

An Analysis of the Mountain Goat Issue in Olympic National Park

**Prepared by:
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Position

Olympic Park Associates supports the National Park Service's preferred alternative (#1) for removal of mountain goats from Olympic National Park.

Introduced to the Olympic Mountains in the 1920s, the non-native mountain goats reproduced unchecked, reaching an estimated population of 1,175 in less than 60 years. In the late 1960s, members of Olympic Park Associates and the Port Angeles-based Klahhane Club notified the National Park Service (NPS) of soil erosion and damage to alpine and subalpine plant communities caused by grazing, trampling, and wallowing of these introduced animals.

The Olympic Peninsula is an island ecosystem. Isolated by glacier ice through much of the Pleistocene Epoch, it served as a refugium for plant species and communities that were displaced elsewhere throughout the Northwest. As a result, numerous rare, endemic (occurring nowhere else), and disjunct (far removed from their normal ranges) plant species occur here. This rich diversity, unusual for so small an area, contributed to Olympic National Park's selection by UNESCO scientists as a Biosphere Reserve and World Heritage site. Throughout their evolution, these alpine plant communities developed in the absence of any large rocky outcrop herbivores -- including mountain goats -- until this century.

The draft environmental impact statement concludes that mountain goats have done considerable damage by trampling, grazing, and creating wallows in fragile alpine areas. This puts 33 known rare and/or endemic plant species at risk, including the Olympic Mt. milkvetch, a candidate for listing under the Endangered Species Act. Following more than 25 years of research, the evidence is clear:

- mountain goats are not native to the Olympic Peninsula
- even small numbers of mountain goats have a detrimental effect on many plant species
- chemical contraception is not an effective long-term means to eliminate mountain goats
- live capture is not an option due to safety considerations and high mountain goat mortality

Olympic Park Associates (OPA) is joined by a number of regional and national environmental organizations in supporting the National Park Service's preferred alternative. Supporting organizations include the Friends of the Earth, The Mountaineers, National Parks and Conservation Association, Pilchuck Audubon Society, Seattle Audubon Society, Sierra Club, Washington Native Plant Society, Washington Wilderness Coalition, The Wilderness Society, and Wilderness Watch - The Washington Task Force.

In order to clarify the facts and counter some of the misinformation that currently surrounds this issue, OPA has prepared this white paper in an attempt to answer some of these questions. This report details selected aspects of the mountain goat issue, presenting evidence that mountain goats are not native to the Olympic Peninsula and are indeed causing significant damage to fragile, alpine ecosystems.

Background

In 1925, four adult mountain goats (*Oreamnos americanus*) were transplanted by local sportsmen into the Lake Crescent area from the Selkirk Mountains of eastern British Columbia. Seven (or eight) more were brought in from Alaska in 1927 and 1929. From these eleven (or twelve) animals, the herds grew in size to an estimated population of 1,175 individuals by 1983.

The effects the mountain goats were having on their new found habitat were recognized as early as the late 1960's. Visible vegetation damage was observed in the Klahhane Ridge/Mt. Angeles area near Hurricane Ridge. 1973 marked the first year that researches started to measure these impacts. Preliminary findings revealed extensive occupation of the mountain goat throughout Olympic National Park and adjoining National Forest lands. A five-year study commenced in 1977 to better identify habitat requirements of these animals and additional associated effects.

It was determined that mountain goats inhabited 30-40% of Olympic National Park -- 100% of the park's alpine zone and 70% of the subalpine zone. These studies revealed that the habitat and forage requirements of these animals coincided with that of rare or endemic plant species, such as Olympic Mt. groundsel (Webster's senecio), Piper's bellflower, and Olympic Mt. aster.

At the end of this study, it was determined that left unchecked (as these animals have no known predators on the Olympic Peninsula) their effects on the biotic community would be devastating. A five-year experimental management program was initiated in 1981. The goal of this effort was to develop a program that could be implemented to "manage" this population of animals to reduce resource damage. During this study, numerous live capture techniques were employed resulting in over 300 animals captured and relocated to neighboring states. Approximately an equal number were captured, tagged, and released for further studies. Some animals were killed for research purposes, others underwent experimental sterilization procedures to determine if this was an effective tool to control the population.

At the conclusion of this research project, a Mountain Goat Management plan was released in 1987. The determination was to live-capture all goats from the core of the park and employ control measures for those remaining goats around the periphery of the park. In 1988, 80 goats were captured with an 8.7% mortality rate. In 1989, only 67 goats were captured, but the mortality rate had climbed to 19%. It was evident that live capture methods were quickly becoming ineffective in removing the goats and the program was canceled in 1990.

