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DEVELOPMENT OF THE VIRGINIA COOPERATIVE COYOTE CONTROL PROGRAM TO PROTECT LIVESTOCK

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Abstract**:** The Virginia Cooperative Coyote Control Program was created in 1990 to address increasing livestock losses to coyotes and the inability of producers to solve such problems themselves. The eastern coyote arrived in Virginia in the late 1970s or early 1980s. Lobbying efforts of agricultural groups, such as the Virginia Sheep Federation, helped create a cost-share program administered by the Virginia Department of Agriculture and Consumer Services (VDACS) and U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Wildlife Services (USDA-APHIS-WS). The objective of the program was to educate producers about control methods and to alleviate damage by removing offending coyotes where damage was chronic or economically harmful. The Cooperative Coyote Control Program has focused on educating producers about livestock husbandry practices that reduce coyote predation and developing an integrated direct control program to remove offending coyotes. Initially, only trapping and shooting during daylight hours were legal methods to remove offending coyotes. VDACS and USDA-APHIS-WS worked with the Virginia Department of Game and Inland Fisheries, animal welfare interests, and other affected stakeholders to broaden the methods available to remove coyotes that were killing livestock. In 1997, the integrated coyote control program used traps, shooting, calling and shooting at night, snares, M-44s, denning, and Livestock Protection Collars to remove offending coyotes and stop predation. M-44s and Livestock Protection Collars were restricted to use only by USDA-APHIS-WS personnel. The strategy of alleviating livestock losses in Virginia shifted from primarily corrective control to preventive and corrective control as more effective means to reduce livestock losses. A record-keeping system was implemented to track livestock losses and management responses as means to evaluate the program.

Key Words: *Canis latrans*, Cooperative Control Program, coyote, livestock depredation, Virginia

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INTRODUCTION

Coyotes (*Canis latrans*) are native to North America and historically inhabited the deserts and short grass prairies of the West until Europeans colonized North America (Parker 1995). The extirpation of gray wolves (*Canis lupus)* and habitat modification by humans are believed to be contributing factors in the immigration of coyotes into eastern North America (Parker 1995). Across the western United States, coyotes have been a primary predator of domestic livestock (Terrill 1975).

The eastern coyote arrived in Virginia in the late 1970s. Livestock losses to coyotes first were reported to the Virginia Department of Agriculture and Consumer Services (VDACS) in the early 1980s. According to Virginia Department of Game and Inland Fisheries (VDGIF) and U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (APHIS) records, 522 sheep and 7 calves were reported killed or injured by coyotes in 6 western counties from the early 1980s through 1987 (Tomsa 1991). The National Agricultural Statistics Service (NASS) reported 4,100 sheep and 700 calves killed by coyotes in Virginia in 1990 and 1991, respectively (NASS 1991, 1992). Sheep and calves reported killed by coyotes in these two surveys were valued at $366,500 (NASS 1991, 1992). The Virginia Sheep Federation, a state-wide umbrella organization comprised of the 7 wool pools in Virginia, and other agri-business groups lobbied the legislature

to establish a program to assist livestock producers with coyote depredation. The Virginia Cooperative Coyote Damage Control Program (VCCDCP), a 50:50 cost-share program between VDACS and APHIS, was created in 1990 to address the increasing predation problem that producers were unable to alleviate themselves.

VDACS negotiated with APHIS to establish a 50:50 cost-share program to fund a wildlife biologist position devoted solely to assisting producers. The objective of the program was to educate producers about coyote control methods and to alleviate damage by removing offending coyotes where damage was chronic or economically harmful. Later, the Virginia Sheep Industry Board was created by referendum in 1995 and a "head tax" collection program was imposed for each sheep sold as a means to fund predator control and marketing. Funds from the Sheep Industry Board were used to support a technician position within APHIS.

Nationally, APHIS has been the lead federal agency in managing wildlife damage and conflicts to protect agriculture, human health and safety, natural resources, and property (USDA 1994). APHIS has been providing service since the late 1800s to reduce depredation to livestock. In Virginia, VDACS has been the lead state agency directed by law to protect agriculture, human health and safety, and property from damage associated with wildlife. Both agencies have provided technical assistance, loaned equipment, and provided direct control services to alleviate wildlife damage or conflicts.

Wildlife damage management is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife. It is an integral component of wildlife management (Leopold 1933, The Wildlife Society 1990, Berryman 1991). APHIS and VDACS use an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as Integrated Pest Management, or IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the Animal Damage Control Program Final Environmental Impact Statement (USDA 1994). Prior to August 1, 1997, Wildlife Services was named Animal Damage Control.

In this report, we discuss the development and efficacy of the Virginia Cooperative Coyote Damage Control Program.

