

Controlling Ungulate Populations in native ecosystems in Hawaii

Position Paper
Hawaii Conservation Alliance

Position Statement

Ungulates impede the progress of conservation and restoration of native Hawaiian ecosystems. Ungulate removal, in conjunction with other management actions, is necessary to ensure the success of ecosystem restoration and preservation of native Hawaiian ecosystems.

Summary

It is firmly established that the conservation and restoration of native Hawaiian ecosystems is unsuccessful in the presence of ungulates.^{5, 11, 16, 18} Controlling ungulate populations, specifically goat, pig, cattle, sheep, and axis deer, is the vital first step; dramatic and otherwise unaided ecosystem recovery has been documented when it has been accomplished. Despite demonstrated success of eradication and in certain circumstances reduction and control of ungulates, some public groups strongly oppose ungulate population control. Clearly, there is a need to effect the control in the most efficient ecological, social, and humane manner possible. Finding the right balance between these needs is critical in preserving our ethical integrity as well as in preserving both the cultural and natural aspects of Hawaii's rich heritage. This paper addresses the ethical, social, economic and ecological costs and benefits of ungulate population control by drawing from the accumulated knowledge of seven and a half decades of ungulate population control and research on selected areas in Hawaii.

Hawaiian ecosystems are vulnerable to ungulate presence

Hawaii's economy and the health and quality of life of Hawaii's people depend upon the richness of Hawaii's natural resources. Isolated for millions of years, the Hawaiian Islands harbor tremendous biological diversity and incredible life forms found nowhere else on this planet. The few species that managed to wash up onto Hawaiian shores, or that got carried over by wind or wings evolved into thousands of new species in dramatic displays of adaptive radiation. Ungulates were not among these initial colonizers, and our endemic life forms evolved without need to compete with or defend against them. Ungulates devour and destroy native plants and ground cover, facilitating sediment run-off and the smothering of coral reefs. The soil disturbance caused by rooting ungulates also facilitates the introduction and expansion of invasive plants, and creates breeding grounds for mosquitoes that transmit avian disease to native forest birds. The invasion of non-native species poses one of the greatest threats to Hawaii's native ecosystems and their inhabitants. Already nearly three quarters of the extinctions in the United States have occurred in Hawaii, and nearly forty percent of the endangered species in the United States are Hawaiian species. Although many species continue to decline in number, some species are on their way to recovery as a result of habitat protection and management efforts. Continued progress toward recovery will require the application of good science to natural resource management and policy decisions.

Components of ungulate removal

There are several areas in Hawaii where goat, pig, sheep and cattle populations are successfully kept at zero population levels over large areas.^{1, 10, 12, 15, 18, 19} In these cases successful control of ungulate populations involved: 1) establishment of barriers to isolate populations, 2) barrier inspection and maintenance, 3) removal of significantly greater percentages from populations than can be replenished by reproduction and ingress from adjoining areas,³ and 4) vigilance in monitoring of animal population increase and ingress. These four components are explained in more detail in Attachment 1. Present control strategies for each species are outlined in Attachment 2. Attachment 3 provides a summary table of animal removal techniques, and their levels of effectiveness and public acceptance.



Figure 1. The Kukalauula Study Exclosure classically illustrates the newfound ungulate control understanding of the early 1970s: 1) goats did not jump 4' hogwire fences, even when malnourished and highly palatable plants visibly grew inside, and 2) rare native Hawaiian plants, safe from ungulates, sprouted and flourished inside the fence. Outside the fence all were alien plants, browsed to the rootstalks.²

Tools for ungulate control in natural areas

Public acceptance is often crucial to the success of restoration and preservation plans on public lands. Ungulate population control has met with criticism regarding the economic practicality of fencing. Arguments are made that the high construction, installation and sustained maintenance costs of fence barriers to ungulate movement are prohibitively expensive. However, experience indicates that fences are the cheapest way to achieve ungulate control goals. For example, Hawaii Volcanoes National Park removed goats (at a rate of up to 5,000/year at times) for a half century without any effect whatsoever upon the remaining goat population. After resorting to fences, the park zeroed out its goat population within a decade.¹⁵ Despite the daunting upfront costs incurred with fencing, this investment in natural resource conservation is key to maintaining the tourism industry upon which Hawaii's economy relies.

