State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife

TECHNICAL REPORT
No. 07-01

REVIEW OF METHODS AND APPROACH FOR CONTROL OF NON-NATIVE UNGULATES IN HAWAII

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Table of Contents

INTRODUCTION

Hawaiian ecosystems evolved in the absence of mammalian herbivores and, as a result, are vulnerable to damage by introduced ungulates (Cuddihy and Stone, 1990). Controlling the impacts of introduced ungulates poses a number of challenges for land managers. This report provides a review of individual control methods, a management approach that incorporates consideration for the use of humane methods and public participation through recreational hunting, and recommendations on future use and actions needed to manage ungulates in some areas and to eradicate them from areas of high conservation value.

The purpose of the report is not to provide guidance or discussion on the development of specific ungulate control policies and objectives. Rather, this paper assumes that the land manager has identified objectives consistent with policies, and provides technical information to identify potential tools and procedures that may be used to accomplish those objectives. The paper is not meant to provide information for the management of areas intended for game production, but for areas in which a permanent reduction or elimination of ungulates is the stated objective.

The information contained in the report was compiled through consultation with experts and literature searches. An initial draft of the paper was distributed to a working group of interested parties for review. The working group was invited to participate in a workshop on September 8–9, 2006 at Kilauea Military Camp to provide their views on the various methods for ungulate control, and recommendations on their use. Workshop participants represented 1) individuals and entities engaged in or supporting ungulate control or eradication to protect natural resources, 2) individuals and entities involved in the recreational, nutritional, and cultural use of ungulates through hunting, and, 3) individuals and entities concerned with the humane and ethical treatment of animals by humans. Following the workshop, comments were reviewed and the document was revised. The revised draft was sent to the working group for a second review in October 2006. Comments received following that review were incorporated into this draft. This report describes the different control methods and approaches reviewed and discussed during this process.

The Department has also outlined its approach and procedures at the present time, incorporating research and techniques discussed. It is hoped that this report will also provide guidance for control efforts by other agencies and landowners. For all land managers, fundamental to any ungulate control program is an up-to-date evaluation of the full range of tools available, management flexibility in the choice of methods and approach deployed, and an integrated approach that utilizes multiple methods and approaches.

Included in the report are a list of workshop participants (Appendix 1) and notes of the workshop discussions on this issue (Appendix 2).

REVIEW OF UNGULATE CONTROL METHODS

Safety, feasibility, and effectiveness of methods to control or eradicate ungulate populations vary among target species and the biological and geological features of the habitat in which the work is conducted. Choice of methods requires a complete evaluation of the site and habitat characteristics to plan and implement operations that achieve acceptable levels of these considerations. Determination of the methods and approach to be used must be conducted on a case-by-case basis with the ability to adapt procedures to changing conditions. In most cases, a combination or sequence of methods will be required to achieve the desired objective.

In the review that follows, we discuss methods currently available or in development for the control of ungulates, and cite key advantages and disadvantages of each. Key features that are of interest to constituents that have contributed to the development of this report include considerations of the effectiveness, humaneness, and availability of game resources for public hunting. For the purposes of this paper, we adopt very broad definitions for each.

Effectiveness is here defined as the number of animals removed or killed per unit effort, all else being equal. For example, we state that aerial shooting over pasture land is more effective than aerial shooting over an area that is forested and therefore more difficult to see the animals. As result, more animals are shot per unit of flying time, all else being equal. We have avoided considerations of cost-effectiveness for this paper. A complete analysis of the cost-effectiveness of the methods and approaches detailed here would be well beyond the scope of this report, and could only be done on a site-by-site basis because of the number of site-specific biological, geological, and geographic variables.

Humaneness is here defined as the relative magnitude and duration of pain. We distinguish between non-lethal and lethal methods, the latter being less humane. We also assume that if a snare is untended for more than 24 hours then it is likely to be less humane than a properly placed gunshot. We do not attempt to quantify the relative humaneness of other lethal methods, including toxicants and biological control because information available is insufficient to make a reasonable determination.

Public hunting is defined as licensed hunting in accordance with the state's hunting laws and rules. In addition to the direct use of a public hunting program to harvest animals, driving and translocation also indirectly facilitate public hunting by allowing for game resources to be made potentially available to the public for hunting at another site or time.

Biological control

Biological control is the control of organisms by natural predators, parasites, disease-carrying bacteria or viruses. In the case of feral ungulates, this could involve introducing a predator or a disease organism. Neither of these could be considered a practical means of control for Hawaii's feral ungulates. Introducing a large predator capable of taking pigs, goats, sheep, and deer would likely cause more problems than it would solve, and there are presently no known disease organisms that could be safely introduced without threat to non-target species. Infecting a population of animals with a disease-causing organism has the potential to be highly effective in reducing the number of animals. However, even a low likelihood of infecting domestic livestock or humans makes this technique impractical in most locations (Choquenot et al. 1996). It is not

presently practiced or recommended for any of Hawaii's feral ungulate species and appears to hold little promise for safe use in the near future (McGaw and Mitchell 1998).

Bounties

Bounties have been found to be generally ineffective in animal management, and have actually resulted in increases in the target species in many cases (Latham 1960). Problems include fraud (such as bringing in evidence of kills from animals outside the target area), deliberate release of breeding animals, or purposely leaving some animals behind to provide future income (Choquenot et al. 1996). A great deal of literature reports that bounties are ineffective or counterproductive, and interfere with other methods (Australasian Wildlife Management Society online; Choquenot et al., 1996). However, a more recently developed program that is now being implemented for the control of nutria (*Myocaster coypus*) by the Louisiana Department of Wildlife and Fisheries appears to be effective, suggesting that implementation of appropriate procedures and oversight may provide for effective programs in some cases (http://www.wlf.state.la.us/experience/nutriacontrol/nutriacontrolprogram/).

Driving

Driving animals from newly fenced units just before the last section of fence is installed can be an effective way to remove many animals (Henzell 1984). Animals may also be driven from cover into more open areas for aerial or ground shooting. Driving animals has been used successfully in Hawaii, notably in the national parks to reduce goat populations (Katahira and Stone, 1982), and recently by DOFAW to remove mouflon sheep from a 5,000 acre fenced exclosure on North Mauna Kea using a helicopter (DOFAW in prep.).

Where the terrain allows, animals can be herded from horseback, motorcycles, or on foot, and may employ the use of dogs. In rough terrain, helicopters may be more effective (Parkes et al. 1996). Animals may be driven toward ground crews and holding pens, where they may be dispatched, provided to interested individuals, or driven out of an open section of an exclosure if adjacent areas provide an acceptable site for translocation. Care must be taken to avoid moving animals into areas where their presence is undesirable. Driving may be most effective in open areas, and less effective in areas with dense cover that provides animals with opportunities to freeze or hide.

An aerial sheep drive was recently conducted by DOFAW to herd mouflon hybrid sheep out of the 5,000 acre Pu`u Mali exclosure and into an adjacent private ranch (Kukaiau Ranch). The method was very effective, removing 100 animals – approximately 80% of the sheep within the exclosure – within 45 minutes (DOFAW in prep.).

In Australia as many as 1,600 goats have been successfully driven from land areas as large as 50 sq. km (Henzell 1984). Over such large distances, care must be taken to prevent exhaustion (Parkes et al. 1996). Guidelines for humane procedures are provided in Sharp et al. (2005).

