Benefits and Costs Associated with Wildlife Services Activities in California

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ABSTRACT: This paper presents a general summary of an economic assessment of the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) Program in California (CA). Detailed analyses quantified WS economic benefits to each of the 38 counties that contributed cooperative funds in 2004, with an aggregate report of county results used to form an overall statewide estimate of the Program's value. Four general categories of wildlife damage management activities were: Agriculture, Health and Human Safety, Natural Resources, and Property. Two general methods of determining economic valuation were employed to quantify benefits: replacement-cost method, and damage-avoided method. Results showed that the protection of livestock, particularly sheep, cattle, and goats, from predation was a main activity of WS–CA personnel in each of the cooperating counties. Annual estimated replacement costs for WS–CA operations for Year 1 and Year 2 of the analysis (i.e., approximately equivalent to fiscal years 2003 and 2004, respectively) totaled $6,605,234 and $8,602,590 for the combined counties, respectively. Mean replacement costs for WS operations in the cooperating counties in Year 1 and Year 2 equaled $173,821.95 and $226,373.13, respectively. Given that the counties paid an average $51,798.10 share to WS–CA in 2003, the counties would have incurred averaged net increased expenses of $122,023.85 and $174,575.03 for similar services offered by commercial wildlife damage management companies.

KEY WORDS: benefits, costs, damage avoidance, economics, replacement costs, USDA, wildlife damage management, Wildlife Services

Proc. 22nd Vertebr. Pest Conf. (R. M. Timm and J. M. O'Brien, Eds.)
Published at Univ. of Calif., Davis. 2006. Pp. 356-360.

INTRODUCTION

The Wildlife Services program has been in existence for more than 120 years (USDA 1994). The 1931 Animal Damage Control Act directed the U.S. Department of Agriculture to control wildlife for the benefit of protecting agricultural resources, forestry products, and public health and safety (USDA 1994). More recently, the 1988 Rural Development Agriculture, and Related Agencies Appropriations Act expanded functions to include the control of nuisance animals and birds, plus wildlife sources of disease (Clay 1996). Personnel in the WS program set up cooperative agreements with federal land management agencies, state and county governments, livestock associations, Native American tribes, universities, and individual farmers/ ranchers to manage wildlife-caused damage and disease.

In 2003, fiscal issues greatly impacted the State of California's budget. The state invoked budget cuts estimated at about $26 billion, resulting in a $980,000 reduction of State contributions to fund county participation with WS–CA (C. Coolahan, pers. commun., 2003). This abrupt 35% loss in funds caused many counties to assume cooperative payments and to question the return on investments from WS–CA.

Also in 2003, California's Vertebrate Pest Control Research Advisory Committee (VPCRAC) funded a comprehensive economic assessment of WS operations in the state (Shwiff *et al*. 2005). At the time, the WS–CA program had cooperative agreements and memoranda of understandings with 40 of the state's 58 counties (69% participation) (Figure 1). While most farmers and

Figure 1. Map of California's 58 counties showing the five WS-CA Districts; cooperating counties (*n* = 40) are shown by hatching or matting.

ranchers have long offered testimony to the savings incurred from WS activities, particularly predator damage control, analyses to substantiate these claims were lacking. An economic assessment to delineate potential monetary savings attributed to WS–CA was overdue.

This paper presents a general description of methodologies and results associated with the VPCRAC-funded economic assessment of the WS–CA program (Shwiff *et al*. 2005). Economic assessment methodology offers procedures for quantifying the potential return on investment from wildlife damage management activities as well as program services.

APPROACH AND METHODS

Economic Data

Valuation of the benefits of WS–CA operations required identification of the services provided to cooperating counties (Shwiff *et al*. 2005). This entailed a survey of WS district supervisors on a county-by-county basis. District supervisors were asked to identify the top three wildlife damage management services provided per category (i.e., Agriculture, Health and Human Safety, Natural Resources, and Property) in each county. Responses for agricultural protection were dominated by livestock protection for sheep, cattle and goats. Health and human safety activities focused on general public safety and disease prevention. Natural resource protection was composed of services to protect riparian areas, trees and timber, and rangeland. Property activities were comprised of services to provide protection to buildings, landscaping, and irrigation/dams.

Actual frequencies of the top three services cited in the district supervisor surveys for the counties were derived from data collected in the WS–CA Management Information System (MIS) database during the inclusive period 1999 through 2003. WS specialists routinely complete MIS forms to record actions that they take in the protection of each county's resources and to record estimates of loss associated with each event (USDA 1994).

Cooperative Costs

County costs were valued as the 2003 cooperative shares paid by each county to fund WS–CA operations (Shwiff *et al*. 2005). These costs are established annually between respective county Agricultural Commissioners and WS personnel. A $51,798.10 share represented the mean cost paid in 2004.

