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# Economic Research of Wildlife Impacts on Agriculture, Public Health, and Natural Resources

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## National Wildlife Research Center Scientists Conduct Diverse Economic Analyses to Quantify the Benefits and Costs of Wildlife Damage Management

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques.

**Major Research Accomplishments:**

- In California, WS is conducting a county-specific, benefit-cost analysis of agricultural, natural resource, human health/safety, and property factors involved in WS activities that will serve as a model for other WS state programs.
- WS conducted an empirical cost analysis of skunk rabies in Southern California; the average per-patient cost for a suspected rabies exposure was $3,345 (Range $673-$8,335) in 2003 dollars; the direct and indirect costs averaged $2,254 (Range $267-$5,673) and $1,091 (Range $406-$2,662), respectively. The five-year, two-county cumulative costs, including rabies tests for 468 suspected animals, totaled $448,230.
- To date, WS has published over 35 economic-relevant papers and have made over 100 presentations at scientific and stakeholder meetings.
- WS formed more than 20 effective partnerships/collaborations with other Federal, state, academic, and international agencies interested in economics research of wildlife damage management.
- WS determined that predator management offers a cost-effective approach to the recruitment of game animals. For Wyoming, a range of values for each antelope fawn (i.e., $400, $1,500, $3000) was used to determine that the benefit-cost ratios for the number of antelope saved by predator management were greater than 15:1.
- WS performed a benefit-cost analysis of protecting threatened saltwater marsh from feral swine damage in Florida. Using a pre-/post-approach, it was estimated that a year of swine removal resulted in an 8% decrease in damage to threatened plants--a return of between $1.0 and $3.3 million in savings. Valuation of the plant destruction was based on Florida's civil penalties for destroying endangered saltwater marsh habitat.

Since 2001, NWRC staff have conducted studies aimed at developing or adapting economic methods to assess the benefits and costs of NWRC research and WS operational activities.

Justifications for economics research associated with wildlife damage research and management are numerous. The 2001 Research Needs Assessment of USDA/APHIS/WS cited a growing need for economic assessments of diverse management techniques, products, and programs. Emerging wildlife diseases (i.e., wildlife rabies, West Nile virus, chronic wasting disease, and bovine tuberculosis) have required an increasing share of research and management resources, but the economic costs and savings associated with controlling these diseases are uncertain and difficult to quantify. Regional and local imbalances in predator, avian, and rodent populations hinder recovery of certain threatened and endangered (T&E) species, but valuations of recruited T&E animals per effort expended require novel analytical and estimation procedures. Additionally, the benefits and costs of many NWRC research products (e.g., Diazacon for ground squirrel population reduction, anthraquinone as a secondary repellent for blackbirds to rice seed) and WS programs (e.g., aerial hunting of coyotes for livestock protection, aircraft hazing to avert sunflower damage by blackbirds, removal of dangerous animals such as mountain lions in parks or coyotes in residential areas) are unknown.

NWRC's goal is to quantify the benefits and costs of NWRC products and WS operational activities that aim to mitigate the impacts of wildlife diseases, wildlife damage to agriculture and natural resources, and wildlife risks to public health and safety.

## Applying Economics and Expertise to the Challenges of Wildlife Damage Management

**Economics of Wildlife-transmitted Diseases—**NWRC researchers are conducting analyses to quantify the costs posed by selected wildlife transmitted diseases versus the benefits of potential disease mitigation methods. Collaboration with the WS Rabies Coordinator and Rabies Economic Team has led to empirical estimates of post-exposure rabies prophylaxis, public health costs, and animal control expenses linked to wildlife rabies. In addition, analyses of the potential benefits from oral rabies vaccination (ORV) programs have been performed. Plans also include collaboration with select county health offices to study the direct and indirect expenses related to West Nile virus.

