

Wildlife Services

Protecting People
Protecting Agriculture
Protecting Wildlife

National Wildlife Research Center

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Economic Research of Human-Wildlife Conflicts: Methods and Applications



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• Major Cooperators

- California Department of Agriculture, Vertebrate Pest Control Research and Advisory Committee
- Colorado State University
- Cornell University
- Global Alliance for Rabies Control
- Michigan State University
- Ontario Ministry of Natural Resources, Canada
- Texas A&M University
- Texas Department of State Health Services
- The Ohio State University
- University of Hawaii
- USDA National Rabies Management Program
- WS Operations Personnel

• Groups Affected By These Problems

- Agricultural producers
- International wildlife conservation organizations
- State county agricultural commissioners
- State game and fish agencies
- State natural resource agencies
- State public health agencies
- Wildlife Services managers

National Wildlife Research Center Economists Use Benefit-Cost Analyses to Quantify Economic Impacts of Human-Wildlife Conflicts

The Wildlife Service's (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted to resolving human-wildlife conflicts through the development of effective, selective, and socially responsible methods, tools, and techniques.

The 2011 Research Needs Assessment of USDA/APHIS/WS ranked economic assessments of diverse management techniques, products, and programs third among the eleven most frequently cited data requirements by WS programs and staff. Economics research at NWRC seeks to meet this need and to satisfy The Government Performance and Results Act of 1993 by acquiring accounting-type, outcome-based data of program efficiency.

NWRC economists conduct research to determine the potential benefits (savings) and costs involved in reducing the impacts of introduced invasive species, emerging wildlife-transmitted diseases, and traditional wildlife-caused damages to agriculture, property, and natural resources, as well as wildlife-posed risks to public health and safety.

Applying Economic Expertise to the Challenges of Wildlife Damage Management

Cost of Starling Damage to Dairy Farms—More than 200 million invasive European starlings live in North America. When gathering in large flocks—numbering in the thousands—these birds exact a large toll on agriculture. To better quantify the damage from European starling-livestock interactions at dairies, NWRC economists looked at starling-related costs associated with the consumption of cattle feed, increased feed spoilage, and higher veterinary expenses. To better characterize these interactions, NWRC researchers surveyed dairy operators in Pennsylvania. The survey results indicated that starling damage at dairies costs the State more than \$10 million annually in lost productivity. Results also indicated that Pennsylvania dairies lose approximately 6 percent (or 178 million pounds) of cattle feed to starlings each year, costing farms thousands of dollars in additional feed. Dairies with large starling populations were associated with higher occurrences of Johne's disease (up to a 148-percent increase) and Salmonella (up to a 900-percent increase) in their herds, resulting in increased veterinary costs compared to farms with lower starling numbers. These research efforts aid in the development of effective, practical, and cost-effective management strategies.

Preventing Wildlife Rabies Saves Lives and Money—Rabies is an acute, fatal viral disease that can infect people and animals. The disease's impact on society can be great. The cost of detection, prevention, and control of rabies in the United States alone exceeds \$300 million annually. Approximately 90 percent of the reported rabies cases in the United States occur in wildlife. Raccoons and skunks account for the most reported cases, but bats, foxes, and coyotes are also among those commonly infected. Since 1995, WS has been working cooperatively with Federal, State, and local agencies; universities; and other partners to reduce rabies in wildlife. Each year, WS and cooperators distribute about 6.5 million oral rabies vaccination (ORV) baits in selected States to create zones where raccoon rabies can be contained.

NWRC economists have assessed the value of WS' ORV efforts on several fronts. Initially, simulation models were developed to determine likely scenarios related to the spread of raccoon rabies if WS' ORV program were terminated. Based on these scenarios, economic models were then developed to determine the likely economic consequences of abandoning the ORV program. Economists estimated that an enhanced rabies program



United States Department of Agriculture
Animal and Plant Health Inspection Service

(i.e., one that pushes for the full eradication of the raccoon strain of rabies) would likely prevent an estimated \$48 million to \$456 million in rabies-related damages. Enhancing the ORV program was estimated to cost between \$58 million and \$158 million. Thus, the return on investment for national ORV programs in wildlife could be as high as \$8 for every dollar spent.

On a more local scale, NWRC economists evaluated the return on investment of a coyote ORV program in Texas. From 1995 to 2006, south Texas implemented an ORV program to eliminate a rabies outbreak in domestic dogs and coyotes. The cost of the 10-year program was approximately \$26 million. However, an economic analysis estimated that the program's overall savings ranged from \$89 million to \$346 million in avoided rabies-related damages, indicating that between \$4 and \$13 were saved for every dollar spent.