Driving	
Advantages	**Disadvantages**

• Can be highly effective to rapidly move large numbers of animals • Non-lethal when conducted properly • Potential to relocate animals to appropriate areas (e.g. for later public or private hunting)	• May require many people • Heavy vegetation and difficult terrain may reduce effectiveness • Limited use at low densities or in unfenced areas • Not effective for some species • May exhaust the animals if not done properly or if area is too large

Fencing and barriers

When adequately maintained, fences and barriers to prevent ingress can limit the presence of animals in management units following control or eradication efforts. Landscape features such as cliffs, lava fields, or ocean may complement fencing in some areas. Where it is impractical (even if technically possible) to build a continuous fence across an area of steep cliffs, smaller sections of strategic fencing, placed to take advantage of natural barriers, may be a cost-effective option (Buddenhagen et al., 2006). Fences also may be fitted with one-way gates at established trails so animals can exit, allowing game resources to continue to be available to the public where appropriate.

A high density of animals on one side of the fence, coupled with a higher-quality food supply on the other, may encourage animals to more aggressively attempt to breach the fence (e.g. Texas Animal Damage Control Service, http://texnat.tamu.edu/symposia/feral/feral-10.htm.). Research is ongoing to better understand pig movements in Hawaii and better guide management planning and implementation of fences (J. Sumiye, pers. comm., DOFAW unpublished data).

To minimize animal injury, care must be taken in choosing fencing materials. For example, 300 mm spacing of vertical wires is preferred for goat mesh, as horned animals may get their heads stuck in smaller mesh (Long and Robley, 2004), although few cases of injury have been reported in Hawaii (DOFAW unpublished data). Visual impacts of fences may be reduced by using recently developed green wire mesh.

Regular inspections and maintenance of fences are critical. Corrosion, storms, falling trees, and vandalism all can result in fence breaches, and rapid response is needed. Once a fence is damaged, it can take considerable effort to locate any animals that may have exploited the breach. A fence that is effective at blocking one type of animal may be useless against another. For example, four-foot fences that are typically used for pigs are ineffective for deer, which simply jump the fence (DOFAW unpublished data). Modifying these fences for deer is expensive, but a modified fence will block both types of animals and may sometimes be cheaper than building a new deer fence from the ground up. Fences as high as 10 feet are recommended for the maximum control of axis deer (*Axis axis*), although depending on terrain a 6 foot fence will deter many deer and 8 foot fences are most common (Anderson, 1999; Barnes, 1993). Double fences and plastic mesh are other options that might be cost-effective alternatives to 8 or 10 feet of wire mesh (see designs at University of Missouri Extension web site).

To prevent ingress of mouflon sheep (*Ovis musimon*) a 6-foot fence is necessary (DOFAW unpublished data). For goats, 4-foot-high hog wire is often used. The fence bottoms must be guarded with a row of barbed wire. Potential springboards (e.g. rock or trees) near fences that goats or sheep can use circumvent fences must be removed. Feral pig (*Sus scrofa*) fences should be at least 3-feet high, with an apron of wire net on the ground or barbed or electric wire near the fence bottom to prevent pigs from forcing their way underneath. For more on ungulate fence specifications see Long and Robley, 2004.

Fence costs vary by terrain, type of fence needed, and accessibility. In Hawaii, many areas require helicopter transport of all materials, equipment, and personnel. As of January 2007, costs range from $50,000-$140,000 per mile (DOFAW unpublished data). The size of the manageable units, and therefore the length of fence and cost of construction and maintenance, varies among sites and species. Although electric fencing may be cheaper than alternatives (Littauer, 1997), they are not generally used by agencies in Hawaii due to potential impacts to endangered bats and seabirds. Lifespan of fences in Hawaii may be less than five years where exposed to sulfur plume and salt spray, to more than 20 years on open, high-elevation slopes away from corrosive elements (H. Hoshide, pers. comm.)

Fencing and barriers	
Advantages	**Disadvantages**
• Highly effective when well constructed and maintained • Non-lethal • May be fitted with one-way gates to allow animals to exit where appropriate • May help to provide a defined management unit	• Short or long term game or native resource damage may occur to an adjacent area due to changes in animal movements • Expensive to build and maintain • May impede public access if not fitted with sufficient gates or access points

Fertility control

Effective fertility control for feral animal populations may hold promise as a valuable, non-lethal tool in the near future. The methods are still in the research and development stage, and are currently not available as a practical control tool for Hawaii's feral ungulates (U.S. Department of Agriculture, 2006; Miller et al. 2004). As of January 2007, there is only one commercially available contraceptive for a wildlife species: OvoControl, which reduces hatching of Canada goose eggs (U.S. Department of Agriculture, 2006). Recent research to develop contraceptives such as GonaCon show promise, but several practical issues remain problematic (Miller et al. 2004). To be practical for use on free-ranging animals, permanent sterility and oral delivery is necessary (Killian et al., 2006; Miller, 2002). Most immunocontraceptive vaccines developed for large mammals require an initial injection followed by a booster shot (Fagerstone et al., 2002). There is considerable cost and effort involved in capture, vaccination, marking, release, and recapture, for a temporary end result.

If effective wildlife fertility control were available, populations of animals with short lifespans—such as rodents—could likely be rapidly reduced. However, for longer-lived animals, damage would continue for years if only fertility control measures were implemented (Fagerstone, 2006).

There is a great deal of interest in wildlife fertility control, and research is now being conducted to address the need for permanent sterility, species specificity, and an effective delivery system (Miller, 2002; U.S. Department of Agriculture, 2006).

Fertility control	
Advantages	**Disadvantages**
• Non-lethal • Could be effective if permanent • May be improved in the future	• Presently not permanent • Requires repeated administration • Delivery to individual animals labor intensive • Oral delivery methods for large scale use not available

Live trapping (cage/box/corral traps)

Trapping allows animals to be taken alive, providing the option of releasing in appropriate areas, providing them to individuals for food or sale, or dispatching when alternatives are not acceptable. Traps are useful tools when combined with other methods to control feral pigs. Timing their use to coincide with low availability of preferred foods may increase success (Barrett and Birmingham, 1994). Timing use of traps during peak breeding season, from November to March in Hawaii, may enhance the probability of catching entire family groups or males that are solitary at other times of the year (Katahira et al., 1993). Since September 2003, a trap and release program at Kulani on the Big Island resulted in the translocation of 460 pigs from two units into a nearby hunting area (DOFAW, unpublished data). Removal of the last 10-20 pigs from the unit is in progress.

Success can be enhanced by prebaiting the area. Prebaiting the trap itself with the gate wired open will allow pigs to get used to entering and feeding in and around the trap and increase the chance of catching multiple animals at once (Littauer, 1997). If many pigs frequent an area, a corral trap may work well. Placing one or two decoy pigs in the trap with plenty of food and water is sometimes an effective means to attract others (DOFAW unpublished data). In Australia, goats are captured in corral traps around water sources (Bellchambers, 2004). Corral traps are not recommended for pristine areas because of the heavy localized damage that can result at the trap site from a high concentration of animals.

Although primarily used as a technique for pig control in Hawaii, live trapping of white-tailed deer for later release has been evaluated on the mainland in response to concerns about the humaneness of shooting (VerCauteren et al., 2005). It is reasonable to look at these studies when evaluating methods to control axis deer in Hawaii. However, it is difficult to find appropriate places to release such animals (Balcones Canyonlands Preserve, 2005).