In 1991, an interagency cooperative effort commenced between the National Park Service, U.S. Forest Service, and Washington Department of Wildlife. The focus had changed to address the goat management issue for the entire Olympic alpine and subalpine ecosystems. By early 1993, the later two agencies pulled out of the EIS process, once again restricting the goat management issue to just the park. In 1993, Olympic National Forest began a five-year study on mountain goat impacts on 'eastside' forest lands; however the project went unfunded in 1994.

The 1995 release of the Mountain Goat DEIS once again charts the course for mountain goat management in the park, calling for a total elimination of the mountain goat over a 3 to 5 year period by shooting from helicopters.

Ethnographic

Q: Early explorers documented Native tribes manufacturing blankets with goat wool. Doesn't this material indicate it was obtained locally and not obtained from long distances?

There is a plethora of reports documenting that blankets made from mountain goat wool were of great value, often showing high rank & status. Wool retains heat well when wet, making for an ideal material in a maritime climate. Finished blankets and raw wool were widely traded by the various tribes.

There is extensive reference to the manufacture of blankets and clothing using the wool of mountain goat as well as that of a now extinct dog which possessed a wool-like coat.

Manufacture "The Indians of the Sound and the Straits of Juan de Fuca attained considerable skill in manufacturing a species of blanket from a mixture of the wool of the mountain-sheep and the hair of a particular kind of dog...The wool is obtained from the hunting tribes next to the Cascade Mountains, and is an article of trade." (Gibbs, 1877)

Trade The trade network amongst Northwest tribes was vast and well developed, extending from Alaska to northern California, across the Cascades as far as the Great Plains tribes. Gibbs states that bowls of mountain sheep horn and spoons of mountain goat horn were traded from the northern Northwest Coast (probably the tribes north of Vancouver Island such as the Tlingit, Bella Coola, and Tsimshian) and as far south as California.

"The Tlingit traveled as far as Puget Sound with their famous Chilkat blankets in order to barter them for dentalia snails, ahliotis shells...The Nootka offered waterproof hats and baskets in addition to whale oil..." (Bruggmann & Gerber, 1987)

Hunting Drucker (1951) noted that the Nootka (living north of the Olympic Peninsula) and Suttles and Lane (1990) noted that the Southern Coast Salish (living east of the Peninsula) mention mountain goat hunting locations in the Coast Mountains of BC and Washington Cascades. Conspicuously absent in all documents is mention of any hunting of mountain goats on the Olympic Peninsula.

Wool dogs It should be noted that those tribes that possessed the "wool dogs" were also those that did not have a local source of mountain goat wool, such as the Quinault, Quileute, Makah, Klallam, and Twana (as well as the tribes on Vancouver Island). Erna Gunther in 1927 specifically noted that those coastal tribes possessing wool dogs also did not hunt mountain goats, and those that did hunt mountain goats (Snoqualmie, Skykomish, and Nisqually) did not keep wool dogs.

Mythology Mythology plays an important role in all cultures, which is especially evident in the extensive oral traditions of all Native American tribes. It is interesting to note that no mountain goat myths are present in the tribes of the Olympic Peninsula except the Twana which state:

"He (Transformer) put no goats in our mountains here but he gave the Skagit goats in their mountains, to eat and use the wool of." (Elmendorf, 1961)

The following gives additional background information on Olympic Peninsula tribes.

Quinault Primarily a riverine people, though they hunted in the mountains in late summer/early fall. Olson (1936) describes hunting techniques employed by the Quinaults to hunt elk ("especially abundant"), deer, and bear and states: "It is claimed that mountain goat and mountain sheep were unknown." Robes were made of marmot, mountain goat, and bison. Chiefs wore sea-otter & bison robes, obtained from east of the Cascade mountains.

"Early in the nineteenth century trade with the Columbia river tribes resulted in the bringing in of buffalo skins and horns after that time a few horn spoons were made. One informant stated, however, the horns of mountain goat and sheep were known earlier." (Olson, 1936)

Of all Peninsula tribes, the Makah were probably the most dependent upon the ocean for their sustenance.

