Wildlife Services

Protecting People
Protecting Agriculture
Protecting Wildlife

National Wildlife Research Center

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Reducing Wildlife Hazards to Aircraft

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Major Cooperators:

- Airline Pilots Association
- Airports across the United States
- Auburn University
- Bird Strike Committee USA
- Federal Aviation Administration
- Indiana State University
- Mississippi State University
- National Association of State Aviation Officials
- National Center for Atmospheric Research
- North Carolina Division of Aviation
- North Carolina State University
- Port Authority of New York and New Jersey
- Purdue University
- University of Georgia
- U.S. Air Force
- U.S. Air Force Bird Air Strike Hazard (BASH) Team at Kirtland Air Force Base
- U.S. Army
- U.S. Fish and Wildlife Service
- U.S. Marine Corps
- U.S. Navy

Groups Affected by This Problem:

- Airline passengers, pilots, crews, owners and administrators
- Aircraft and engine manufacturers
- Insurance underwriters
- Military pilots and aircrews
- Residents near airports

National Wildlife Research Center Scientists Study Wildlife Hazards On and Near Airports

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 socially responsible methods, tools, and techniques. The NWRC field station in Sandusky, Ohio, is dedicated to providing a scientific foundation for WS and Federal Aviation Administration (FAA) programs that reduce wildlife collisions with aircraft. Consequently, the scientists work closely with WS airport programs throughout the nation, the FAA, and the U.S. Department of Defense.

To be certified for commercial passenger traffic by the FAA, many U.S. airports are required to develop and implement a wildlife hazard management plan. The FAA strongly discourages any management practice that might create a significant attractant to wildlife hazardous to aircraft in the vicinity of an airport. NWRC scientists conduct research to provide guidance to the FAA and WS regarding mitigation of wildlife-aircraft strike hazards. More specifically, NWRC research is focused on understanding the nature of wildlife hazards on and near airports; developing management methods and tools to reduce those hazards; and providing WS, airport personnel, and the FAA with information on the latest strategies for controlling wildlife hazards.

Applying Science and Expertise to Wildlife Challenges

Wildlife Habitat Management and Other Land-Use Studies—Habitat management is fundamental to reducing wildlife use of airfields. NWRC scientists have studied vegetation types and vegetation management practices to identify strategies for making areas on and near airports less attractive to wildlife. For example, previous NWRC research has shown that grazing Canada geese do not consume endophyte-infected tall fescue. Grasses containing endophytic fungi (i.e., a fungus that lives within a plant without causing harm) have several benefits, such as resistance to both grazing and insect herbivory, heat and drought stress tolerance, and increased vigor. Over 200 varieties of turf-type tall fescue are currently available from the turfgrass industry for use in airfield re-vegetation projects. NWRC scientists identified several commercially available tall fescue varieties, including Titan LTD, 2nd Millennium, and Crossfire II, which grow successfully in airport environments but are not a preferred food source for geese. NWRC scientists also are evaluating wildlife use of various agricultural crops to determine whether some may be safe for planting on and near airports.

Safe management of stormwater runoff on and near airports is another focus of research. NWRC scientists and WS biologists have developed models of bird use of stormwater-detention ponds and identified factors that discourage birds from using these facilities, particularly within airport approach/departure zones. Researchers suggest that stormwater ponds be located as far away as possible from other water resources, but recommend a minimum of one kilometer of separation between a planned stormwater facility and other water resources. Also, designs that minimize perimeter, surface area, and the ratio of emergent vegetation to open water help reduce bird use of stormwater ponds. This research aids in the design of new airport facilities.

NWRC researchers are evaluating the potential for alternative energy production at airports. Many airport properties are already managed to reduce wildlife abundance and habitat quality as part of efforts to avoid wildlife collisions with aircraft. Ongoing and future NWRC research will examine whether renewable energy practices that limit use by wildlife hazardous to aircraft and are compatible with safe airport operations. For example, NWRC researchers and collaborators are studying wildlife use of solar array facilities and adjacent airport grasslands in Arizona, Colorado, and Ohio. NWRC researchers and collaborators at Mississippi State University are evaluating wildlife use of experimental biofuel production

plots that contain switchgrass or a mixture of native warm-season grasses in Mississippi. Once biofuel crops that are suitable for airport use are identified, the conversion of grasslands to these alternative land uses could produce renewable energy and provide airports with an additional source of revenue.

Researchers note the economic profitability of solar, biofuel, or wind production will vary markedly, and will depend primarily on yield, establishment and maintenance costs, opportunity costs of land (i.e., land rental or revenue from other commodities), and processing or utilization costs. For many airports where land is currently available, the benefits may outweigh the costs.