Some observe that 100% ungulate removal is not the only way to improve conservation resources in certain specific degraded ecological systems. They maintain that the goal and degree of restoration needs to be taken into account. To reestablish structure and composition close to a pre-disturbance landscape (including rare and ungulate sensitive species) complete ungulate removal is required. Anecdotal observation suggests, in severely degraded native ecosystems (for example, chronically grazed forested pasture) removal of the majority of ungulates may lead to partial recovery of composition and structure.

Impediments to ungulate control

There is also public opposition to animal removal techniques that are deemed inhumane. As outlined in Attachment 3, the most ecologically efficient removal techniques from fenced or isolated populations involve using professional trappers and shooters, and snares and "Judas" goats and sheep for removal of remnant populations. Those who view the trapping and shooting of ungulates as inhumane may favor far less effective and more labor intensive techniques such as live capture and sterilization of animals. Both methods fail to remove a significantly greater percent of the population than can be replenished by reproduction, a key component to the success of native ecological restoration plans. Some of these techniques purported to be "humane" could also be regarded as prolonged, sustained animal harassment. Unfortunately, no techniques currently exist to effectively control ungulate populations that are widely regarded as humane.

Thus, some opponents insist that preservation of native Hawaiian ecosystems must be achieved in ways which do no harm to ungulates. They feel it is unethical to harm any animal. This narrow view would subject the rarest plants and animals in the world to direct consumption or loss of their only home on the planet by common barnyard animals. Resource managers consider the big picture, and attempt to conserve the integrity of native ecosystems in order to protect the most species possible. To sacrifice

watershed health and potentially dozens or hundreds of rare and endangered species to extinction in order to spare the lives of a few individuals of a populous and widespread species runs counter to sound ethical logic. There is a strong social desire to preserve native Hawaiian ecosystems, but this is impossible without ungulate control.^{9, 18} The use of fence barriers with the maintenance of near zero populations results in the need to eliminate the fewest numbers of animals, and confines the control to finite areas.^{2, 15, 18}

Ungulate removal techniques have also come under attack for being wasteful. In particular, there has been public criticism of land managers who leave behind animal carcasses killed at remote sites.⁹ Previous attempts at helicopter removal of ungulates from remote control areas have revealed that even the simplest handling of carcasses and removal by helicopter incur costs far greater to consumers than purchasing equal poundage of prime cuts of pork or mutton at the food market. Moreover, field handling of the carcasses and removal from remote sites does not meet USDA requirements for meat handling and processing for public consumption. No technology that meets public health codes is available to salvage carcasses from remote sites for public use. Thus, land managers have concluded that it is in far greater public interest to leave animal carcasses for nutrient recycling in the natural areas being protected. Indeed, this nutrient recycling is regarded as ecologically wise, not wasteful.

Perhaps the strongest resistance to ungulate population control comes from the hunting community. Hunters claim a traditional right to hunt, and perceive the elimination of ungulates from Hawaiian forests as a great threat to Hawaiian culture. However, goats, sheep, deer, the European boar, and cattle were all western introductions to Hawaii. The Polynesian pig traditionally was raised in enclosures as opposed to hunted in the wild. These established historical facts reveal that the hunting of ungulates was not a part of Hawaiian cultural tradition.¹³ However, the gathering of natural plant resources for wood and medicinal purposes, and of native bird feathers to make capes for Hawaiian royalty is part of Hawaiian cultural tradition. In fact, ancient Hawaiians used fencing to protect these valuable native resources. Their extinction would be an immeasurable loss to the heritage of Hawaiian people.