Determination of Benefits

In most situations, the determination of economic benefits assumes that there is some market in which the value of the commodity (goods or services) can be determined. The value of the commodity is therefore determined by the interaction between market supply and demand. However, when markets do not exist then the demand and supply schedules are not given and market prices and quantities can not be observed. In these cases, valuation must be determined using nonmarket techniques (Randall 1984, Gramlich 1990).

Benefit-cost analysis is most often used where there are nonmarketed goods and services to value, such as environmental goods. The service of protecting agriculture, health and human safety, natural resources, and property is nonmarket. To measure such values, a number of concepts and measurement techniques have been developed (Zerbe and Dively 1994). Both market and nonmarket approaches are used to evaluate nonmarketed goods (Zerbe and Dively 1994). Accepted methodologies to value and determine benefits of non-market goods and services are replacement-cost method and damage-avoided method (King and Mazzotta 2003).

Replacement Costs

The replacement-cost method was used to estimate the cost of replacing WS–CA or its services (King and Mazzotta 2003). That is, a value was inferred by finding similar market values where the price or quantity change was used to represent the missing market value (Gramlich 1990). Applications of this methodology are broad and include the assignment of value to a range of entities, including ecosystems, natural resources, property and countless other commodities (Ulibarri and Wellman 1997). Replacement values for WS were determined using two replacement programs: agriculture (livestock protection) replacement; and health and human safety, natural resources, and property replacement (Shwiff *et al*. 2005).

Agriculture (Livestock Protection) Replacement

For agriculture or livestock protection (i.e., sheep and cattle only), an equivalent program (Marin County's Ranch Improvement/Non-lethal Control and Indemnity Plan) was identified, and estimates of replacement costs derived based on that program's costs for roughly 2003 and 2004. This livestock protection program is an actual method used in Marin County, CA to replace WS–CA costs. The trends in the levels of predation, indemnification, participation, production, and reimbursements over two years of this alternative program's operation were used to calculate the costs to other counties if they employed this alternative program (i.e., replaced costs).

Marin County's Ranch Improvement/Non-lethal Control and Indemnity Plan involved two parts: a) monetary reimbursement for protection improvements to facilities (e.g., fencing, guard dogs, scare devices, etc.), and b) indemnification– compensation for livestock depredated by predators (market price per head lost). Predation rates of 1.5% (Year 1) and 3.2% (Year 2) were based on the number of lambs lost to predators in each year and a hypothetical lamb crop of 1.5 lambs/1 ewe. Indemnification costs at these levels of predation were calculated by multiplying the number of lambs lost to predation by the market price given in the livestock protection replacement program (Year 1: $70/head; Year 2: $82/head).

To estimate total replacement costs, the information regarding the level of reimbursement for protection improvements and indemnification was extrapolated to each WS cooperating county, based on the number of sheep and cattle subject to predation. The total cost of replacing the WS–CA livestock protection program in each cooperating county, therefore, was evaluated as the cost of monetary reimbursement for protection improve-

ments and indemnification for losses that each county would incur under this replacement program.

Health and Human Safety, Natural Resource, and Property Replacement

To estimate the cost of replacing the service of capturing and removing animals that pose health and human safety threats or cause damage to natural resources and property, a range of costs was averaged for pest control providers across California. An arbitrary number of commercial vendors were contacted via telephone and asked for charges associated with typical service calls. Typically, pricing for service by commercial pest operators is based upon a single trap setup and removal of a single animal; whereas, a single damage incident reported by WS personnel may constitute multiple trap sets and the capture of multiple animals.

To calculate these replacement costs, the number of incidents documented in the WS–CA MIS during the 5-year period (1999-2003) was multiplied by $170.00 in most cases, by $287.50 for beaver incidents, and by $395.00 for coyote incidents, and then divided by the number of years to determine mean replacement costs per year. Removal of large predators other than coyotes such as mountain lions and bears are generally not performed by the private industry. Therefore, incidents involving these species were calculated using the mean cost for coyote removal, as the replacement cost for their removal was likely higher. These calculations produce a very conservative estimate of what WS provides– a cost for the minimum replacement service likely to be performed.

Damage Avoided

The damage avoided method used the value of resources protected under the categories of agriculture, health and human safety, property, and natural resources as measures of the benefits provided by WS–CA activities (see King and Mazzotta 2003). It was posited that WS–CA activities prevented or suppressed wildlife-caused damages in cooperating counties, therefore if WS–CA operations were to cease operations, damage to agriculture, health and human safety, natural resources, and property would likely increase. Again, agriculture (livestock protection) was valued separately from the other categories due to its unique characteristics. Here, the damage-cost-avoided method used the value of livestock protected and the revenue and jobs saved or protected that support the livestock in the county as a measure of benefits provided by WS–CA activities.