**Identify, Assess, and Quantify the Benefits and Costs of WS Operational Activities—**Research is underway to develop a comprehensive framework and modeling system that integrates economic, biological, and demographic data into profiles of county-by-county WS activities. Four factors of potential benefits and costs have been identified: 1) agricultural protection (e.g., crop, livestock), 2) public health and safety (e.g., wildlife disease prevention, aircraft bird strike reduction), 3) natural resources protection (e.g., threatened and endangered species conservation through local predator management, archeological site preservation through rodent management), and 4) property protection (e.g., impoundment maintenance through rodent control, safeguarding buildings through rodent management). Data will be used to identify the three most frequent "Species X Complaint" activities under each of the four factors within each county. The approach entails estimating "replacement" costs for WS; that is, what will it cost counties to acquire/perform similar wildlife damage management services privately?

**Benefits and Costs of Predator Management for T&E Species—**NWRC scientists are conducting studies to quantify the potential savings or increased revenues associated with predator management agreements aimed at protecting threatened and endangered species and enhancing game populations. Research efforts will focus on continued documentation of predator management agreements in several states (e.g., California, Florida, and Wyoming) and the commonwealth of Puerto Rico. Much of this work relates to data needed for Environmental Assessments, Environmental Impact Statements, and other National Environmental Policy Act documents and requirements set forth in The Government Performance and Results Act.

**Economic Surveys and Analyses to Quantify Wildlife-caused Damage—**NWRC staff are engaged in collaborative efforts with several private and municipal organizations to design economic impact surveys. For example, survey data are being collected by groups in Hawaii and Guam to project potential economic impacts to Hawaii if the invasive brown tree snake were to become established; livestock organizations in several Eastern states are providing data to estimate losses caused by black vultures in that region; and, data analyses are being used to estimate the cost effectiveness of egg addling and other Canada goose management techniques used by WS in Washington state.

**Wildlife Indexing and Damage Assessment Methods—**New, time and labor-saving methods are being developed to document damage caused by wildlife. Efforts are focused on brushed-dirt-plot indices for relatively quick, easy, and inexpensive estimates of wildlife numbers and management effectiveness. These methods have resulted in rapid, reliable determinations that raccoon removals aid sea turtle hatching success and that rodent ingestion of toxic baits correlates with lower population numbers.

**Benefit-cost Handbook—**NWRC staff are preparing a Benefit-cost Analysis Handbook that will be published for use by NWRC scientists and WS specialists. This handbook will provide a useful guide for researchers and specialists in collecting economic data and building improved data sets for future benefit-cost analyses of wildlife damage management.

### Groups Affected by This Problem:

- Wildlife Services managers
- State natural resource agencies
- Agricultural producers
- U.S. citizens

### Major Cooperators:

- Economics Department, Colorado State University
- WS Operations personnel

### Selected Publications:


- Engeman, R. M.; Shwiff, S. A.; Smith, H. T.; Constantin, B. 2004. Monetary valuation of wildlife species and habitats as a basis for economically evaluating conservation approaches. Endangered Species Update 21:74-79.
- Shwiff, S. A.; Bodenchuk, M. J. 2004. Coyote predation management: an economic analysis of increased antelope recruitment and cattle production in South Central Wyoming. Sheep & Goat Research Journal 19(1):32-36.
- Engeman, R. M.; Smith, H. T.; Shwiff, S. A.; Constantin, B.; Nelson, M.; Griffin, D.; Woolard, J. 2003. Prevalence and economic value of feral swine damage to native habitats in three Florida state parks. Environmental Conservation 30:319-324.
- Shwiff, S. A.; Sterner, R. T. 2002. An economic framework for benefit-cost analysis in wildlife damage studies. In: Timm, R. M.; Schmidt, R. H., eds. Proceedings of the 20th vertebrate pest conference; 4–7 March, 2002; Reno, NV. Davis, CA: University of California, Davis: 340–344.
- Sterner, R. T. 2002. Spreadsheets, response surfaces and intervention decisions in wildlife damage management. In: Clark, L.; Hone, J., et al., eds. Human conflicts with wildlife: economic considerations; 1–3 2000; Fort Collins, CO. Fort Collins, CO: U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center: 42–46.
- Sterner, R. T.; Tope, K. L. 2002. Repellants: projections of direct benefit-cost surfaces. In: Timm, R. M.; Schmidt, R. H., eds. Proceedings of the 20th vertebrate pest conference; 4–7 March, 2002; Reno, NV. Davis, CA: University of California,