Caring for the land

Central to Hawaiian culture is a strong land stewardship ethic. Hawaii's unique and precious natural ecosystems form the very foundation of this culture, as well as Hawaii's economic stability. The loss of any individual life is unfortunate, but the extinction of an entire species is permanent, and may have far reaching effects. Sound ecological and ethical values embrace the knowledge that all life forms do not exist in a vacuum. Removal of ungulates is the critical first step in preserving near pristine ecosystems and restoring degraded native Hawaiian ecosystems to near pristine conditions, thereby preserving the richness of Hawaii's unique heritage to pass on to future generations.

End Notes

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Attachment 1

Four main components in successful ungulate population control

- 1) **Ungulate barriers** to isolate populations usually consist of fences, sometimes abutting against barren, inaccessible habitat (the sea, cliff faces, or expansive open lava) to form management units. Currently 4-foot high hog-wire with no gaps at the ground is used to deal with goats, cattle, domestic sheep, and pigs. Since deer and sheep are jumpers, 6-foot high hog wire is used (with the realization that some animals will still be able to penetrate the barrier). The size of the units in some instances are as large as 10,000 acres, but must be smaller if managers are not able to reliably remove an acceptable percent of the population each year. Pig units must be much smaller unless managers are able to use snares on a widespread basis.
- 2) **Taking animals in greater number than their annual reproduction**, augmented by numbers which penetrate the barrier fences requires massive and relentless energy.^{3, 10, 15} This requires taking more than a third of the remaining goat (or deer or sheep) population each year. Before 1970, management staff at Hawaii Volcanoes National Park were removing 2,000 goats per year without any effect on the remaining goat population.² With a goat population numbering about 15,000 and an annual increment capable of reaching 5,000 per year, taking just 2,000 a year from this population was meaningless.² Pigs are more prolific which requires take of than 70% each year.^{3, 10, 20} As populations are squeezed, the remaining animals become extremely wary.³ One hypothesis is that it requires an equal cost or energy input to cut a population from 100 down to 50 as it did to cut the 1,000 population down to 500.¹⁰ Careful records of number, sex, age and reproductive status of removed animals form the basis for reviewing control progress and refining strategy through adaptive management.
- 3) **Inspecting and Maintaining barriers** such as fencing never ends. Failure to mend fences and to remove the annual increment of animals or those that leaked through will result in the negation of all previous labor, costs, and ecosystem recovery gains.^b Monitoring both barrier fences and animal populations are integral to controlling ungulate populations.^{12, 15}
- 4) **Vigilance in monitoring** and removing any animal population increase and ingress, like fencing, never ends if an area is to be kept ungulate free. Monitoring animal populations is integral to controlling ungulate populations. To achieve a sizable area free of ungulates where they were previously numerous is so difficult, and so rarely accomplished, that it is unconscionable to neglect monitoring and thus enable populations to rebound to former levels. A tiny goat population, left undetected, can recover to 90% of its former levels in only four years. Pigs recover more quickly.^b Years of ecosystem recovery can be reversed in a few short months of renewed feral ungulate depredation. Most monitoring involves regular helicopter transect inspections, ground transect analyses to detect 'sign' or browsing, and snare transects (pigs) in remote sites. Judas goat searches are very effective in monitoring goat-free areas.

Attachment 2

Present Control Strategies (in sequence) by Species

Goats^{2, 9, 11, 15, 18, 19}

- Fence management unit (4' hogwire with no gaps at ground; can be 10,000 acres)
- If not remote, public/volunteer shooters may make initial population reduction.
- Specially recruited, trained, and supervised volunteers remove initial numbers of animals.
- Release Judas goats.
- Professional shooters kill most remaining population, aided by Judas goats.
- Professional shooters from helicopter mop up remnant individuals along cliffs.
- Fences are routinely mended; Judas goats are left to help professional hunters monitor and shoot any strays or new entries.