Trapping is an effective method in certain areas where other methods are not safe or feasible. For example, traps are preferred in urban and residential areas, where discharge of firearms is illegal or unsafe, and where the use of dogs conflicts with other public uses (Debernardi, 1995). Trapping pigs in problem areas, where other methods are not safe or effective, is common in Hawaii. State DLNR staff may provide permits, equipment, and assistance where appropriate to

assist landowners to remove nuisance animals. Because of the bulk of the materials and equipment needed, access by road or helicopter is required; costs are generally lower when road access is available.

Numerous trap designs have been used in Hawaii and elsewhere, including box, cage, and corral-type designs (e.g. Barrett and Birmingham, 1994, Choquenot et al., 1996, DOFAW unpublished data).

Trapping	
Advantages	**Disadvantages**
• May be non-lethal • Multiple animals can be taken at once • Can be used where good snare sites are scarce or absent • May catch animals that have developed avoidance behavior to other methods • Non target animals captured may be released unharmed • Allows potential to relocate animals to appropriate areas (e.g. for public or private hunting). • Can be used in residential or urban areas	• Costs are higher where accessibility is limited • Less effective when food is plentiful (bait is less attractive) • Some animals are shy of traps; may not control to zero alone • Must be checked regularly to reset and add bait • May cause high stress levels in some species • Suitable release sites may not be available

Professional (staff or volunteer) shooting – aerial

Professional aerial shooting can result in a rapid reduction of animal numbers and has been used effectively in Hawaii and elsewhere, especially in pristine or sensitive areas or areas that are difficult to access (DOFAW unpublished data; Campbell and Donlan, 2005).

In Hawaii, this method has proven extremely effective at reducing goat populations on steep cliff faces. It also has proven effective for goats in open canopy areas where skilled shooters are able to take animals that appear only briefly in openings in the vegetation (Campbell and Donlan, 2005).

Aerial shooting from helicopters is particularly effective in rapidly reducing numbers where density is high and accessibility is limited (Sharp and Saunders, 2004a), as well as in eradicating the last animals in large protected areas with difficult terrain. Crews may be limited to a skilled pilot and a shooter in high-elevation areas, with a spotter/counter included at lower elevations.

Choice of firearm, ammunition, and shot placement are all factors in the humaneness and success of an aerial hunt. A ground crew in the area to shoot dispersing animals also is highly beneficial (Littauer, 1997).

Shooters may use Judas animals to help locate others of the same species. This technique involves fitting animals with transmitters and releasing them so they will lead shooters to other animals. Use of Judas animals is cited most often in removing remnant populations of highly social animals such as goats (Campbell and Donlan, 2005; Taylor and Katahira, 1988). However,

the Judas animal method also can be useful for other species. A trial in New South Wales, Australia, resulted in removing 14 pigs in two hours — animals that one manager stated would have been almost impossible to locate otherwise (New South Wales National Parks and Wildlife Service, 2003). Females are the best Judas pigs (Wilcox et al., 2004; Sharp and Saunders, 2004b). In appropriate fenced areas, Judas animals also can be used to check for other animals that may have breached the fence.

Professional shooting – aerial	
Advantages	**Disadvantages**
• Effective for removal of remnant animals following other methods • Useful for inaccessible or remote areas • Only target animals are taken • Results are immediate (significant animal damage reduction in a short period of time) • Rapid removal of many animals	• Can be hazardous • May be difficult to schedule due to weather/wind considerations • Less effective where animals have significant cover • There may be liability issues for landowners allowing aerial shooting over their property • Regulatory or legal issues may limit availability of certified personnel

Professional shooting (staff or volunteer) – at baited stations

An alternative to active hunting is shooting at baited stations, often at night when animals are more mobile. Where reduced range of ammunition is desirable, such as a residential area or park, this may be done with bows or shotguns with slugs. Suppressors are often used to avoid alarming other animals nearby. A tree stand or "high seat" is generally used to help shooters avoid detection by animals.

In a 16,160-acre park area in Italy, a five-year pig control project (1988–1993) used a combination of cage traps and shooting from high seats on the same days. Traps took 327 pigs, and 159 were shot from high seats (Debernardi et al., 1995). Kessler (2002) reported that shooting pigs at baited stations worked better than cable snares in the Northern Marianas due to the lack of established pig trails in the control area.

Shooting at baited stations is frequently used on the mainland U.S. to control deer. Take of more than 10 deer per bait site per night is reported as common (Wisconsin Department of Natural Resources, 2003). Effectiveness drops with density as remaining animals grow wary, but reducing shooting to one or two consecutive nights per week can enhance take compared with more frequent shooting (Wisconsin Department of Natural Resources, 2003). This shooting method can facilitate good shot setup and may be less stressful to animals than being chased.

Professional shooting – at baited stations	
Advantages	**Disadvantages**
• May take advantage of animals' night feeding without the hazards of hiking	• Relies on animals to come while shooter waits; there may be long waits with no

through darkness • Target specific • Complements other methods; may capture trap-wary animals	results, particularly at low densities • May not be as attractive to volunteers as active hunting • Bait may provide a food source for other pest animals such as rats, allowing them to increase in number

Professional shooting (staff or volunteer) – on the ground with dogs

Using dogs to locate and bring game to bay is a proven and long-practiced technique. The experience of all parties concerned is a factor in success: hunters, dogs, and target animals. Various types of dog training are used to increase take and reduce impacts on non-target animals. Recent successes in removing goats from islands have demonstrated the effectiveness of specialized dog training (Campbell and Donlan, 2005).

In Hawaii and elsewhere, professional ground shooting with dogs has proven effective at reducing pig populations to low densities (Katahira and Finnegan, 1993, Choquenot et al. 1996). Prohunt New Zealand has devised a system for shooting goats in forested areas using a line of hunters with trained dogs. The hunters are in radio contact, and each dog is trained to chase and hold a goat until the nearest hunter can shoot it. This method is designed to reduce the number of animals that escape their first encounter with ground shooters (Parkes et al., 2002). Kessler (2002) reported that similar methods were less effective for pigs, which tend to break back through the line. Use of Judas animals can increase effectiveness.

Working at night when animals are most active can give dogs more opportunities to locate scent. However, tracking animals in the dark can be hazardous, particularly in rough terrain. Night shooting at baited stations avoids the need to chase down the animals.

Professional shooting – on the ground with dogs	
Advantages	**Disadvantages**
• Effective for target animals that have evaded other methods • With multiple teams, a number of animals can be taken in a relatively short time	• Dogs may be injured or killed when baying large boars

Public hunting with dogs

Public hunting can provide a valuable service in aiding property owners with feral ungulate problems and contribute to native resource management by reducing ungulate populations. Historically, hunting has been shown in a number of places to maintain animal populations below carrying capacity on a landscape level. This was indicated, for example, by the wide-ranging increase in ungulate densities in Australia and New Zealand, when WW II deprived the areas of hunters, ammunition, and gasoline and other supplies.

In Hawaii, pig hunting in heavy cover is usually accomplished with the use of dogs. The dogs locate, chase, grab, or bay the game, which is then dispatched by the hunter with a gun, knife, or spear. This method has been effective in many areas in Hawaii for pigs but is not approved for other species of ungulates (Chapter 13-123-22, Hawaii Administrative Rules).