"Of land animals they eat the flesh of the elk, deer, and bear; but, although these abound a short distance in the interior, the Indians very seldom hunt them." (Swan, 1870)

Makah

The Makah manufactured beautiful blankets from mountain goat wool. Dunn (1845) mentions their manufacture, but not the source of their material, though Gunther states:

"Although the mountain goat does not occur on the Olympic peninsula the informant was familiar with the animal... Mountain-goat wool was bought in Victoria through the Klallam. Finished blankets were bought more often than raw wool." (Gunther, 1936)

Once again, the sea offered the most for the Klallam, but a few hunters did venture into the mountains to hunt. Specific hunting techniques for deer and elk are mentioned.

"Hunting is of least importance, economically, to the Klallam. ... The mountains back of the Klallam territory are known only to the few hunters who go there for elk and deer." (Gunther, 1927)

Klallam

Mountain goat wool blankets were made (mostly for trade items and potlatch gifts).

"Mountain goat wool was brought by the Klallam from the Songish of Vancouver Island, who in turn secured it from the Cowichan of the mainland. Occasionally it was gotten from the Skagit and Snoqualmi who were good hunters." (Gunther, 1927)

"The works (goat-hair blankets) of the Clallam were supplied by the Skikwamish." (Curtis, 1917)

The Twana (Skokomish) regularly hunted for elk, as well as black bear and marmot. The Twana are the only culture on the Peninsula that mentions mountain goats in their mythology, specifically to state that the animal did not exist. However, the wool of the mountain goat was much prized.

"Mountain-goat horn was obtained in trade, from Puget Sound groups, but spoons of this material were probably not manufactured by the Twana. They were valuable and expensive articles.... Informants were doubtful whether mountain-sheep horn spoons were ever obtained; this animal, like the mountain goat, did not occur in Twana territory." (Elmendorf, 1960)

Twana

"The Twana bought or traded for most of their goat-wool blankets; the mountain-goat did not occur locally" (Elmendorf, 1960)

"...(dishes were) made of the horn of the mountain sheep. This kind was made by the Indians of British Columbia, the Klikitats, and probably by some of the Sound Indians on the east side, who hunted high in the Cascade Mountains." (Eels, 1985)

"Blankets of this material (mountain-goat wool) were comparatively scarce among the tribes of the Puget Sound, who obtained goat-hair or the finished product from the Klickitat, Cowlitz, and Snoqualmu." (Curtis, 1913)

"Mountain goats could be hunted only in the Cascade Range, and so the saltwater Puget Sound tribes and the Twana obtained the wool from upriver peoples such as the

Skykomish." (Suttles & Lane, 1990)

Chehalis Adamson (1926) noted that people receiving mountain goat wool, finished mountain goat spoons, and buffalo horn spoons were from relatives east of the Cascades. She stated:

"(there) were no goats here." (Adamson, 1926)

Source: Randall Schalk's "A review of the ethnographic and archaeological evidence relating to mountain goats in the Olympic Mountains", 1993.

Historic

Q: Early explorers venturing into the heart of the Olympics identified mountain goats as being present. Doesn't this evidence clearly demonstrate that mountain goats are native to the Peninsula?

Between 1790 and 1890, only three expeditions made claims of spotting goats. In contrast, between 1792 and 1921, no less than two dozen documented expeditions were conducted, many of which journeyed throughout the interior of the Olympic Peninsula. None reported seeing mountain goats, even when they were specifically looking for these animals in their journeys.

Don Manuel Quimper (1790) mentioned as he sailed along the shores of the Strait of Juan de Fuca that "...wild goats...feed on their luxuriant pastures". The only problem with his observation, he never ventured inland from the coast and couldn't have possibly seen goats from aboard ship while passing the Olympic Peninsula. He may have been referring to the mainland B.C. coast, whose waters were considered part of the Strait of Juan de Fuca at the time.

Gilman's explorations (1889-1890), published in National Geographic in 1896, details his two explorations on the west side of the Peninsula, where he stated: "Game is plentiful, and it would be a paradise for the hunter were it not so difficult of access. In addition to elk and bear ...are deer, mountain goat ... and many smaller or less desirable birds and animals." Since he died before the publication of this article, no verification could be made by the National Geographic Society of the content of his submission. It should be noted that his second expedition was confined to the lowlands on the periphery of the Peninsula, which is not mountain goat habitat.

Press Expedition (1889-1890) had one entry in the journal kept by naturalist, C.A. Barnes, that stated: "One goat was seen by the party" He also mentioned seeing a chicken, of which the prairie chicken is not known on the Peninsula.

Charles Pickering, who participated in the United States Exploring Expedition of 1841, stated in 1875 that the Chinook Indians wove blankets and belts from the wool of the Mountain Goat: "an animal said to be abundant to the northward".