An input-output (IO) model was used to estimate the total value of damage associated with predation on livestock that was avoided. This model captured not only the direct effects of number of livestock loss avoided, but also the impact of increased predation on industries that directly and indirectly support livestock production. IO modeling allows for the creation of a mathematical representation of the county and state economy so that changes in the number of head of sheep and cattle can be input into the model to determine how that changes output (jobs and revenue) in the economy (Jones 1997).

This modeling system IMPLAN® (Minnesota IMPLAN® Group, Inc., Stillwater, MN) was used to estimate the impacts of economic change in a specific sector to other parts of the economy. For the purposes of this analysis, the source of economic change is an increase in predation on sheep and cattle due to the absence of WS. Relevant scientific literature suggests that in the absence of predation management, predation rates will likely increase for both sheep and cattle (Bodenchuk *et al*. 2002). Lending further support to this argument, the livestock protection replacement program previously described yielded predation rates that conservatively increased 1.7% from Year 1 to Year 2. Thus, for the IO analysis, hypothesized increased predation rates for sheep were set at three levels: 2%, 2.5%, and 3%; increased predation rates for cattle were set at 1%, 1.5%, and 2%.

For example, to calculate the damage avoided for an increase in predation in the absence of WS–CA, a 2% increase in the current level of predation on sheep and a 1% increase in the current level of predation on cattle served as our minimum level inputs into the IO model. These direct input changes then created multiplier or secondary effects throughout the economy. For example, if a rancher loses sheep to predation, he might buy less hay, thereby reducing the sales of the local feed supplier, which in turn may reduce the amount of hay purchased from local producers and so on depending on the relationships in the economy. IMPLAN® captured the secondary effects and calculated the impact on the amount of revenue diminished and jobs lost as a result of the predation increase. The savings in damage costs avoided was measured by the amount of revenue and the number of jobs affected by having WS–CA activities in each county. This process was repeated for all levels of damage for both sheep and cattle protection to determine the total amount of damage avoided.

Similarly, the benefit of health and human safety, natural resources and property protection was determined by estimating a hypothetical increase in the amount of damage under each resource category protected. The damages caused by wildlife incurred by the public were recorded by WS specialists using the MIS. It is important to note that the WS MIS database only captures a small portion of the total wildlife damage that occurs in each county during a given year. Certainly, many homeowners, ranchers, and farmers simply tolerate or deal with damage on their own and don't report the damage to WS–CA. Because it is impossible to determine the exact proportional increase in damage if WS were to cease operations, we have therefore projected a range of possible levels. That is, increases of 25, 50, and 100% were used to estimate projected damage. The resultant total damage avoided valuations were made by increasing the current average level of damage by 25% at the lowest level, 50% at the middle level, and 100% at the high level. This allowed for a benefit calculation to be made by determining the savings in damage costs avoided by having WS–CA activities in each county.

RESULTS

Replacement Costs of WS Program

Annual estimated replacement costs for WS–CA operations for Year 1 and Year 2 of the analysis (i.e., approximately equivalent to fiscal years 2003 and 2004, respectively) totaled $6,603,964 and $8,601,320 for the combined counties, respectively (Table 1). These costs involved cumulative replacement totals for projected agriculture (Marin County's Ranch Improvement/Non-lethal Control and Indemnity Plan extrapolation), health and human safety, natural resource, and property operations (derived from MIS frequencies and commercial operator fee estimates). Given that the counties paid a total of $1,968,327.87 in cooperating share costs, net annual increased expenses of $4,635,636 to $6,632,992 would be incurred by the cooperating counties to attain similar benefits afforded by WS–CA.

Table 1. Total replacement program benefits of Wildlife Services operations in California.

	Year 1	Year 2
Livestock Protection	$5,878,595	$7,875,951
HHS Protection*	$297,223	$297,223
Nat. Resource Protection*	$13,634	$13,634
Property Protection*	$414,512	$414,512
Total Replacement Program	**$6,603,964**	**$8,601,320**

*Replacement cost calculated for only one year.

More specifically, replacement costs for wildlife damage activities (i.e., agriculture, health and human safety, natural resource, and property) in respective counties for Year 1 and Year 2 averaged $173,821.95 and $226,373.13, respectively. Given that these counties paid a mean $51,798.10 share to WS–CA in 2003, it could be argued that an average net increased expense of $122,023.85 for Year 1 and $174,575.03 for Year 2 would have been incurred to obtain commercial wildlife damage management company services similar to those of WS–CA.

Assuming that damage from wildlife would increase 25 to 100 percent in the absence of WS–CA activities, it was projected that the cooperating counties would have incurred between $5,758,612 and $10,625,890 in additional expenses (Table 2). Under the current circumstances cooperating counties experience a minimum net savings of $3,790,284 ($5,758,612 - $1,968,327.87) or a maximum of $8,657,562 ($10,625,890 - $1,968,327.87) by using the WS Program.