DEVELOPMENT OF THE COOPER-ATIVE COYOTE CONTROL PROGRAM

The VCCDCP, an integrated wildlife damage management program, uses non-lethal and lethal methods (Table 1). The integrated program has used any and all practical methods to alleviate damage while minimizing environmental impacts. Initially, APHIS had few methods available to remove offending coyotes. Therefore, a strategic plan was developed to identify and prioritize potential management methods suitable for use where the objective was to reduce livestock predation to the lowest levels possible. Reducing predation on sheep was viewed by APHIS and VDACS as critical because the sheep industry in Virginia was in decline, as measured by a reduction in sheep numbers from 165,000 sheep in 1990 to 88,000 sheep in 1997. Two of the reasons commonly given by sheep producers for going out of business were coyote predation and the interaction of coyote predation and low lamb prices in 1993 and 1994.

Educating People about Coyotes and Providing Technical Assistance

Education, technical assistance, and the dissemination of information have been the primary emphases of the VCCDCP. This approach has allowed the VCCDCP to provide assistance to >180 different producers in 31 counties and to educate the public about impacts coyotes have on livestock production.

Educational Programs—APHIS conducted annual educational programs for people directly involved in livestock production to inform them of current methods of coyote damage management and how these methods could be incorporated into current livestock production practices. Animal Control officers were involved because of their role related to an existing compensation program for dog predation on

livestock. State wildlife biologists were provided information about coyote predation and control methods. The education program focused on 1) identification of coyotes and coyote sign, 2) distinguishing between coyote and dog depredation, 3) methods producers can use to help themselves, and 4) methods available to alleviate coyote predation on livestock. APHIS conducted 5-14 educational programs per year to 2,983 people between June 1990 and July 1997.

Fencing—Predators of large domestic animals have been absent from Virginia for >100 years. The condition of woven wire fence (4-6 inch stays), the standard fence used by sheep producers in Virginia, was in a general state of disrepair statewide in 1990 (Tomsa 1991). Initial non-lethal recommendations emphasized the need for producers to improve, repair, and/or replace ineffective fencing.

Guard Dogs—Initial efforts to use guard dogs as a method to alleviate sheep depredation were ineffective, primarily because breeders were selling dogs that had not been trained properly to guard; these dogs were not reared with livestock to establish necessary bonding. As a consequence, guard dogs were viewed by livestock producers as being ineffective, based on past personal experience or shared perceptions of other producers. APHIS facilitated the placement of 12 working guard dogs to create credibility among livestock producers. The success of these dogs has increased the popularity of guard dogs in Virginia. APHIS continues to assist sheep and goat producers in locating, training, and using suitable livestock guard dogs.

Snare Cooperative—Snares are an important, cost-effective tool that allows producers to help themselves. APHIS assisted sheep producers in Highland County set up a snare cooperative. Funds from the Highland County Wool Pool, Predator Committee, were used to purchase snare components recommended by APHIS. Then, producers were trained by APHIS personnel to create their own snares and how them to catch coyotes. Producers paid a replacement cost for snare components that allowed the cooperative to be self-supporting.

Media—The VCCDCP was staffed by 1 wildlife biologist responsible for educating livestock producers about alleviating coyote predation in 31 counties in western Virginia. Because the number of producers who could be served effectively by 1 biologist was limited, the media, especially newspapers, was seen as an important potential conduit of information. Information on protecting livestock from coyote predation was disseminated through local newspapers (e.g., *Highland Recorder*), regional newspapers (e.g., *The Roanoke Times*), and statewide news sources (e.g., Associated Press). APHIS conducted 3-12 newspaper interviews and 1-3 radio spots per year. Additionally, APHIS cultivated relationships with the media by working with county agents, public affairs specialists with state agencies, and livestock interest groups.

Coyote Control Tools Available In Virginia

When the VCCDCP started in 1990, only trapping and calling/shooting during the daylight hours were legal techniques in Virginia. An assessment of available coyote control methods was made and efforts were started to obtain additional methods (Table 1). Tools or methods identified in the strategic plan as being suitable and necessary included calling/shooting at night, snares, gas cartridge, M-44s, and Livestock Protection Collars.

Calling/shooting at night with night-vision goggles or spotlights was allowed when permitted by VDGIF in 1990. This method proved to be time consuming and costly in terms of personnel and equipment. Therefore, APHIS has made only limited use of this method.

Snares were identified by APHIS and VDACS as a critical tool that would allow livestock producers to catch depredating coyotes themselves. The use of snares was made available by permit from VDGIF in 1990. In 1991, VDGIF, with support from APHIS and the Virginia Trappers Association, modified the existing snare regulation to allow the use of locking snares.

The gas cartridge is registered for use on coyotes under a Federal Insecticide, Fungicide, and Rodenticide Act, Section 3, registration by the

Environmental Protection Agency. The gas cartridge was registered in Virginia as a means to fumigate coyote pups in the den, which has been shown to be an effective means of stopping predation on livestock (Till and Knowlton 1983). However, this option has been used only sparingly in Virginia because coyote dens are so difficult to find.