O'Neil Expedition of 1890 crossed the southern Olympics, including an ascent of Mount Olympus. Pvt. Harry Fisher stated he: "kept a vigilant look out for goat and sheep" and was "satisfied that neither are to be found in this range of mountains".

C. Hart Merriam journeyed to the Olympic Peninsula in 1888 and 1897. As chief of U.S. Biological Survey he stated in his report: "the most striking peculiarity of the region is the species it lacks. There are not Mountain Sheep, Goats,... in the Olympics".

E.B. Webster, in his book *The King of the Olympics: The Roosevelt Elk and Other Mammals of the Olympic Mountains*, specifically stated that: "the fauna of the Olympic Mountains...has never included the Mountain Goat".

The following is a partial list of explorers or residents of the Olympic Peninsula, all of whom failed to see mountain

goats on any of their journeys (taken from A Review of the Historical Evidence Relating to Mountain Goats in the Olympic Mountains (Susan Schultz, 1993)).

Capt. George Vancouver (1792)
Jose Mariano Mozino (1792)
Lt. Charles Wilkes (1841)
Pacific Railroad Surveys (1853-1856)
Watkinson's Exploration (1878)
O'Neil Expeditions (1885 & 1890)
Wickersham's Excursions (1889 & 1890)
Smith (1881)
Conrad (1890)
Bretherton (1894)
Streator (1894)
Merriam (1888 & 1897)
Reid, Hoopper, Munn, & Church (1896)
Dodwell & Rixon (1898-1899)
Field Columbian Museum Expedition (1898)
The Mountaineers (1907)
Reagan (1908)
Morgenroth (1890-1927)
Humes (1897-1934)
Webster (1900-1920)
Smith (1910-1950)
U.S. Biological Survey (1917-1921)

Source: Susan Schultz's "A review of the historical evidence relating to mountain goats in the Olympic Mountains prior to 1925", 1993.

Archaeological

Q: Archaeological digs by Reagan at La Push clearly identifies the remains of mountain-goats. Doesn't this prove mountain goats are native to the Peninsula?

Over thirty archaeological sites exist on the Olympic Peninsula; the majority are located in coastal areas. Only one site (La Push) identified evidence of mountain goat and bighorn sheep.

Albert Reagan lived in La Push from 1905 to 1909. In 1917, he published a report of his archaeological work during that period, whereby he identified uncovering mountain goat and bighorn sheep horns ("usually only in the ladle form of horns").

First, his claim is suspect since the keratinous composition of horns typically does not preserve well. This is further made suspect since Reagan also claims the midden contained bones of squid and those of five different salmon species. Squid simply do not contain any non-perishable parts and the technique to differentiate salmon bones did not exist in 1917.

Second, assuming Reagan was correct in identifying horns and bones, there remains not even a hint of proof from his data that the material was obtained locally. The extensive trading network of Northwest Coast tribes is well documented. Acquisition of mountain goats bones and their wool could easily have been the obtained by the Quileute at La Push from the neighboring Makah, who are known to have obtained mountain goat wool from the British Columbia via the Klallam.

Third, it should be noted that Reagan authored a paper in 1908 devoted to the animals of the Olympic Peninsula. In it,

even he did not identify mountain goats in his animal list.

Taking into consideration that bighorn sheep were never located on the Olympic Peninsula, coupled with fact that materials gathered at the remaining archaeological sites on the Peninsula did not contain mountain goat remains, this single reference simply lacks in significance in drawing a conclusion that mountain goats are native to the Peninsula.

Source: Randall Schalk's "A review of the ethnographic and archaeological evidence relating to mountain goats in the Olympic Mountains", 1993.

Threatened and Rare Plants

Q: No plant species are endangered with extinction because of mountain goat activities. Doesn't this negate the need to remove mountain goats?

One plant species is known to be threatened with extinction, the Olympic milkvetch (*Astragalus australis* var. *olympicus*). This species is listed as threatened in Washington state and is a candidate for federal listing. There are fewer than 4,000 of these plants in the entire world.

"Only four population centers of this species occur in the world and all are located within the NE portion of Olympic National Park (and Forest) in the alpine and subalpine zones." (Kaye, 1989)

Hundreds of Olympic milkvetch plants were documented to have been killed or damaged by mountain goat grazing, wallowing, or trampling. "Grazing was evident on 72% of the individuals" in study plots with "most...noted as 76-100% grazed." (Houston et al., 1994)

Even in areas where the mountain goat population had been substantially reduced, "(mountain goat) sign was found inside or near 70% of the (study) plots." (Houston et al., 1994) Other research showed "(a) total of 168 wallows were counted within 164 feet of two populations of milkvetch." (Kaye, 1989) It is important to note, the damage to these plants caused by mountain goats to date "would likely require 25 to 100 years" (Schreiner) to fully recover.