NWRC economists also collaborated with the California Department of Health Services to determine the direct and indirect economic costs of human rabies exposure in two California counties. Results indicated that the average cost of a single suspected rabies exposure was approximately \$4,000. Using these identified costs, WS economists then assessed the potential benefits and costs of ORV baiting to eliminate or prevent the spread of skunk rabies in California. The results showed that for every dollar invested in wildlife rabies control and prevention, the return value in benefits could be as high as \$6.35.

Results from analyses like these provide an economic basis for decision-making and serve as a guide for future ORV baiting campaigns in the United States and other countries.

Wildlife Costs to Agriculture. In 2002 (the most recent year for which data are known), USDA's National Agricultural Statistics Service estimated the annual cost of wildlife damage to agriculture was approximately \$944 million. WS activities help reduce damage to livestock and aquaculture, as well as fruit, vegetable, and grain crops. In California, WS experts help to prevent rodent and bird damage to numerous crops, including avocados and wine grapes. California accounts for the majority of the annual U.S. production of avocados (\$200 million) and wine grapes (\$2.1 billion). WS reduces this damage by hazing animals with propane cannons and using repellents, barriers, netting, and toxicants. NWRC economists estimated the net benefits of bird and rodent control on a per-acre basis and accounted for crop savings, property damage avoided, and control costs. In avocado production, the net benefit of bird control was estimated to be \$60 to \$196 per acre, and the net benefit of rodent control was estimated to be \$574 to \$1,117 per acre. In wine grape production, the net benefit of bird control was \$956 to \$1,600 per acre, and the estimated benefit for rodent control was \$390 to \$832 per acre.

Taking the analysis further, NWRC economists estimated the total impact of bird and rodent damage to the California economy due to decreased agricultural yields and increased pest control costs for 22 selected crops. Multiple economic models were integrated to estimate the economic impact to the State, including the use of an input-output model for a subset of California's 10 leading agricultural counties. The total estimated revenue lost annually in the 10 counties/22 selected crops due to bird and rodent damage ranged from \$168 million to \$504 million. The total estimated number of jobs lost annually ranged from 2,100 to 6,300.

Estimating the economic impacts associated with wildlife damage, including predation, disease, and crop loss, provides valuable information to decision-makers about whether, when,

and how much damage management is appropriate. The need for NWRC economic studies is expected to continue to grow in the coming years as more decision-makers request information to aid in making difficult financial decisions.

Selected Publications:

ANDERSON, A., SHWIFF, S., GEBHARDT, K., RAMÍREZ, A. J., SHWIFF, S., KOHLER, D. AND LECUONA, L. 2012. Economic evaluation of vampire bat (*Desmodus rotundus*) rabies prevention in Mexico. *Transboundary and Emerging Diseases*. doi: 10.1111/tbed.12007

GEBHARDT, K., A. M. ANDERSON, K. N. KIRKPATRICK, AND S. A. SHWIFF. 2011. A review and synthesis of bird and rodent damage estimates to select California crops. *Crop Protection* 30:1109-1116.

SHWIFF, S. A., K. N. KIRKPATRICK, AND K. GODWIN. 2011. Economic evaluation of beaver management to protect timber resources in Mississippi. *Human-Wildlife Interactions* 5:306-314.

SHWIFF, S. A., C. P. NUNAN, K. N. KIRKPATRICK, AND S. S. SHWIFF. 2011. A retrospective economic analysis of the Ontario red fox oral rabies vaccination programme. *Zoonoses and Public Health* 58:169-177.

SHWIFF, S., C. AENISHAENSLIN, A. LUDWIG, P. BERTHIAUME, M. BIGRAS-POULIN, K. KIRKPATRICK, L. LAMBERT, AND D. BELANGER. 2012. Bioeconomic modelling of raccoon rabies spread management impacts in Quebec, Canada. *Transbound Emerg Diseases*. doi: 10.1111/j.1865-1682.2012.01351.x.

SHWIFF, S. A., J. C. CARLSON, J. H. GLASS, J. SUCKOW, M. S. LOWNEY, K. M. MOXCEY, B. LARSON, AND G. M. LINZ. 2012. Producer survey of bird-livestock interactions in commercial dairies. *Journal of Dairy Science* 95:6820-6829.

SHWIFF, S. A., A. ANDERSON, B. P. CULLEN, L. WHITE, AND S. S. SHWIFF. 2012. Assignment of measurable costs and benefits to wildlife conservation projects. *Wildlife Research Review*. <http://dx.doi.org/10.1071/WR12102>

Major Research Accomplishments:

- WS economic studies showed European starling damage at Pennsylvania dairies costs the State more than \$10 million annually in lost productivity.
- WS economic studies estimated the return on investment for national Oral Rabies Vaccination programs in wildlife could be as high as \$8 for every dollar spent.
- WS economists estimated the total impact of bird and rodent damage to the California economy due to decreased agricultural yields and increased pest control costs for 22 selected crops. The total estimated revenue lost annually ranged from \$168 million to \$504 million. The total estimated number of jobs lost annually ranged from 2,100 to 6,300.