Directed public hunting is usually most effective when ungulate densities are high. Because of lower hunter success and participation, effectiveness typically is reduced where animal densities are low or as animals are removed from an area (Kennedy and Misaki, 2001; Katahira and Stone, 1982). Effectiveness also is highly dependent on terrain and access and may be very low in remote areas.

Public hunting with dogs	
Advantages	**Disadvantages**
• Effective where densities are high • Facilitates the use of knife or spear methods, which can be used in residential or other high-usage areas • Hunting with dogs may take animals that have avoided other methods • Provides public access to game resources	• Inadequately trained dogs may take non-target animals • Effectiveness lower where densities are low and access is limited • Not approved for species other than pigs

Public hunting without dogs

Hunting of ungulates using firearms without dogs can be effective, although effectiveness is usually lower compared to hunting with dogs. Hunting with bow and arrow is an effective method without dogs. As with other public hunting programs, effectiveness is highest when game densities are high, and declines as numbers decrease or is reduced in areas of lower game densities.

Public hunting without dogs	
Advantages	**Disadvantages**
• Effective where densities are high • Provides public access to game resources	• Effectiveness lower where densities are low and access is limited

Snaring

Cable snares consist of a loop of steel cable fastened to a secured or heavy object and situated so that animals are caught as they pass through a narrow area. Rope leg snares are an alternative to cable snares. Snares are low cost and many snares can be set in a relatively short time. Snares are frequently more effective than hunting or shooting when animal densities are low; especially in rugged terrain with significant cover (DOFAW unpublished data). Snares are often needed to capture animals that have evaded other methods and are frequently the only remaining method feasible to eliminate particular animals (Littauer, 1997; Buddenhagen et al., 2006; Katahira et al., 1993). A key success factor is ensuring that snares are placed in the home range of every pig in the area to be cleared (Anderson and Stone 1993).

In a remote area of Kipahulu Valley on Maui, a successful eradication of feral pigs was achieved using snares (Anderson and Stone, 1993). To capture both adult and juvenile pigs, snares were set 5–20 cm above the ground. Over a period of 45 months, 228 pigs were snared – a management action that resulted in rapid recovery of this highly valued natural area.

Although cable neck snares are very effective, if tended infrequently they are generally less humane than a properly placed gunshot. Tending more frequently during initial use periods and setting snares to maximize the likelihood of catching the animal around the neck and on a slope can speed death. Use of telemetry devices to alert technicians when an animal is captured can increase humaneness (Marks, 1996), but shorter response times may be logistically impractical. Research is ongoing to develop faster-killing snares to address issues of humaneness.

Snaring	
Advantages	**Disadvantages**
• Effective for pigs and goats • May catch very wary animals • Effective for low densities or particular animals for which all other methods fail	• Non-target dogs or other animals may be susceptible • Snares must be removed before hunting with dogs in the same area • Usefulness may be limited by availability of suitable anchors points • Effectiveness may be compromised over time if not set correctly

Toxicants

Although toxicants are used in other parts of the world and have been found to be the most cost-effective technique for feral pig control (Choquenot et al., 1996), none are currently registered for use on ungulates in the United States. Hawaii's attendees at the 2006 National Conference on Wild Pigs in Alabama reported that a group of mainland landowners was lobbying to get toxicants approved for use on feral pigs. The biggest impediment to registering such a toxicant for use in the U.S. is likely the cost and effort required to comply with data requirements of the U.S. Environmental Protection Agency (Littauer, 1997). Use of approved toxicants in Hawaii may be less problematic than other continental areas where non-target mammals are a concern. Research is ongoing to improve baits and toxicants for feral pigs (see Australian Alps Cooperative Management Program, 2005, for examples). Research also is being conducted on the use of poisoned foliage to control deer and goats. Although no toxicants are currently approved for use for ungulate control in the U.S., they are used elsewhere, and are used widely for the control of other pests, such as rodents, in the U.S. Further development of this method is warranted and may provide an effective means for control.

Toxicants	
Advantages	**Disadvantages**
• Can rapidly reduce the number of animals • Can be aerially distributed in remote areas, • Effective at taking trap-wary animals	• Not presently approved for use in the U.S. • EPA approval procedures extensive and lengthy

	• May take non-target species

MANAGEMENT APPROACH AND RECOMMENDATIONS

The Division has the responsibility to protect and preserve native species and habitats in Hawaii, and to promote public hunting. The goals and objectives for these mandates are often in direct conflict when dealing with management of ungulates across Division-managed lands. With regard to ungulate control, the Division's approach is to protect native resources while allowing public access to game resources to the greatest degree that is safe, feasible, and effective, and to deploy the most humane methods available to eliminate threats from ungulates to sensitive native resources. Much of the interest in the issue concerns how the Division and other landowners implement control programs and what methods are used. This section provides a general framework for the ungulate control program on Division-managed lands that integrates these needs and concerns, and may be useful for ungulate control programs conducted by other landowners as well.

On Division-managed lands, overall guidance for the ungulate control program is provided on a strategic landscape scale in DOFAW's Draft Management Guidelines. The guidelines identify land use priorities based on vegetation characteristics and identify management objectives with regard to ungulate control and the public hunting program. Detailed implementation plans are generally drafted on a site-specific basis in accordance with the management guidelines.

The Draft Management Guidelines were last revised nearly five years ago and require revision. Further, while detailed implementation plans are available for some areas, no single document integrates the guidelines with specific implementation plans. The Division is committed to revising and updating the guidelines as integrated site-specific implementation plans are developed.

Control or elimination of non-native ungulates is essential to maintain the biological integrity of sensitive native ecosystems in many areas. The Division's overall approach emphasizes public access to game resources and deployment of the most humane methods of control when possible. Within this framework, safety, human impacts to sensitive ecosystems, feasibility, and effectiveness of alternative methods to reduce or eliminate ungulate numbers vary among target species and the biological and geological features of the habitat in which the work is conducted.

Choice of methods requires a complete evaluation of the site and habitat characteristics to plan and implement operations that achieve an appropriate balance among these considerations. Analysis of alternate methods is required to guide and inform management actions to be implemented. In most cases, deployment of several methods concurrently or sequentially is required to achieve the desired objectives (Wilcox et al., 2004; Campbell and Donlan, 2005; Cruz et al., 2005). Fundamental to success is the ability to adapt approaches to different sites and changing conditions.

The overall guidance for the development of the strategic approach requires a clearly stated management objective, including timelines and funding levels. Timelines are essential to ensure that animals are eliminated faster than they reproduce, and that the level of ongoing resource damage is taken into consideration. Constraints imposed by funds and time must be incorporated into the overall approach that seeks effectiveness, public access to game resources, and deployment of humane methods.

The Division management approach includes the following steps and actions:

1. Determine the methods to be used to prevent ingress following control activities (e.g. fencing, natural barriers, etc.).

   Barriers to prevent ingress are the most effective method to reduce the numbers of animals to be removed over time following initial removal actions. The size of the management units needed, and therefore the cost of construction and maintenance, varies among sites and species. Where feasible and cost-effective, barriers should be deployed. However, in some cases, barriers may be cost-prohibitive or may require multiple years of sequential appropriations to complete, leaving sensitive native resources at risk. In these cases, alternative methods of control are needed and a decision analysis is needed to guide long term planning.

