killed animals (of wildlife control activities) be left or distributed where they can be utilized by scavenger species such as eagles or vultures.

Restoration Objectives and Mandate to Preserve Wilderness Character

The caribou invasion of Kagalaska Island meets the criteria of an invasive species, and Alaska Maritime National Wildlife Refuge believes that the harm posed by the caribou to the native vegetation warrants action to remove them from becoming established on the island. The objective of initiating caribou control on Kagalaska Island is to prevent resource damage from non-native caribou, thereby protecting native plant communities and upholding the specific Refuge purposes, “to conserve fish and wildlife populations and habitats in their natural biodiversity” (FWS 2014, p. 5). This action also supports directives to combat invasive species per the National Invasive Species Act of 1996 (16 U.S.C. 4701). By preventing caribou from establishing a viable population on Kagalaska Island, the Refuge is also preventing future damage to the next island east of Kagalaska, called Little Tanaga Island. A second objective is to thoroughly document the caribou that are being culled to refine future control methods as part of an adaptive management strategy.

Restoration Treatment and Affected Environment

The Refuge proposes to send Refuge staff, Refuge volunteers or Refuge contractors to Kagalaska, most likely on a biannual basis, to conduct caribou control by patrolling the island as thoroughly as possible on foot to locate the caribou. Beginning in the summer of 2015, a group will be transported by boat, landing below mean high tide and outside the refuge and the wilderness boundary, and will use rifles to kill all caribou present on Kagalaska Island. An operational plan will be developed for each control mission to maximize effectiveness and prioritize the safety of each team member. Not every acre of the

⁷ <http://www.fws.gov/policy/701fw5.html>

island will be covered, but informal plots will be selected for each person to maximize visual coverage of the island, and if a caribou is spotted they will change tactics to stalking and killing the animals. The ship will pick them up in a different location to increase the distance covered for the two-day period. The shooters will carry the necessary equipment to safely complete their task including a GPS unit and two-way hand-held radio. In compliance with the Wilderness Act, no motorized vehicles or mechanized transport will be used on the island (FWS 2014).



Caribou preferentially forage on lichen; they also trample vegetation, create trails and compact the soil.

The growing population of caribou on Adak Island makes complete extermination of caribou on Kagalaska Island impossible because as the population increases, caribou will continue to spread towards Kagalaska Island. At this time there are no efforts to control increasing caribou populations on Adak Island due to multiple land owners and conflicting values over the existing population. Refuge Manager Steve Delehanty says

that he would like to have a management plan on Adak Island, and the best solution would be to

discuss options with the Alaska Department of Fish and Game, the City of Adak, and the Aleut Corporation, which owns most of the private land on Adak, to develop a viable management plan. Each group views the caribou invasion differently, and arriving at a consensus to a management plan while caribou continue to swim over to Kagalaska is not viable presently⁸.

Monitoring

Monitoring will play an important role for creating adaptive management strategies to control caribou. With each mission to Kagalaska Island, information such as the timing, number, age and gender of caribou will be documented. This will be used to refine control strategies in the future and determine the appropriate frequency, duration and season of control missions.

Management Alternatives

Several management alternatives were analyzed to meet the project objectives of preventing caribou from colonizing Kagalaska Island and preventing resource damage to native plant communities on the island.

- Control the source of migrating caribou on Adak Island
 - The most logical solution would be to control the source population of caribou on Adak Island, however, various landowners and interest groups would need to develop consensus on a management plan that included a reasonable caribou population objective. Strategies for meeting those population objectives would also need to be

⁸ Personal communications with S. Delehanty 2/2/15

developed before any change in Adak caribou management could be expected to reduce the probability of caribou emigration to Kagalaska Island.