There are 14 endemic (found nowhere else in the world) plant species found on the Olympic Peninsula (six of which are also found on Vancouver Island). Of this total, 12 are within mountain goat habitat. There are 106 rare plant species on the Peninsula, 33 of which are present in mountain goat summer range. Of these 33, "(n)ine high-elevation taxa were known from only one park location, and 17 occurred at five or fewer sites in the park." (Houston et al., 1994) The documentation is extensive showing mountain goats effects on these rare plant species.

"Olympic aster was grazed in 12 of the 18 plots where it occurred in Royal Basin" (Houston et al., 1994)

"Impacts from heavy grazing on endemic Webster's senecio and from goat trampling on endemic Flett's violet) and Piper's bellflower were discovered" (Moorhead, 1976)

"...Piper's bellflower and Webster's senecio, and ... Olympic aster, had significantly reduced leaf length, flower production, and growth (cover and biomass) when grazed by goats. Grazing removed 65% of aboveground net production of Webster's senecio plants." (Pfitsch et al., 1982)

"Production of foliage of ... Piper's bellflower ... Webster's senecio and ... Olympic Mountain aster was reduced between 20% and 60% depending on site characteristics as well as grazing intensity. Flower production for all three species was drastically reduced by grazing" (DEIS, 1995 & Houston et al., 1984)

Until a plant actually goes extinct, scientists have no way of proving that mountain goats will cause extinction of native plant species. This is not an experiment any right-minded scientist nor any sensible human being would allow just to prove a point. However, we can infer from mistakes made elsewhere (such as goats introduced in Hawaii and

Galapagos Islands) that herbivores have caused the extinction and near extinction of plants (Loope et al., 1988) and may very well do the same in the Olympics.

As was stated by Schreiner et al. (1994),

"Enough information exists to be concerned about the long-term fate of these taxa."

Environmental Damage

Q: Doesn't the research to date indicate that overall impacts on plants, soils, and wildlife have been over-exaggerated?

As described in the DEIS, the documented impacts to vegetation includes the following:

- Changes in dominance and competitive relationships between plant species which alter relative abundance of species in native communities
- Direct and indirect alteration of plant communities through changes in plant structure, reproductive patterns, growth rates, and seedling establishment
- Local plant impacts in wallow areas include decreased plant material and cover
- Habitat for 33 rare plant taxa substantially overlaps with habitat considered ideal summer range for goats
- Goats consume four endemic taxa and have injured or killed individuals of the rarest endemic species
- Goat-caused mortality of Astragalus (Olympic Mountain milkvetch) plants occurred even at medium goat densities
- Grazing (much of it severe) was evident on as many as 72% of the milkvetch plants in three plots in a given year
- Soil impacts include wallow and trailing. Wallow complexes up to 2,475 sq. feet in size were measured. Wallows which are continuously used will not fully recover

Additional studies have shown that consumption or trampling of plants results in numerous adverse impacts, some of which are listed below. A stressed plant may survive for several years when climatic conditions are favorable; however climatic extremes could result in the death of stressed individuals.

- diminished or slowed growth
- production of tannins to deter herbivory
- tissue damage
- lowered leaf biomass
- reduced root development
- inability to flower or reduced number of flowers
- burial
- prevention of seed generation or reduced numbers of seeds
- death
- lowered seed germination, emergence, and survival

This alteration of plant communities, whether by outright destruction of individual plants or by compositional change, affects animals that occupy these areas. The endemic Olympic marmot appears to have been displaced by mountain goats, as marmots tend to live only on the fringe of meadows frequented by mountain goats. Diminished plant cover reduces the opportunity for viewing flower-filled meadows by humans, but also reduces necessary nutrients for a host

of insects and birds. Like a garden in your backyard, soil disturbance from mountain goat wallowing, trailing, trampling, bedding, or grazing, also creates an environment ripe for invasion of 'weed' species. Fragile alpine plants that have been stressed, oftentimes cannot compete, allowing opportunistic invasive species to gain a foothold, thus upsetting the balance of plant communities and reducing overall diversity, stability, and adaptability to environmental change.