2. Determine the feasibility and acceptability of non-lethal driving and one-way gates.

   Consideration of methods to relocate animals should be one of the first methods evaluated. Driving and one-way gates allow game resources to continue to be available to the public and avoids unnecessary killing of the animals. However, driving requires that relocation does not pose a threat to sensitive resources or conflict with management objectives for other areas or landowners. Further, driving is not effective for some species or sites.

3. Determine the feasibility and effectiveness of public hunting.

   Use of public hunting is incorporated into control programs when safe, feasible, and effective. Public hunting should be used to reduce numbers as much as possible before progressing to the use of other lethal methods. Effectiveness of public hunting depends on hunter success and participation. For highly fecund species such as pigs, levels of take must be relatively high to effect a reduction in the size of the population (e.g. Hess et al., 2006). Monitoring and analysis is necessary to determine the effectiveness toward removal objectives and is needed to guide management decisions.

4. Determine the feasibility and effectiveness of a trapping program.

   Where passive relocation and public hunting are not effective, a trapping program using staff or volunteers may be a next step. Trapping provides the opportunity to allow game resources to continue to be made available to the public in cases where the animals can be

relocated to areas not at risk or where the animals can be made available to the public in the traps. Traps can be used to capture animals missed by hunting.

5. Evaluate other staff control methods designed to complete the objectives once the above methods are no longer feasible or effective. These include staff ground and aerial shooting, trap and shoot, and use of snares. Where snares are used the initial deployment is tended, followed by less frequently tended use.

   In many cases, approaches 1-4 above will contribute toward the management actions but will not be sufficient to complete the desired objective. In these cases, a decision analysis is conducted to plan staff actions. Use of snares is deployed as a last resort for animals that cannot be effectively removed by other means.

These sequential steps are analyzed and used on Division-managed lands and may provide a potential model for use on other lands.

Recommendations

1. Improve communication of ungulate control plans, methods and approaches, and activities to the public.
2. Employ a step-wise, adaptive approach that incorporates a variety of techniques to meet control objectives.
3. Consider use of non-lethal methods when safe, feasible, and effective.
4. Utilize public hunting for ungulate control when safe, feasible, and effective, to reduce numbers as much as possible before progressing to the use of other lethal methods.
5. Use snares in combination with other methods and as a last resort where other methods are not effective to meet control objectives.
6. Continue to review and update methods to maintain adaptive management approach.
7. To maximize effectiveness, employ a wide variety of methods.
8. Continue to review statutory, regulatory, and policy guidance to maintain and enhance program effectiveness.
9. Improve monitoring of native ecosystems and ungulate impacts to guide management decisions.
10. Continue and enhance opportunities for the public and volunteers to participate in ungulate control efforts.
11. Revise and update DOFAW's Draft Management Guidelines as site-specific implementation plans are developed.
12. Collaborate with the game management working group and other organizations and individuals to assess the feasibility and effectiveness of the development of a game management plan for the island of Hawaii. Consider plans for other islands.

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APPENDIX 1

Ungulate Control Methods Working Group
September 8–9, 2006
Kilauea Military Camp

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APPENDIX 2

Ungulate Control Methods Working Group
September 8–9, 2006
Kilauea Military Camp
Workshop Notes

Overview

Detailed notes and a summary of discussion that occurred at the workshop on September 8-9 are provided below. One of the first discussions at the workshop resulted in rapid consensus that everyone is fatigued with conflict and the lack of progress over this issue, and all would like to see some resolution before they retire or die. The participation of all interested parties in the workshop was appreciated. The Division is responsible for both preservation of native species and providing hunting opportunities. It is hoped that participating in this process, and drafting and distribution of this report will help provide information as we seek to move forward with actions that can balance both of these Division mandates. The following are general observations on the discussions: JJ: I think we should more strongly emphasize that these are just workshop notes and not a list of items that were most strongly agreed upon.

Stakeholder positions and priorities

The comments, positions and priorities of the individuals in the workshop on the various methods described in the report generally reflected the interest group they represented. The conservation interests supported methods and operations that controlled ungulates most efficiently with limited resources and provided the most protection of native plants and animals. These individuals stressed the importance of keeping all control methods available because of the difficulty of the task, the broad range of situations on the ground, and the ability of individual animals to adapt and evade various methods.

Hunters support hunting first and foremost and were not supportive of methodologies that waste resources, particularly objecting to toxicants, aerial shooting and untended cable neck snares. Some hunters objected to any control activity that does not include recovering the meat, and stressed the importance of preserving hunting opportunities. One hunter stated that of all control methods discussed, hunters prefer box traps next to hunting.

Animal welfare groups support those methodologies that do not involve animal suffering and seek to minimize animal suffering in all situations, including hunting and animal control activities. Participants from these groups were concerned about use of untended cable neck snares, aerial shooting, toxicants and about the care and treatment of hunting dogs, as well as use of hunting dogs near populated areas because of the threat to pets. These participants also expressed the most interest in fertility control, and advocated more research in this area.

Humaneness

There was not consensus on humaneness on most issues. The discussion on the use of snares, as one of the most contentious issues, illustrated the differences in opinion and values. Animal welfare groups and some hunters expressed opposition to use of snares in any situation for

humane reasons. Others expressed sentiment that untended cable neck snares should be used - but only in remote areas. Others suggested that other methods should be used first to reduce animal densities so fewer animals are snared. Some land managers also suggested that where snares can be frequently tended, they may be appropriate for use in other areas where pets and people would not be at risk. Others stressed that there are situations in which no other method will remove the last few animals from an area, and without snaring as a tool, resource protection goals cannot be met.

Those practicing control stated that they continue to search for better and more humane control methods. A potentially more humane snare was discussed, which is currently investigating by various parties.

Representatives of animal welfare groups and others expressed concern over the care and use of hunting dogs. It was suggested that dogs should be microchipped, and that how they are cared for should be addressed. A Big Island hunter stated that the County is currently looking at this issue.

There was consensus among ungulate control advocates that humaneness for native species, some of which are very rare, is also an issue, and that allowing introduced animals to prey on native species and spread disease through their habitat is inhumane.

Game management and ungulate control plans needed

Workshop participants were unanimous in agreeing that comprehensive planning for ungulate management in Hawaii is badly needed. Consensus was reached to recommend that the Division seek funding to draft both an ungulate control plan and a game management plan for each island and for each ungulate species. Unanimous agreement by all stakeholders on this point is significant, and obtaining adequate resources to produce comprehensive, high-quality ungulate strategy plans for each island is a high priority.

Separation of land use

There were many comments that a significant problem in the past has been a failure to separate the land uses of hunting game mammals and preserving other resources.

Managers of lands designated for protection stressed that on lands identified for protection, fencing followed by an intensive effort to remove all ungulates as rapidly as possible would have two significant benefits. First, it would allow the fastest and most complete recovery from ungulate damage, and second, it would enhance humaneness by avoiding the endless ongoing animal control that would be needed if some number of animals continued to live and reproduce in areas mandated for protection.

A Big Island hunter stated that a problematic land-use issue for many hunters has been that when an area has been identified for ungulate removal, hunters are expected to hunt elsewhere, but the food supply for game in the remaining GMAs does not support enough animals to provide quality hunting.

