

Wildlife Services

Protecting People
Protecting Agriculture
Protecting Wildlife

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Economic Research of Human-Wildlife Conflicts: Methods and Assessments



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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
- U.S. citizens

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

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 WS ranked economic assessments of diverse management techniques, products and programs third among the 11 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

Estimating the Cost of Rabies. — The World Health Organization estimates that about 55,000 people die of rabies each year, and that 99 percent of these deaths are attributable to canine rabies in Africa and Asia. NWRC economists estimated the economic impact of canine rabies in Latin America, Africa, and Asia. Accounting for the direct and indirect costs of rabies prophylaxis after exposure, dog vaccination and control, rabies diagnostic testing, and cattle mortality, the analysis showed that the overall global cost of canine rabies is approximately \$124 billion annually. Decreases in consumer spending from canine rabies cause additional loss of more than 6,000 jobs and \$600 million in income annually. These results illustrate the potential benefits that could be realized if canine rabies were eliminated and provide an important benchmark against which the cost of potential eradication campaigns can be compared.

Forecasting the Spread of Raccoon Rabies. — In the United States, wildlife accounts for 92 percent of all reported rabies cases. The raccoon rabies virus variant is responsible for significant spillover infection into dogs and cats, as well as other wildlife. Following the relocation of raccoons from Florida to Virginia during the 1970s, 80s, and 90s, raccoon rabies has spread and is now prevalent throughout the eastern United States. Although the spread of raccoon rabies beyond the eastern United States was slowed in part by geographical features (e.g., the Appalachian Mountains, the Great Lakes, large rivers), an extensive collaborative oral rabies vaccination (ORV) program led by WS has further helped to prevent its westward spread. Maintaining the ORV zone produces significant public health, agricultural, and wildlife management benefits. Specific benefits include reductions in human post-exposure prophylaxis (PEP), reduced livestock and pet losses, and protection of wildlife resources. To better quantify ORV program benefits, NWRC researchers and partners modeled the spread of raccoon rabies over 20 years in the absence of current ORV activities. The forecast models incorporated three different rates of spread: low (15km/year), medium (30 km/year), and high (60 km/year) based on historical rates of raccoon rabies spread in the eastern United States. Over the 20-year horizon, the spread would extend as far west as the Texas border and western Iowa. However, over a longer period, the spread would likely continue to the Rocky Mountains, where harsh winters and unsuitable habitat might stop the rabies spread. Such forecasting information aids managers in determining the costs and benefits associated with ORV programs.

Wildlife Costs to Agriculture. Wildlife damage takes a large toll on U.S. agriculture. In 2002 (the most recent year for which data is 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 to fruit, vegetable, and grain crops.

California accounts for the majority of the annual U.S. production of avocados (\$200 million) and wine



United States Department of Agriculture
Animal and Plant Health Inspection Service

grapes (\$2.1 billion). In California, WS experts help to prevent rodent and bird damage to numerous crops, including avocados and wine grapes. WS reduces this damage by hazing animals with propane cannons and using repellents, barriers, netting, and toxicants. NWRC economists calculated the net benefits of bird and rodent control on a per-acre basis and accounted for crops saved, 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 for the 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.

Benefits of Targeted Versus Sport Hunting Predator Management. — Nonlethal methods for reducing livestock predation can be cost effective but may also be impractical or insufficient in some situations. As a result, lethal predator control is often used. Lethal methods employed by professional wildlife managers can selectively target individual predators that have killed or are likely to kill livestock. Although sport hunting may also help, as it reduces or limits the size of local predator populations, it is unlikely that hunters will target individual predators suspected of killing livestock. The distinction between these two methods is an important one. NWRC economists developed a simple method to compare the benefits to livestock from targeted lethal removal of predators relative to the benefits of sport hunting. Using data on lynx predation on sheep in the French Jura Mountains, economists found that the benefits of targeted removal outweigh those of sport hunting by up to 175 percent. Several conclusions can be drawn about the benefits of targeted removal relative to sport hunting based on the developed framework. Targeted removal is preferred when the value of the vulnerable livestock is high and predation rates are variable. However, when predation rates are consistently high, sport hunting is preferred, likely because a high predation rate implies that removing any given animal is likely to protect livestock.

Selected Publications:

Anderson, A., S.A. Shwiff, R.B. Chipman, T. Atwood, T. Cozzens, F. Fillo, R. Hale, B. Hatch, J. Maki, O.E. Rhodes, E.E. Rees, C.E. Rupprecht, R. Tinline, K.C. VerCauteren, and D. Slate. Forecasting the spread of raccoon rabies using a purpose-specific group decision-making process. 2014. *Human-Wildlife Interactions* 8(1):130-138.

Anderson, A., C.A. Lindell, K.M. Moxcey, W.F. Siemer, G.M. Linz, P.D. Curtis, J.E. Carroll, C.L. Burrows, J.R. Boulanger, K.M.M. Steensma, and S.A. Shwiff. 2013. Bird damage to select fruit crops: The cost of damage and the benefits of control in five states. *Crop Protection* 52: 103-109. doi: 10.1016 / j.cropro.2013.05.019.

Anderson, A., K. Kirkpatrick and S.A. Shwiff. 2012. The net benefits of controlling bird and rodent pests in wine grape and avocado production. *Proceedings of the Vertebrate Pest Conference* 25: 353-356.

Shwiff, S., K. Hampson, and A. Anderson. 2013. Potential economic benefits of eliminating canine rabies. *Antiviral Research* 98:352-356.

Werner, S.J., S.A. Shwiff, J.L. Elser, K.N. Kirkpatrick, S.E. Pettit, J.Suckow, R.C. Willging, J.A. Tharman, and J. Heil. 2014. Perceived impacts of wild turkeys and management techniques for Wisconsin ginseng production. *Crop Protection* 65:221-226. doi: 10.1016 / j.cropro.2014.08.004.

Major Research Accomplishments:

- WS economic studies showed the overall global cost of canine rabies is approximately \$124 billion annually. Decreases in consumer spending from canine rabies cause the additional loss of more than 6,000 jobs and \$600 million in income annually.
- WS modeling efforts showed raccoon rabies could potentially spread as far west as the Texas border and western Iowa within 20 years in the absence of current oral rabies vaccination efforts.
- 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. The total estimated revenue lost annually in 10 counties for 22 selected crops ranged from \$168 million to \$504 million. The total estimated number of jobs lost annually ranged from 2,100 to 6,300.
- WS economic studies found that the benefits of targeted predator removal for livestock protection outweigh those of predator removal via sport hunting by up to 175 percent.