- Encourage sport hunting on Kagalaska Island
 - Sport hunting is currently allowed, and will remain allowed on Kagalaska Island, but hunting is either absent or at extremely low levels due to the low caribou population, challenging access, and the presence of a large caribou herd on more easily accessible Adak Island. Sport hunting will not eliminate the establishment of a breeding population of caribou on Kagalaska Island and was therefore not considered as a feasible alternative (FWS 2014).
- Build a fence on Kagalaska to prevent caribou from coming ashore
 - Another option considered was to build a fence on Kagalaska to prevent caribou from coming ashore. However, this was dismissed because a fence would (1) be a permanent installation in wilderness, which would negatively affect the undeveloped quality of wilderness character; (2) is cost-prohibitive.
- Haze the caribou or use biological control strategies
 - Other alternatives that were considered but dismissed include hazing the caribou, biological control such as introducing caribou diseases or large predators, or interference of caribou reproduction by injecting the caribou with reproductive inhibitors and sterilants (FWS 2014). However, introducing a non-native predator would be counter to refuge mandates as defined by refuge law and policy. Both options were dismissed because there is a lack of information about Kagalaska Island caribou to determine if a non-native predator or biological agent would be effective in accomplishing restoration objectives.

Stakeholder Values

Scoping comments for the proposal to lethally remove all non-native caribou on Kagalaska Island received support both for and against the restoration action, although according to Delehanty, there was very little public interest in the issue which he speculates is due to the remote location of the action. The main concern expressed in comments about the proposal was not whether or not to take action, but how to dispose of the caribou once they are killed. Many people wanted to ensure that all of the meat would be salvaged for donations. Decisions about donating the meat are up to the Refuge because the main objective of the project is to eliminate all caribou found on the island during each control mission; salvaging caribou carcasses adds to both the cost and complexity of any individual control effort. Under a control action, once one caribou is shot, the shooter or a second person would immediately follow the remaining caribou, as they often stay in herds, and make sure they are all eliminated. If the objective includes salvaging all the meat, after each kill, the shooter would need to spend a significant amount of time and energy on each carcass transporting it to a location by foot to later be taken off the island by boat. Thus, carcass salvage inevitably requires either more time on the island or more people involved in the effort, both of which add costs to the project (ship time to support the project is roughly \$10,000 per day). Salvage of carcasses may vary over time with resource availability and is neither required nor prohibited in the action.

Individual citizens had varying opinions on the restoration action; some were against the proposal from an animal rights perspective and the lethal harm it would inflict on the caribou, while others were in favor of the proposal and wished it could go further to manage the caribou herd on Adak Island because they were seeing the destruction to vegetation of valued natural plants on Adak. None of the public comments addressed concerns about management alternatives in relation to the legal mandate to preserve wilderness character.

Effects Analyses

In the following effects analysis section, we observe how the restoration action affected the five qualities of wilderness character. The five qualities are derived from the legal definition of wilderness cited in The Wilderness Act of 1964, and are used as a management tool for agencies to comply with law and policy, and improve wilderness stewardship by assessing the implications of management actions (USDA Forest Service 2008).

Untrammeled

- Controlling caribou on Kagalaska Island would degrade the untrammeled quality of wilderness by attempting to control the environment, albeit from anthropogenic changes to nearby Adak Island. This action attempts to intervene in the free play of natural forces, even though caribou are not native to Adak Island (which is the source of the problem).
- The long term effects of controlling caribou are not known at this time, but project objectives will require repeated future trammeling to prevent caribou re-colonization of Kagalaska Island.

Natural

- By removing non-native caribou and therefore protecting native vegetation, native wildlife, and natural ecological processes on Kagalaska Island, the natural quality of wilderness would be maintained.
- During caribou control activities, there is a small potential for disrupting marine mammal activity, however the Environmental Assessment mitigates this by following their “Boat Operation Guidance to Avoid Disturbing Sea Otters” (FWS 2014).
- If caribou are not controlled on Kagalaska Island, the natural quality of wilderness would degrade as native vegetation, wildlife and ecological processes would be negatively affected from the influx of non-native caribou from Adak Island.