There were comments suggesting that a lack of planning has resulted in inadequate management of GMAs and that a review of lands should be performed to (a) more clearly identify lands to be managed primarily for hunting, and (2) identify and prioritize lands for ungulate control. Furthermore, the GMAs should be enhanced as needed to provide a satisfactory hunting experience.

Cautious optimism was expressed that completion of game management and ungulate control plans would allow for best-practices management of GMAs for game production and natural areas that require ungulate control to protect other resources.

The complete group memory for this workshop follows this summary of areas of highest agreement. The facilitator would like to thank all participants for their willingness to listen to each other and work together around issues which elicited vastly different points of view.

- **There needs to be a review of snaring that looks at tended versus untended – types of snares and humaneness – when and where to use snares – practicability and expense**
- **The terms "remote areas" and "units of suffering" need to be defined**
- **Public hunting is an important component of control but can't reach ultimate goal in an area where that goal is eradication**
- **All management areas and methodologies need to be well planned for maximum effectiveness**
- **Should have comprehensive game management plan and ungulate control plan island by island**
- **These strategic plans need appropriate input from all stakeholders early in the process**
- **Need to define GMAs and goals for each GMA area**
- **We all recognize and thank volunteers as an important part of the work we do**
- **Hunting should be used as the first method in clearing an area of game as long as it is practicable**
- **The report should have a new introduction which would be all the whereases in the Resolution; also need an executive summary on methodologies and recommendations**
- **Separate out the planning section and discussion**
- **Present the methodologies in alphabetical order**
- **Put all hunting methodologies together**
- **Next draft needs to get to folks so that 2 weeks is provided for review**
- **The participants recommend that the Department identify the resources and budget for a good Game Management and Ungulate Control planning process island by island – including a public input process that starts early**
- **The participants recommend that no statewide task force be formed**

FRIDAY EVENING SEPTEMBER 8, 2006 - GROUP MEMORY

The meeting began Friday evening at 5:30. The facilitator noted that the purpose of the meeting was to provide an opportunity for stakeholders to discuss and make comments and recommendations on the draft report prepared by DLNR to respond to SR 26. DLNR is responsible under the Resolution for the final report and has agreed to consider all comments and recommendations made at this meeting. The DLNR representatives also agreed to append this document to the final report.

Everyone introduced themselves and talked about why this issue was important to them. The following reasons were shared:

- Need to have a working group of the various interests to discuss this draft
- Hunting and conservation need to work together
- It is part of my job to deal with ungulates and conservation
- Assisting DOFAW with information
- Need to identify and protect areas that need protection as well as those appropriate for hunting
- It's time to resolve the conflicts
- Care about native forests – understand that hunting is important to many individuals – interested in finding balance
- Part of my job is to find balance in this area
- Introduced animals are a problem; interested in finding ways to deal with them in a humane and effective manner
- Here to represent present and future hunters
- Have to control ungulates in TNC holdings, looking for tools – want to kill as few animals as possible while providing protection
- Be of assistance and learn
- I manage water resources and am concerned about hunting issues
- Involved in this issue tooooooo long – want resolution before I retire
- Here to represent hunters on Kauai and conservationist
- To provide a voice for the animals
- Resolve issues before I retire – where want hunting – where it should not take place
- Four participants also shared that their boss made them come

The group next talked about the draft document and its history.

- It was noted that a variety of people authored the report including Ed, Randy, Mary and others
- The Resolution that was being responded to came from Senator Kokubun's office as the result of a Bill that hunters were suggesting be introduced that session requiring the DLNR to check their snares daily – they also noted that the snares do not work as designed for a quick kill – they often snare the animal around the snout or middle which causes suffering and a slow death if the snares are not checked daily
- I feel that the Resolution called for a neutral report – I do not feel this draft report is neutral but is written as a justification for killing pigs
- Regardless of the history DOFAW was tasked to write the report
- We need to start identifying and setting up areas for sustainable yield hunting and areas where it is important that all ungulates be removed
- Disappointed with the process of this report – the Resolution called for hunters to be part of a working group – I don't feel we were involved in the draft – the report should just focus on what the Resolution asked for, methodology review and recommendations – everything else should be removed from the draft. I am also concerned that the document arrived just Wednesday afternoon which did not provide adequate time for review prior to the meeting

- I thought the report got to the point
- There needs to be more discussion concerning the incompatibility between hunting and conservation – more on the current conflict
- Non-consultation with stakeholders mentioned in the Resolution during the draft development is a problem
- The hunting groups have strong reservations about the draft document
- I don't have a problem reworking the draft to address the Resolution and focus on methodologies
- When the Department sends documents out for review they need to provide enough time for review and comment
- The document needs to be stripped to methodologies and recommendations as the Resolution stated
- The department noted that written comments would be accepted until October 2, 2006
- It was noted that local research and successes in the area of ungulate control needed to be sited in the report – one example: at the prison site 200 pigs removed through trapping

The group decided to begin the discussions in the morning with methodologies and to discuss these one by one to make recommendations and comments. They will then discuss recommendations and then the entire structure of the report including the introduction. The group prioritized the order in which they wanted to discuss the methodologies. The following order was decided on.

1. Snaring
2. Public or sport hunting
3. Cage and box traps
4. Fencing
5. Directed volunteer hunting with knives and dogs
6. Professional aerial shooting
7. Professional ground hunting with dogs
8. Toxicants
9. Fertility control
10. Judas animals
11. Biological controls
12. Bounties
13. Shooting at baited stations
14. Driving

There was some discussion on combining the hunting categories but the group decided to keep them separate at this time.

SATURDAY, SEPTEMBER 9, 2006 – GROUP MEMORY

Methodologies Discussion

Snaring

- Snaring is effective
- It is the only way to get 100% of the animals out of an area
- It is not humane, especially unattended snares when they snare an animal in an area other than the neck
- The frequency of monitoring snares goes directly to the degree of inhumaneness of the method
- There is a new kind of snare (safety pin mechanism) that is more accurate in getting an animal around the neck – can still snare unintended animals
- Need to map and tend snares so that they are not left active in the forest forever
- Hakalau used a combination of hunting and snaring to eradicate – hunting lowered numbers but when hunting was no longer productive used snares to clear area
- Snares are used by setting up transects and then mapping where the snares are placed – snares are only lost when pigs break them – checking is done periodically and they are removed when done
- Snaring is also used with intensive monitoring and when the area is cleared the snares are removed
- The amount of time between checking snares varies by program, can be up to 2 months
- Need to look at unattended snaring and current snare type versus the Collarum (safety pin type) for humaneness
- Snares if used should be used in remote locations that have already been through hunting and trapping – should be used as a last resort (the term "remote" needs to be defined)
- The issue of cost between attended and unattended snares needs to be assessed
- Not claiming snares are humane – that is why they are used at the end of the clearing process when other methods have done what they can – but they are the only effective tool for removing the last few animals – should continue to look at new technologies that could reduce the use of snares
- When we look at humaneness we also need to consider the humaneness of allowing ungulates to foster and spread disease to other species such as native birds
- There needs to be a review of snaring that looks at attended versus unattended – types of snares and humaneness – when and where to use snares – practicability and expense
- Unattended may be appropriate for remote areas
- Unattended snares are necessary to reach eradication in an area
- Look at developing criteria for use of snares area by area
- Should be working toward being able to achieve eradication without the use of snares
- Managers of areas that need to remain ungulate free for protection and restoration needs must have all tools available and discretion to use them
- Snares are needed both in eradication areas and also in ungulate damage control areas