M-44s and Livestock Protection Collars are restricted-use pesticides that are regulated stringently by the Environmental Protection Agency. However, the use of these tools was viewed as being an essential element of an integrated program and, in certain situations, provides cost-effective coyote control. M-44s and Livestock Protection Collars can operate in wet or severe winter weather that would disable most traps and snares. Additionally, M-44s and Livestock Protection Collars require only a 7-day check (Lowney 1996), whereas snares and traps, by state regulation, must be checked daily. It took 3 years to garner support from VDGIF, VDACS, and animal welfare advocates, and to write a training manual before M-44s were registered for use in 1994. The same process took 5 years before Livestock Protection Collars were registered (1996) and first used in Virginia (1997).

M-44s and Livestock Protection Collars allowed APHIS to serve more sheep, cattle, and goat producers than would have been served if only traps, snares, and shooting were used (Table 2). Just as importantly, M-44's and Livestock Protection Collars allowed APHIS to implement a more efficient strategy of predation management.

Strategies and Methods to Alleviate Coyote Predation

As additional methods became available (Table 2), the strategies for addressing coyote predation by the VCCDCP changed. In 1990, when the VCCDCP first opened, emphasis was placed on removing offending coyotes after a livestock depredation had occurred because data on the extent, location, and seasonality of coyote predation on livestock in Virginia was lacking. We called this strategy "corrective" control. In 1994, the VCCDCP made 2 management changes: 1) "preventative" control efforts were initiated in areas characterized by historic livestock losses to coyotes, and 2) the use of leghold traps replaced calling/shooting as the primary lethal method of coyote removal (Table 2). "Preventative" control was defined as removal of coyotes from farms with a history of livestock predation before any lambs, kid goats, or calves were released onto spring pastures for grazing. Preventative control occurred primarily from January through mid-April; after that, APHIS shifted to corrective control strategies to respond to new, emerging or current predation problems.

Preventative control efforts focused on removing adult coyote pairs during late winter/early spring and prior to denning in areas adjacent to farms that had a history of depredations; coyote predation on livestock could be reduced or prevented for the upcoming lambing/kidding/ calving season. Producer requests for assistance were more evenly distributed and handled in the spring when preventative control occurred, whereas under corrective control prior to 1994, APHIS received a deluge of requests for assistance in the spring between April and June, which prevented the sole biologist from serving all requests in a reasonable time frame. Because preventative control was hampered by the daily requirement to check traps and snares, APHIS relied more on M-44s. To some extent, daily trap and snare checks were compensated for by having livestock producers check equipment while tending livestock. However, this often resulted in traps and snares being placed in areas convenient to the producer rather than in locations optimal to catching coyotes. Equipment was not set if livestock producers were unable to check traps and snares daily.

Since 1996, preventative control has shifted from the use of traps and snares to the use of M-44s. This shift increased the efficiency of the VCCDCP. Most importantly, the requirement that these devices be checked weekly, rather than daily, allowed wildlife biologists more time to provide services to more livestock producers. Less reliance is placed on producers having to perform daily checks. M-44s require less

maintenance than traps or snares that can be rendered ineffective during inclement weather. When non-target wildlife (e.g., opossum, raccoon, skunk, fox) are captured in a snare or trap, it becomes unavailable for coyotes. Because M-44s are more species-specific for coyotes, the VCCDCP has become more efficient.

The corrective control strategy has been used primarily from mid-April through August and uses a combination of methods: snares, M-44s, traps, and Livestock Protection Collars. The use of Livestock Protection Collars further improved program efficiency by providing an additional tool for situations where other lethal methods were deemed inappropriate or ineffective. Traps and snares were used more often during summer months when M-44s became less effective in taking coyotes. M-44s were not used from September through the second Saturday in January due to concerns about killing hunting dogs.

EFFECTIVENESS OF THE VIRGINIA COYOTE CONTROL PROGRAM

APHIS in Virginia developed a feedback system to monitor program effectiveness and provide accountability to producers, VDACS, and the Virginia Sheep Industry Board, all of whom fund the VCCDCP. A report of program accomplishments has been prepared annually and distributed to these groups. In addition to the annual report, producers receive a summary report of activities on their property. Also, strategies and methods have been evaluated continuously and, where necessary, changed to fulfill the goal of reducing livestock losses to the lowest possible level (Table 2).

Methods to measure program effectiveness have been agreed upon by APHIS, VDACS, and the Virginia Sheep Industry Board. These included determining the rate of reduction in sheep depredations statewide and on individual farms. APHIS personnel also continue to evaluate the benefits of new strategies and the incorporation of new, innovative methods into the existing integrated wildlife damage management program.