Table 2. Total prevented damage benefits of Wildlife Services operations in California.

	Level 1	Level 2	Level 3
Livestock Protection	$5,520,321	$7,565,184	$9,672,741
HHS Protection	$42,798	$85,597	$171,190
Nat. Resource Protection	$15,260	$30,519	$61,037
Property Protection	$180,233	$360,462	$720,922
Total Prevented Damage	**$5,758,612**	**$8,041,762**	**$10,625,890**

The WS Program achieves certain economies of scale that individual replacement programs do not. This is a result of efficiency gains inherent in WS operations due to the fact that WS can use a broad spectrum of available resources and technology to mitigate wildlife damage problems. We contend that because alternative programs would not have these efficiency gains (e.g., the livestock replacement program) then rates of predation would be higher and resulting damages would be greater. For example, in Year 1 it would be possible to have replacement programs in place with an associated total cost of $6,603,964 and also to have increases in damages and loss to the economy of $8,041,762 (level 2), for a grand total of $14,645,726 (Table 3). This grand total, minus the sum of cooperative share that the cooperative counties pay ($1,968,327.87) could be viewed as a net benefit of $12,677,398 that was realized as a result of contributing cooperative funds to WS. The net value of WS operations in California was calculated to range between $10,394,248 and $17,256,882.

Table 3. Total and net benefits of Wildlife Services operations in California.

	Level 1	Level 2	Level 3
Year 1			
Total Benefit	$12,362,576	$14,645,726	$17,227,854
-Share Cost	$1,968,328	$1,968,328	$1,968,328
Net	*$10,394,248*	*$12,677,398*	*$15,259,526*
Year 2			
Total Benefit	$14,359,932	$16,643,082	$19,225,210
-Share Cost	$1,968,328	$1,968,328	$1,968,328
Net	*$12,391,604*	*$14,674,754*	*$17,256,882*

DISCUSSION

The current economic analysis of WS activities in CA demonstrated that multiple returns on invested cooperative dollars were provided to the cooperating counties. Wildlife damage protection was afforded mainly for agriculture, but protection of health and human safety, natural resources, and property were also key areas.

The activities and operations of WS–CA have monetary value; however, until now these services have been poorly quantified. Economic methodology was derived that afforded meaningful and reliable dollar valuations to WS–CA operations. Although a diverse group of techniques exist to value non-market commodities, the most appropriate and applicable to quantify the unique services provided by WS–CA were shown to be the replacement cost and damage avoided methods.

Additionally, it must be noted that the cooperating counties receive a number of indirect and intangible benefits related to health and human safety, natural resource, and property protection as a result of paying cooperative funds for WS activities. Indirect benefits refer to diverse auxiliary benefits from professional and regulatory amenities that federal agencies provide in support of agriculture. Examples include the requirement for WS to comply with National Environmental Policy Act (NEPA) regulations in the conduct of wildlife management practices, the training and certification of WS specialists in firearm safety and chemical use and disposal, the participation and support of professionals at the National Wildlife Research Center to provide research and technical support on diverse pesticide registration and

use issues, the use of capture methods that adhere to "best management practice" (BMP) guidelines for the removal of animals that come into contact with people, the safe disposal of captured animals using methods that meet current sanitation regulations, and an accurate accounting of program activities via the MIS.

ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance of the Vertebrate Pest Control Research Advisory Committee (VPCRAC). Our thanks go to Marvin Meyers (Chair) and to the Committee Members (Dennis Bray, Charles Crabb, Ellen Des Jardin Hirth, Mark Novak, Duane Schnabel, Dan Spangler, Robert Timm, Art Foster, George Simpson, and Edward Tully) for agreeing to fund this research. Special appreciation goes to Duane Schnabel (Primary State Agricultural Biologist, California Department of Food and Agriculture) for providing critical guidance and suggestions that were incorporated into the report. The County Agriculture Commissioners from the 39 California counties involved in the analyses were especially helpful, and, in particular, the assistance of Mary Pfeiffer (Agriculture Commissioner, Shasta County) and Dennis Bray (Agriculture Commissioner, Alameda County) for detailed feedback about county wildlife issues, demographic details and other editorial suggestions.

Additionally, we thank Stacy Carlson (Agriculture Commissioner/ Director, Marin County), Fred Crowder (Deputy Commissioner/ Director, Marin County) and their staff for cooperating with this assessment by providing data from that county on indemnity and non-lethal control improvement payments made to ranchers during 2003-2004.

A number of WS–CA personnel provided assistance in completing portions of the research– Scott Beckerman, Joe Bennett, Steven Carlson, Harold Jones, Jr., Jack Parriott, James Shuler, and John Turman. Finally, we would like to thank Jim Gionfriddo and Kathy Fagerstone for detailed reviews of this manuscript.

Use of product names does not constitute endorsement by the Federal Government.

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