<u>Public or Sport Hunting (undirected hunting)</u>

- What is the goal? If the goal is to use as a management tool then it is directed hunting
- Hunting can not accomplish eradication in areas and this continuing discussion tying hunting to eradication is holding up the discussion on sustainable hunting areas and their establishment
- Undirected hunting is not a control tool

- When an area needs eradication or management use public hunting first – provide for the activity including providing access i.e. opening gates to Mt. Ka‘ala etc.
- Some felt that undirected hunting does provide for assistance with management as it impacts the total population – others pointed out that hunting focuses on the males of the species and for control you need to focus on the females and young
- Hunting is not humane unless it is a head shot – dogs terrorize animals
- Public hunting is an important component of control but can’t reach ultimate goal in an area needing eradication.
- There are issues connected with hunting concerning humane treatment of dogs, lost dogs etc.
- For proper management outcomes to be achieved public hunting must be directed
- Need to gather data on effectiveness of hunting as a management tool – it was noted that Tanya would have some information from the Kulani experience

Trapping (box, cage and corals)

- For this methodology to be successful it needs road access, bait availability, staff time to bait, tend and relocate animals, more effective with high densities of animals, good for use in rural and residential areas
- Supported by hunting community as animals can be relocated to other areas for sport hunting
- This method could be used as a way to deliver sterilants before animals are released
- The method requires regular monitoring of traps
- Must match trap design to animal needing to be trapped i.e. side door hinge is better for pigs
- The open air nature of this methodology makes it more humane as it decreases capture anxiety
- Hunters want use to be after area is sport hunted
- There will be data available soon from use of this methodology in Manoa
- A plus is that the method does not drive animals to other areas instead it brings them in and can attract them from a large area
- Traps require staff time to tend them
- Should be some assessment on the pros and cons what works for what type of animal
- If trapped animals are not relocated meat can be salvaged
- Bait and bait effectiveness is a problem – issues that impacts baits are the area the trap is in and what food is available in the area – then need to find effective bait in large quantities that is eco-friendly, affordable and does not attract vermin or unintended species to trap which can be a problem
- The problem with traps is that they do not always work – when the animal density is low – bait is taken by other animals which leads to unintended impacts

Fencing

- Effective with one way gates
- If the intent is to eradicate an area and keep it that way fencing is the only tool
- It is expensive

- Once an area is cleared and kept that way it is humane as it requires no future killing to take place
- Should be fencing sustainable yield areas for hunting
- Fencing changes animals migration habits and trails – can be inhumane if it blocks the way to a water source for animals
- Fences are vulnerable to vandalism and acts of nature – falling trees etc. – some of the vandalism may stem from a lack of clarity on the goals and why the area is fenced
- What happens outside the fence – where do animals go and how does the fence impact them are questions that have not been answered
- It is essential to have an inspection and maintenance program with fencing
- New species that need control may make existing fences obsolete i.e. deer with pig fences
- Type of fence can impact animals and cause unintended kills such as bats
- Need new specification to control new species with fences i.e. deer and mouflon
- Fences can be hazardous to native species bats and petrels – function of height and barbed wire etc.
- Fences help to avoid regional eradication needs
- There is some research that shows that a high wire outside of existing fences with flags on it may work for deer

Directed volunteer hunting with dogs and knives

- Method used in residential areas
- A downside is that the dogs could pose a safety problem for residents – not appropriate in some areas
- Look at access need to areas where directed hunting could be effective
- Should consider closing high recreational areas occasionally for trail work and hunting to control ungulate populations in these areas (Tantalus, Na Pali coast)
- Can also use bows and arrows in these areas where the forest meets the residences
- Look at controlled night hunts – many felt this was not safe – others noted that it is expensive but as part of a strategy with fencing and done right in remote areas it can be very effective – this has proven somewhat effective at Pelekuna as part of a strategy
- Very successful when there is a high density of animals and the area is accessible
- Provides a way to get hunters to areas that are not normally accessible
- Animal rights folks do not view these methods as humane as the quickness of the kill is questionable
- With any of the tools noted the quickness of kill goes to the experience of the hunter

Professional aerial shooting

- Should be allowed if accurate and humane with a quick kill
- Less damaging in remote areas because use helicopter rather the ground access
- The method is limited to use by state employees only - even if applied on private land – when on private land private landowner must assume liability
- Hunters oppose to this method – waste of meat and considered wanton shooting
- Method is highly effective – in rugged areas it is the only effective method
- Aerial in the view of animal rights folks is completely inhumane can not verify kill

- Others felt that you could not always bring the animal out with other methods and did not see the difference
- In the areas where it is most effective hunters could not access let alone retrieve the meat
- Most effective method in the world for certain types of areas when practiced by professional hunters – also the animal carcass provides nutrients back into the depleted eco-system
- Aerial is used as last resort when an area is not huntable – the impacts of doing nothing in these instances are increased erosion which impacts reefs etc. – most of these impacts mean a loss of non-renewable resources as opposed to renewable resources such as goats
- New Zealand is considered by animal rights groups as the most inhumane - so we should not be referencing or looking at them
- It was noted that this was used effectively in Makua where unexploded ordinance made other methods impossible
- Exploring a system of fencing animals in would keep them out of areas that necessitate the use of this methodology
- This is a method that allows quick compliance with mandates
- Cost effective with high density areas example: an area that was reduced to 35% of its original density by hunting was eradicated after 2 aerial shoots
- State hunting education program tell hunters to go for a vital shot not a one shot head shot
- There is a lot of training involved for people that are going to practice this method
- Areas of Molokaʻi recovered very fast without fencing after one of these shoots – it restored stability and allowed the ecosystem to regenerate

Toxicants

- No approved label for use of toxicants in the US – should not even be discussing
- There is an effort currently underway to make them legal in the US
- They were used at one time and then made illegal because they were indiscriminate as to what animal they harmed
- The spreading of the toxicant into the human consumptive food chain as well as the impact on native species is a concern
- Hawaiʻi as a state has a low number of target mammals for toxicants
- Water quality is also an issue with use of toxicants
- They are currently used in the rest of the world – usually as the first tool for knocking out a population
- It is very inhumane
- Need to continue to track and look at research

Fertility Controls

- Need to increase research in this area – there is GonaCon (lasts three years) – it is injectable and works on pigs and produces no side effects when the meat is consumed
- Need to increase funding for research
- Still have damage happening from the animal after release for the rest of its life

- Doesn't help in situations where eradication is the goal
- Need to continue to track research in this area
- Problem also is that you have to catch enough females for it to be effective
- Will become more feasible if one is developed that is permanent and can be delivered orally
- Biologist can predict the threshold of efficiency – how many pigs you need to impact to make it an effective control mechanism

Judas Animals

- Very effective in situations of low density of animals
- Also very effective when coupled with aerial shooting and or corralling or penning
- Also effective with directed hunting
- There are questions about which sex is most effective and what length of time to leave an animal in the area
- It is really a tactic not a method – as a tactic it narrows the search area to increase efficiency of other methods
- It is also effective for managing fence breeches
- Also for long term monitoring within fenced areas

Biological Controls

- Extremely risky
- Very cruel to purposely introduce disease to a population
- Biological controls are predators also