Mountain goats do not have to outright destroy rare plants to have a profound affect on the entire ecological web that has co-evolved in the Olympics before the last Ice Age over 10,000 years ago. The problem with any non-native species is that their presence disrupts the balance of established communities. This disruption may favor some species over others or may have a detrimental affect on all species. For example, in the case of the mountain goats on Klahhane Ridge, measured effects include:

- nearly 34% of a sampled meadow was made barren primarily by mountain goat use
- less than 1% of total cover in this meadow was composed of moss and lichens
- organic matter only accounted for 13% of the soil in this meadow and also showed reduced soil nutrients
- over 70 wallows (greater than 3 square feet) were documented in this meadow (totalling 7% of the surface area), including some wallows as large as 2,575 square feet

Park-wide, in excess of 700 mountain goat wallows have been documented. Hundreds of mountain goat trails and tracks have been identified and are clearly visible to backcountry travelers. Other documented affects throughout the park include:

"Changes in species composition and reduction of plant flowering in goat use areas was documented. Documented goat impacts to soils included actual removal and loss of soil structure." (Olmstead, 1977)

"In the Fescue-Phlox-scrub slope community (extensively used by goats), 'mammal distributions were skewed away from the heavier goat use areas', while the Artemesia-Festuca-Elymus community (low goat use), vegetation was taller, more lush and more dense. More types of small mammals were found in this community." (Dragavon & Weisbrod, 1978)

"Goat activities remove plant cover which enhances soil erosion, causing the loss of the organic topsoil ... The soil also provides less stability and nutrients needed for plant regeneration." (Pfitsch, Reid, Harter, Pike, Bliss, 1982)

"Goats utilized all nine subalpine and alpine plant communities in one study area. Heavy grazing on two preferred species, *Carex spectabilis* and *Festuca idahoensis*, was documented. Concentrated goat grazing and trampling caused reduced species density in Phlox-fescue meadows on Klahhane.' (Pfitsch, Reid, Harter, Pike, Bliss, 1982)

"Goat activities caused substantial mortality in seedlings growing in bare soil. The mortality was primarily caused indirectly by changes in the microenvironment and shifts in distribution of microsites available for seedling establishment.' (Pfitsch, Reid, Harter, Pike, Bliss, 1982)

"For colonizing species ... goat disturbance increases the number of bare ground sites available for colonization. Non-colonizing species, such as *Festuca idahoensis*, decrease in density with increasing goat use because of their inability to establish on bare sites. Goat impacts can be expected to alter species composition over the long-term. 'Overall, species density should decrease because there are fewer species able to colonize goat disturbed areas than there are species able to exist in closed vegetation.'" (Pfitsch, Reid, Harter, Pike, Bliss, 1982)

"The general trend seems to be that this species (Yarrow) is increasing outside the exclosures while remaining unchanged or decreasing inside... These results are consistent with the hypothesis that mountain goats have significantly disturbed the vegetation of the Klahhane Ridge area." (Houston, Moorhead, Schreiner, Starr, Olson, Aho, 1984)

"Displacement of 45 tons of soil from one large wallow was documented. The average soil loss from seven other wallows was 1.3 tons ... In some sample plots on Klahhane Ridge, more than 50% of the plants have been eliminated and trampling-resistant or disturbance-oriented species have become dominant." (Houston, Moorhead, Schreiner, Starr, Olson, Aho, 1984)

"Even where all goat use was eliminated by exclosures, six years were required before significant community realignment occurred. Complete recovery of plant communities will be delayed considerably if goats are not eliminated. It is estimated that 10-20 years will be required for plant community recovery in the absence of goats, and that time may be doubled if goat populations are maintained at low levels. Wallows, severely disturbed sites, and highly preferred sites, will not fully recover as long as goats are present on Klahhane Ridge." (Schreiner, 1985)

"Mosses and lichens, crucial to the stabilization of alpine soils, have been eliminated in many areas." (Robinson & Bolen, 1989)

"Herbivore populations have direct and indirect effects on individual plants, and indirect effects on plant communities and ecosystem processes." (Floate, 1981; Begon et al., 1986)

"Some investigators believe that physical disturbances associated with herbivory may be more important than grazing" (Harper, 1977; Floate, 1981)

"Plant community effects included reduced moss and lichen cover, increased soil disturbance and exposure of mineral soil from wallowing and trampling, an increase in ruderal (disturbance-oriented) species, and a decrease in palatable species." (Houston et al., 1994)

Removal Options

Q: Aren't there non-lethal options for removal that the Park Service has not exhausted?