Opportunities for Solitude and Unconfined Recreation

- As the location of this ecological restoration is extremely remote and difficult to access, this quality would not be degraded by the proposed action. However, if visitors happened to be present on the island while caribou control is in progress, although unlikely, their experience would be negatively impacted by restrictions to certain areas during caribou control for safety reasons.
- Visitor experience may also be degraded by possibly witnessing the actual shooting of caribou by Refuge staff or volunteers, further degrading this quality.
- If the caribou are left uncontrolled on Kagalaska Island, their presence could make visitors feel a sense of confinement or restraint. The presence of large, non-native animals could prevent visitors from exploring certain parts of the island where caribou are present.

Undeveloped

- The undeveloped quality was not affected by this action.

Other Unique Features

- The unique quality was not affected by this action.

Risks and Uncertainties of the Restoration Treatment

There is uncertainty about the long-term success of this project and whether it will succeed over time. If the Adak caribou population continues to increase, more frequent trips might be needed to control caribou that cross to Kagalaska Island. Given budgetary and logistical challenges, it is also uncertain whether the Refuge will have the financial and logistical resources to control future influxes of caribou absent a management regime for the Adak source population. On the other hand, no control on Kagalaska Island will almost certainly allow the establishment of a breeding and increasing non-native caribou population on Kagalaska Island which would threaten other nearby islands as the caribou use Kagalaska as a stepping stone.

RESTORATION OUTCOMES

The caribou control project is expected to begin in the summer of 2015. At this time there are no project outcomes.

Cumulative effects analyses attempt to capture the overall administrative, visitor, commercial and scientific impact to a wilderness area by thinking holistically about all of these actions collectively over space and time. The remote nature of Kagalaska Island has prevented commercial and visitor use on the island. According to Delehanty, visitor use is essentially zero, and there is no commercial use currently⁹. For the 2015 field season, there is one research permit for Kagalaska Island, and a second one pending. Based on this information and aside from any habitation by humans before the area was established as a Refuge, the caribou control activities will represent the largest administrative impact on Kagalaska Island to date. However, this impact must be weighed against the degradation of natural conditions that would occur as a result of caribou becoming established on the island and possibly to other islands beyond Kagalaska. Determining if native species and natural processes will be protected in spite of caribou control activities remains a question for the future.

⁹ Personal communications with S. Delehanty 2/2/15

CONCLUSIONS

Effects of the proposed restoration action on wilderness character were not included in public comments, which instead focused on the use of the harvested caribou meat, concerns about animal rights, and options to transport the caribou away from Kagalaska Island. Site-specific pressures play a unique role in this intervention issue because caribou management decisions by local public land managers and private landowners on nearby Adak Island (roughly half of which is wilderness) are creating an ecological restoration issue for the designated wilderness of Kagalaska Island.

The decision trade-off in this case is that, by maintaining the natural quality of wilderness and allowing native vegetation to grow unimpeded from invasive caribou, the untrammelled quality of wilderness is degraded by the actions to control the incoming caribou from Adak Island. The establishing legislation in ANILCA is clear that conserving native refuge biodiversity is a priority for the Alaska Maritime National Wildlife Refuge, however the Wilderness Act also explicitly states that managers must protect the wilderness character of the Aleutian Islands Wilderness, of which both untrammelled and natural are components.



The research vessel, *Tiglax*, will support caribou control operations on Kagalaska Island. Here, the ship is docked at the Adak Island Port.

Factors limiting success include unknown quantities of caribou crossing over to Kagalaska in the future, making control difficult and potentially ineffective during the times in between control activities. Unpredictable weather patterns, the safety of staff and volunteers implementing the caribou control and continued funding for project operations are all factors that have the potential to limit the success of the control actions. Another factor is the differing values of caribou management from local residents and stakeholders between split-ownership Adak Island, and exclusively refuge-administered Kagalaska Island. Some residents do not have a differing value set between these islands, and this can lead to

support favoring a land management approach that is contrary to the values of the Wilderness Act.

Long-term success for this project will require ongoing future surveys and caribou control to prevent herd establishment. The caribou control action has the potential to be successful; however, multiple interventions will be needed repeatedly into the future. Management actions are a short-term fix to a problem that is not under the purview of Refuge Managers, yet directly impacts areas under their management.

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