^b Uncontrolled, a pig population can double in numbers every four months until the population approaches carrying capacity.³

Pigs 1, 3, 4, 6, 7, 8, 9, 10, 17, 18, 20

- Fence management unit (4' hogwire with no gaps at ground; can be 2,000 acres), sometimes including one-way gates and traps
- If not remote, public/volunteer shooters may make initial population reduction.
- Professional shooters with dogs kill most remaining population.
- Baiting with papaya helps concentrate pigs for shooting and/or snaring.
- Professional technicians set snares (ratcheted Kelly snare) to mop up pig populations.
- Snares are used to take any strays and to monitor for new entries.
- Keep fences mended.

Cattle ¹⁸

- Fence management unit (4' hogwire; can be 10,000 acres)
- Perform cattle drives using cowboys, dogs and helicopters.
- Install one-way gates.
- Set trap corrals, baited molasses and with water. Harvest or kill captured animals or seek cooperation from adjacent ranch to remove animals from trap.
- If not remote, public/volunteer shooters may make initial population reduction.
- Keep fences mended.

Sheep (There is still much to be learned about removing mouflon sheep populations.) ^{9, 18}

- Fence management unit (6' hogwire; can be 5,000 acres)
- If not remote, public/volunteer shooters may make initial population reduction.
- Professional shooters with dogs kill most remaining population. (Combining professional shooters with dogs, and helicopter search and shooting is effective).^c
- Experiment with Judas mouflon as aid to monitoring strays or new entries. (Mouflon sheep socialize in small groups and, if lucky, collared animals may help occasionally.)
- Run helicopter King Index surveys to monitor strays and new entries.
- Keep fences mended.

Axis Deer (There is still much to be learned about removing axis deer populations.) ^{9, 18}

- Fence management unit (6' hogwire; can be 5,000 acres)
- Install one-way gates and traps.
- If not remote, public/volunteer shooters may make initial population reduction.
- Professional shooters with dogs and night spot lighting kill most remaining population.
- Experiment with Judas deer as aid to monitoring strays or new entries.
- Run helicopter King Index surveys to monitor strays and new entries.
- Keep fences mended.

^c Effective technique is for ground teams of several hunters with dogs sweep through area with the objective of flushing sheep hiding under brush and trees. Mouflon sheep are very sensitive to presence of man or dogs and break cover to escape. Then they are vulnerable to the helicopter aerial team.

Attachment 3

Summary of Animal Removal Techniques (assuming from fenced or isolated population)

Technique	Effectiveness	Comment
Live capture	Fails to remove needed % of population. (Low density animals are very trap wary.) ^{6, 9, 15}	Good for Public Relations only.
Public hunting	Fails to remove needed % of population. ³	Good for Public Relations only. Helps only with initial reduction, in very accessible areas. ⁹
Volunteer hunters	By itself, fails to remove needed % of population. ^{3, 15}	Can be effective (if with selective recruitment and direct supervision for organized drives), with initial population reduction. ^{9, 15}
Professional trapper/shooters	Capable of removing needed % of population. ^{9, 10, 18, 19}	Current effective method in Hawaii. ^{9, 10, 15, 18, 19}
'Judas' Animal	Highly effective w/ goats, specially for remnant populations. Partially effective for sheep. Ineffective with other species. ¹⁹	Greatly simplifies goat control for mop up by professional shooters. ¹⁹
Professional Aerial shooting	Very effective method along steep cliff faces.	Very high risk
Neck Snares	Highly effective w/ pigs, goats, & deer if left untended. Ineffective for pigs if snares are closely monitored. ^{8, 9, 10}	Low public acceptance (in part because it works so well, and since snare zones are closed to public hunters) ^{8, 9}
Poison	Very Effective in New Zealand. ^{9, 14}	Not acceptable for use in Hawaii. ⁹
Contraception/Sterilization	Ineffective / impossible ⁹	Cannot remove all ungulates in a population. ⁹
Biological control	Not been used. There are no specific agents. ⁹	Effect not contained within barrier area & will kill desirable farm animals nearby. ⁹