Since 1981, park scientists and outside experts have conducted experiments using no less than 10 separate field techniques in an effort to determine an appropriate non-lethal procedure to eliminate mountain goats from Olympic National Park. These techniques included:

Technique	Success	Personnel Safety	Goat Safety	Potential for Future Use
Rope Snare	Depends upon ability to lure animal into snare with bait (poor track record when goat density is small)	Good	Good	Limited to none (highly inefficient, risky to personnel when handling large billies)
Other Traps/Snares	Unsuccessful in all attempts to capture goats with padded leg-hold traps and wire bear snares	Good	Fair	None
Drop Net	Success depends upon high goat density and ability to lure goats into drop site with bait (no successful captures with small population sizes)	Good	Good	Very limited (inefficient and costly)
Drive Net	Unsuccessful (goats tended to disperse)	Fair	Poor	None (restricted to moderate terrain, costly, very risky)
Manual	Entails chasing goat via helicopter until the goat nears exhaustion, then park personnel jumps from helicopters to subdue goat	Poor	Poor	Limited potential (very risky, severely stresses goats, highly inefficient, very costly, must be on level terrain)
Net Gun				None (only applicable to)

(ground)	Need to approach within 32 ft. of goats	Fair	Poor	level terrain)
Net Gun (aerial)	Mixed success, tests in 1985 had mortality rates of 13-16% with 66-76% of surviving goats receiving injuries	Poor	Poor	Limited (restricted to open terrain, very risk to both personnel and goats)
Chemical Immobilization (ground)	Unsuccessful, unable to get close enough to goats	Good	Fair	Limited to none
Chemical Immobilization (aerial)	Primary technique employed during live-captures (1988-1989), discontinued when goat mortality reached 19%	Fair	Fair/Poor	Limited (risky for both personnel and goats, very costly)
Chemical Immobilization w/ Net Gun (aerial)	Only applicable if tranquilizing dart fails to work using above technique	Fair	Fair	None

Using the best techniques developed from these experiments, the Park Service performed 1-1/2 years (1988-1989) of live-capture. Unfortunately, all the 'easy' mountain goats were captured initially, driving the remaining into more treacherous terrain. The results were devastating to the mountain goats, with a mortality rate of 19% by the time that live-capture was suspended in 1989. From 1988 to 1990, at least 10 investigators re-evaluated the techniques being used during the live-capture operation in an attempt to reduce mortality, evaluate risks, and improve the process. The conclusion of one team was to discontinue live-capture operations because:

"(t)he existing conditions of population distribution, terrain, weather, and helicopter performance simply make the risk unacceptable." (Peterson, 1990)

In addition, eight sterilization techniques were evaluated.. A team of nine noted specialists in non-lethal technologies examined, and re-examined in 1992, 1993, 1994, the field data to determine if there were additional non-lethal (contraceptive) options to removing mountain goats from the park. The contraceptive/sterilization techniques that were tried included:

1. Non-surgical chemical sterilization by oral administration, injection, and intravaginal implant: Judged not feasible for wild goat population
2. Non-surgical cervical closure: Eliminated, uncertainty concerning placement and retention of the device and possible uterine infection
3. Non-surgical use of interuterine device: Eliminated, anatomy too small and sexually inactive during season of live capture
4. Caslic's operation ("apposition and suturing of the vulvar mucosal edges"): Eliminated, likelihood of mountain goat tearing of sutures resulting in infection
5. Tubal ligation: Unsuccessful, oviducts were not accessible without using numerous incisions in different locations in the abdomen.
6. Ovariectomy ("spaying"): Hypothesized as possible, however it would alter hormonal influences on mountain goat social behavior
7. Ovariectomy of one ovary and Tubal ligation of the other: Might be possible
8. Surgical steroid implants: Impractical, short-term effectiveness, high cost and staffing requirements

"After two years of attempts to experimentally sterilize goats, certain conclusions are evident. Any

technique of fertility control, no matter how medically sophisticated, is primarily dependent on the likelihood and efficiency with which goats can be obtained. It is not clear that enough females could be captured in a small population, much less a large one, to effect a decline or control on numbers" (Houston et. al., 1984)

The conclusion of the panel of scientists in 1992 for the applicability of contraceptives to eliminate the mountain goat population:

"...lethal shooting appears to be the only feasible option for use in eliminating mountain goats in Olympic National Park." (Fayrer-Hosken, Garrott, Jessup, Kirkpatrick, Warren, 1992)

To summarize the general view of these scientists in the applicability of current contraceptive technology in 1994 to eliminate the mountain goat population remains:

"...we are no closer to having a proven, one-shot, permanent sterilant available for field application than we were back in 1992..." (Warren, 1994)

Population Estimates

Q: Doesn't the current mountain goat census indicate the population is diminishing?