Statewide Reduction Of Coyote Predation On Sheep

The National Agricultural Statistics Service (NASS) has conducted statistical sampling of sheep producers to measure loss to predators (NASS 1991, 1995). NASS (1991) estimated 4,100 sheep were killed by coyotes in Virginia during 1990. The latest NASS survey of sheep losses to predators estimated 1,125 sheep were killed by coyotes during 1994. This represents a 72% reduction in depredations on sheep by coyotes in the first 5 years of the VCCDCP. The reduction in depredation rate on sheep may be due in part to the coyote predation problem becoming more manageable as fewer sheep producers had to be served by the one biologist.

NASS also conducted surveys of cattle losses to predators (NASS 1992, 1996). The NASS survey of Virginia cattle producers estimated 700 calves were killed by coyotes in 1991. A NASS survey in 1996 indicated 900 cattle (calves and cows) had been killed by coyotes (NASS 1996). This represents a 22% increase in cattle depredations by coyotes. The increased rate of coyote depredation on cattle is attributed to increased coyote abundance in southwest Virginia and a lack of funding for a wildlife specialist to assist cattle producers.

Individual Farm Reduction Of Coyote Predation On Livestock

APHIS documents livestock losses reported by livestock producers through a Management Information System. This information allows for the calculation of the number of sheep killed per farm. The sheep killed per farm ratio has declined since 1994, reaching its lowest value in 1997 (Table 2). We attribute these reductions in sheep depredation to the implementation of the preventative control strategy in 1994 and increased integration of methods during the last 4 years (Table 2).

Without actions to alleviate predation, losses to predators can be as high as 8.4% of ewes and 29.3% of lambs in the flock (O'Gara et al. 1983). Conversely, losses of sheep and lamb to predators are much lower where wildlife damage management is applied (Nass 1977, Tigner and

Larson 1977, Howard and Shaw 1978, Howard and Booth 1981).

Benefits Of A New Strategy And Methods

The number of lambs lost to coyotes declined as additional lethal control methods were made available and emphasis on those methods increased (Table 2). We believe the implementation of preventative control in 1994 reduced coyote predation on sheep by 49% from the previous 2 years. Use of M-44s in 1995 further reduced depredations on sheep. When Livestock Protection Collars were added in 1997, depredations on sheep declined 38% from the previous 3 years (Table 2).

SUMMARY

The development of the VCCDCP has demonstrated several components for success for states and livestock commodity groups needing to implement coyote damage abatement programs. First, educational programs were emphasized to maximize dissemination of information and gain public acceptance; providing technical assistance to individual producers also was extremely important. Secondly, direct control services, both preventive and corrective, were important in reducing sheep losses. Many producers have little time or expertise to resolve predation problems themselves. Finally, an integrated program that uses all available control methods provides the most effective reduction of livestock losses.

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Table 1. Non-lethal and lethal methods available in the United States to manage coyote predation on livestock. Availability of methods may be reduced by state law, regulation, or applicability.

Non-lethal Methods	Lethal Methods
Change pasture being grazed	Leghold traps
Shift lambing, calving, or kidding period	Snares
Select less vulnerable livestock	Callings/shooting
Herder	Dogs (denning and calling/shooting)
Night-penning	Denning
Shed-lambing, calving, or kidding.	M-44
Guard animals (dogs, donkeys, llamas)	Livestock Protection Collar
Electronic guard (sirens and lights)	Aerial gunning
Electric fencing	
Woven-wire fencing	

Table 2. Mean number of sheep killed by coyotes on farms in Virginia in relation to changing emphasis on lethal and non-lethal methods and strategies implemented.

	YEAR							
	1990	1991	1992	1993	1994	1995	1996	1997
Mean # of Sheep Killed/Farm	12.6	11.4	17.8	16.8	8.8	6.8	7.2	5.1
# of Sheep Producers Assisted	44	50	35	24	41	28	56	49
Primary Control Methods (lethal)	SN SH	SN SH	SN SH	SN SH	TR SN	TR SN	TR M-44 M-44	SN M-44
Secondary Control Methods (lethal)	TR	TR	TR	TR	SH	SH	SH LPC	TR
Primary Control Methods (nonlethal)	FN HS	FN HS	FN HS	FN HS	FN GD	GD EG	GD EG	GD FN
Secondary Control Methods (nonlethal)	GD	GD	GD	GD	HS EG	FN EG	FN HS	HS HS
Strategies Used	DAM	DAM	DAM	DAM	PREV /DAM	PREV /DAM	PREV /DAM	PREV /DAM

KEY: SN=snare, SH=calling/shooting, TR=trapping, M-44=self explanatory, LPC=Livestock Protection Collar, FN=fencing, HS=husbandry, GD=guard dog, EG=electronic guard, DAM=corrective control, PREV/DAM=preventative and corrective control.