Bounties

- Risky as it may attract individuals with low skill levels thus decreasing the number of quick kills
- Money not the best motivator for this type of work
- It could encourage some individuals to leave some of the population behind so that they can continue to collect bounties
- If you employ bounties or contracts you need to make sure the outcome desired is clear and that it is achieved
- It encourages cheating
- Viable for specific area with access control to check hunter going in and coming out

Shooting at baited stations

- If it works it can be effective
- Hunters don't like because it is a "canned" hunt
- Has all the problems listed associated with bait under trapping
- Could provide for a high degree of humane (one shot) kills – more humane then chasing and terrorizing with dogs – meat can be harvested
- It might be appropriate in a site where forests meet residential uses
- Concentrates animals which could encourage the spread of disease

Driving

- Effective in certain types of sites i.e. those with fencing or natural barriers to drive to
- Pushing animals from one area to another could create problems
- Should end with a corral or trap situation so that meat can be harvested
- Good because animals don't know how to avoid a drive
- The degree of success is determined by the criteria and the site – example Pohakuloa was not successful with a drive and aerial shooting because there were too many places for the animals to hide and wait it out
- May need to do driving on the ground with horses in some areas for it to be effective
- May not be feasible in large remote areas
- Report could discuss areas where this would be effective and where not

The group next discussed the recommendations section of the document.

Planning

- All management areas and methodologies need to be well planned for maximum effectiveness
- As part of planning we need to decide what areas are for sustainable yield hunting and what area need eradication
- Need to look at the idea of fencing sustainable hunting areas
- Fencing good idea for areas where eradication is goal but not for hunting areas
- Planning needs to be done Island by Island not statewide as there are too many variables and differences Island to Island – on some Islands may have to go to a regional basis
- Once goals are set for certain areas need to identify obstacles to reaching those goals
- It was pointed out that the big Island is trying to write a Game Management Plan (GMP)

Establishment of a Task Force

- We did this all in '93 and there was no follow through – need a task force to keep the momentum going
- The hunting folks are clearly identified as needing to be at the table – the problem is identifying who can represent them
- Need to have multiple representatives from all stakeholder groups
- Statewide for a task force is too hard - there are too many island differences as noted in the planning discussion
- Don't need a task force – need the State to set some policy around where the need is preservation and where the use is hunting
- No task force is needed the State just needs to do its job (the discussion on a task force was deferred till later in the meeting)

Strategic Management Plan

- Yes we need one
- Need by Island or district not statewide
- Strategic plan needs appropriate input from all stakeholders
- Should do at Island level
- Need to define GMAs and goals for each area

- Also need to look at ways to confine GMAs
- Look at areas that might develop as high recreational areas in the future that might impact uses and goals

Statute Revision

- The law governing that only state employees can do aerial shooting on private land needs to be looked at
- Need to look at the ability of the state to go on private land to control invasive species early
- Forest reserves where animal control is necessary should have exemptions on bag limits and access
- Lands designated to preserve native species should be deregulated for maximum animal control – example NARs being managed as GMAs
- Conservation land use permits should not have the same process for activities that are geared toward the conservation goals of the area and those that are not
- Need to make doing conservation work on conservation land easy
- Chapter 343 requiring EAs and EISs need to be applied consistently on the state and private side
- Language in the draft speaks to facilitating state access for all landowners concerned if this is to be construed as the state can force access to private lands – not in favor of this
- Need to regulate appropriately for the use proposed by the goals for the area
- Noted that statute was fixed on liability for injured volunteer – does not mean that the landowner won't get sued but can use as defense
- Need to increase the ease of access to information on animal control activities (OIP regulations). Disclosure for private public partnerships should be the same as if the entire entity is state
- Need clarification on the vehicles to get information
- Need to provide transparency as to where the hunting fees go i.e. how they are spent – this information is on the DOFAW web site – you can track the revolving fund – amounts what is spent and on what are all available

Volunteers

- We all thank them as an important part of the work we do
- Need to provide more and better training
- Look at investing in building volunteers by providing funding for a volunteer coordinator
- Volunteer oversight and management is an issue for landowners as it pertains to liability
- Can we look at partnerships with the state as all volunteers being covered under state liability?
- Volunteers are essential to control programs

Hunting

- Hunting should be used as the first method in clearing an area of game as long as it is practicable

- There are different goals for hunting in different areas and these need to be clear and established
- Need to clarify and change terminology according to goal for the area
- Pristine areas risk introduction of alien species from anyone or thing entering the area including conservation workers, volunteers and hunters
- Increase access to areas appropriate for public hunting
- Hunting areas should be managed to insure a good hunting experience for the license fee and need to be large enough that you are not hunting in a zoo
- The idea of setting up hunting preserves is unique to this group
- Currently there is no game management plan and we need one
- Game management plans need to include management of hunting dogs (micro-chips, lost dogs, number and care of animals are all issues)
- Counties need to be part of this discussion
- There needs to be work done to increase the percentage of hunters who get a hunting license
- It was noted that state hunter education programs deal with education around native species - in a 12 hour course 1.5 hours is spent on endemic species
- Enforcement needs to be increased
- Look at hunting fees to provide enforcement as it is a dedicated fund
- Consider specializing DOCARE officers by resource area i.e. specialization Mauka or Makai

<u>Game Management Areas</u>

- Need to clarify terms and goals
- Should have comprehensive game management plan and ungulate control plan island by island
- Need to address relocation of animals as regards issues such as transportation, humaneness, and disease
- Fence GMAs
- Improve habitat in desired hunting areas to attract animals
- State land of non-importance next to GMAs should be planted with food sources to raise the capacity in the area and attract animals – if fenced one way fences could be used
- Increase research on game animals
- Encourage hunter volunteers to help with management an example is index surveys
- Game management and hunting staff at DLNR need to be looked at and held responsible to do their job
- GMAs qualify as an expenditure under the legacy land acts
- The Big Island has identified a game enhancement area – the need is to come up with a plan to improve habitat in this area
- There is a lack of trust between the department and the public based on the public's perception that there is no follow through on commitments – meetings like this take place and yield good ideas and then nothing happens – plans and reports seem to go on shelves – implementation needs to be done by the department and their employees and we do not see this happening

Report Structure – the group discussed their recommendations to the department concerning the structure of the report to the legislature.

- Confine the report to what was asked for in the Resolution
- Introduction should just give a brief overview of the context
- Do an executive summary on methodologies
- The strategic plan introduction on page 5 is good and should be retained
- The term "units of suffering" needs to be defined
- If page 6 stays in the discussion on humaneness needs to be toned down
- Need to clarify environmental damage from non-control of ungulates and how it also causes units of suffering in native populations
- If the introduction is kept it needs lots of work to correct factual errors
- Need a new introduction which would be all the whereases in the Resolution and an executive summary on methodologies and recommendations
- Need to add in section 1 a statement about the compatibility or lack there of between ungulates and native species
- Start the body of the report with section 2 on methodologies beginning on page 7
- If humaneness section stays in revamp it
- Separate out the planning section and discussion
- Present the methodologies in alphabetical order
- Put all hunting methodologies together

Next Steps discussion

- Next draft needs to get to folks so that 2 weeks is provided for review
- The participants recommend that the Department identify the resources and budget for a good Game Management and Ungulate Control planning process island by island – including a public input process that starts early
- The participants recommend that no statewide task force be formed (revisit of task force discussion)
- Participants asked who the point person would be as the report moves forward – the point person designated by the Department is Ed