Estimating the population of any free-ranging animal, whether they be migratory birds, grizzly bears, elk, or mountain goats is a formidable task and continues to be a challenge for wildlife biologists. Increased accuracy is attainable only by frequent samples during the course of a given season, coupled with additional samples spanning all four seasons. This level of sampling was not possible on the Olympic Peninsula. High helicopter operating costs (~\$15,000-\$18,000 per census) and inclement weather conditions resulted in censuses that were separated by years, not months. Each census was conducted over the course of a single week during each of the sample years (1983, 1990, and 1994), not frequently over the course of all four seasons.

As a result, it is important to look at the population census counts for mountain goats on the Olympic Peninsula as a range of values, rather than the fixed number often quoted. The graph below shows these ranges for the 1983, 1990, and 1994 censuses. It should be noted that 521 mountain goats were removed from the Peninsula between 1983 and 1990 (407 Olympic National Park removals plus 114 killed by hunters in Olympic National Forest).

The removals through 1989 played a significant roll in reducing the total population on the Peninsula. The 'apparent' decline in numbers between 1990 and 1994 does not hold true when analyzed as a population range. The heavy shaded area shows the minimum number of mountain goats estimated to exist on the Peninsula, which is clearly not significantly different between 1990 and 1994. The white area represents the upper range of population which may exist; the smaller white area in 1994 reflects a reduced standard error - the result of researchers expanding the sample areas as well as increasing the number of areas sampled. This change does not reflect a declining population, rather a more accurate count.

Source: Mountain Goat Census in the Olympic Mountain Range, July 1994, Houston, Olson, Hoffman, Moorhead, 1994.

Other Issues

Q: Wasn't mountain goat damage caused by NPS placement of salt licks?

At Klahhane, all salt baiting sites were located further than 1/2 mile away from the nearest study plot. Damage that was attributable to the placement of the salt lick was confined to 165 feet of the site. Only 'local' mountain goats (noted by

their ear tag) used the salt licks, so the salt licks did not serve as an attractant to lure mountain goats from far and wide.

There is evidence (including some home video) that over the years park visitors have placed salt licks and sprinkled rock salt in an effort to attract mountain goats closer to them, both for visitors' viewing pleasure but also for nature photography.

Because of the distances of the study plots away from the salt bait sites, the placement of these salt licks "had no effects upon the overall goat densities...or on the studies of goat/vegetation relationships". (DEIS, 1995)

Q: Isn't the Park Service's preferred alternative arbitrary and capricious?

This is a decision that is over 25 years in the making. The Environmental Assessment of 1987 clearly and concisely presented evidence mountain goat impacts on the environment and recognized at that time that 1) these animals were clearly not native to the Olympic Peninsula, 2) these animals were causing significant damage to the fragile alpine and subalpine ecosystems, and 3) these animals must be eliminated from the park to restore those ecosystems.

Management of exotic species in our National Parks is not solely an issue of policy, it is an issue of law. The Organic Act of 1916 states that the role of the National Park Service is to conserve these parklands "...in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." With 95% of the park designated wilderness, the Wilderness Act of 1964 stipulates that we must "provide for the protection of these areas". Also, the Endangered Species Act of 1974 mandates us "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved."

The Park Service has faced this difficult task before with elimination of burros in Grand Canyon and Bandelier, and both feral goats and pigs in Hawaii Volcanoes. In the process, the Park Service has been consistent in complying with these laws and Park Service policies.

This issue is one of protecting ecosystems and natural ecological processes. No one will argue that mountain goats are not magnificent animals and have tremendous visitor appeal. But our National Parks and wildlands are more than just large outdoor zoos. As Robinson and Bolen stated: "...any philosophy of park management is flawed if it considers national parks only as animal sanctuaries and 'attaches more value to animal life than to plant life' (Lamprey)."

In 1938, the American people made the decision that this area warranted special protection by creating Olympic National Park. Less than 1% of our country has been granted that special protection and increased usage of our national parks reinforces the value these lands still hold for all Americans. It is incumbent upon us to do all that we can to preserve and protect these lands in their natural state. If we value the ecological integrity of this World Heritage site and Biosphere Reserve, we must make the right decision by eliminating mountain goats from the park. As Aldo Leopold once wrote: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."