Bird Movements On and Near Airports—NWRC researchers are developing new methods to quantify bird movements in relation to airport locations and aircraft flight patterns, allowing for a better understanding of wildlife strike risks. Using advanced satellite telemetry tracking technologies, NWRC scientists are studying the movements of raptors including bald eagles, osprey, and red-tailed hawks around commercial and military airports. These research efforts provide detailed information on daily and seasonal movements of birds, the timing of peaks in bird activities, and the specific altitudes at which these birds fly. Using three-dimensional models of the airspace used by both raptors and aircraft, researchers are able to quantify the risk these birds pose to civil and military flight operations.

Exploiting Wildlife Anti-Predation Behaviors and Visual Ecology to Reduce Hazards to Aviation—NWRC scientists and collaborators are investigating the visual ecology of birds and mammals from both physiological and behavioral perspectives. By better understanding how these animals detect and respond to approaching objects, the researchers hope to develop lighting systems that will enhance detection and avoidance responses to approaching aircraft and ground-based vehicles. Earlier research by NWRC scientists and aviation industry collaborators set the stage for developing new aircraft lighting systems intended to enhance bird detection of approaching aircraft and, subsequently, escape behaviors. More recently, NWRC scientists and their collaborators at Purdue University and Indiana State University have confirmed that specific light wavelengths and pulse frequencies can alert and evoke earlier escape responses in birds.

To gain a better understanding of avian visual physiology, NWRC scientists and their colleagues studied the distribution of ganglion cells and photoreceptors in the retinas of captive Canada geese, as well as their eye movements and scanning behavior. Overall, researchers found that the Canada goose's visual system is designed to detect objects such as predators and other geese in open terrain. Furthermore, ganglion cells of geese are arranged in an oblique (i.e., slanting) formation across the retina, which allows the birds to scan the ground and the sky simultaneously when their heads are up and approximately parallel to the ground. The researchers hypothesize that this cell distribution, along with the birds' large eye size, may reduce the need for the birds to move their heads extensively while scanning their surroundings in open environments, whether in flight or on the ground. Thus, Canada geese might have a higher probability than other birds of detecting a light stimulus from an aircraft, particularly from a light that is designed relative to the species' visual capabilities. Future research efforts will examine physiological response by birds to the combination of light wavelength and pulse frequencies (which aid in movement detection) to narrow specifications for candidate lighting systems. Subsequently, the candidate lighting systems will be tested in field experiments involving birds and approaching aircraft exhibiting the specific lighting treatments.In related research, NWRC researchers are studying flight initiation distances of several bird species when approached by vehicles of varying size and speed to better understand how birds perceive and react to approaching objects. This information is critical to understanding how visual stimuli associated with detection of an approaching object are processed by the animal to initiate an avoidance response. Findings from this research will be particularly useful in the design of lighting systems that maximize the chances a bird will detect aircraft and other approaching objects and initiate an appropriate escape response.

Selected Publications:

BIONDI, K. M., J. L. BELANT, J. A. MARTIN, T. L. DEVAULT, and G. WANG. 2011. White-tailed deer incidents with U.S. civil aircraft. Wildlife Society Bulletin 35:303-309.

BLACKWELL, B. F., T. W. SEAMANS, P. M. SCHMIDT, T. L. DEVAULT, J. L. BELANT, M. J. WHITTINGHAM, J. A. MARTIN, and E. FERNÁNDEZ-JURICIC. 2013. A framework for managing airport grasslands and birds amidst conflicting priorities. Ibis 155:189-193.

BLACKWELL, B. F., T. L. DEVAULT, T. W. SEAMANS, S. L. LIMA, P. BAUMHARDT, and E. FERNÁNDEZ-JURICIC. 2012. Exploiting avian vision with aircraft lighting to reduce bird strikes. Journal of Applied Ecology 49:758-766.

DEVAULT, T. L., J. L. BELANT, B. F. BLACKWELL, J. A. MARTIN, J. A. SCHMIDT, L. W. BURGER, Jr., and J. W. PATTERSON, Jr. 2012. Airports offer unrealized potential for alternative energy production. Environmental Management 49:517-522.

DEVAULT, T. L., J. L. BELANT, B. F. BLACKWELL, and T. W. SEAMANS. 2011. Interspecific variation in wildlife hazards to aircraft: implications for airport wildlife management. Wildlife Society Bulletin 35:394-402.

DEVAULT, T. L., B. F. BLACKWELL, and J. L. BELANT, eds. 2013. Wildlife in Airport Environments: Preventing animal-aircraft collisions through science-based management. Johns Hopkins University Press, Baltimore, MD, USA.

FERNÁNDEZ-JURICIC, E., J. GAFFNEY, B. F. BLACKWELL, and P. BAUMHARDT. 2011. Bird strikes and aircraft fuselage color: a correlational study. Human-Wildlife Interactions 5:224−234.

FERNÁNDEZ-JURICIC, E., B. MOORE, M. DOPPLER, J. FREEMAN, B. F. BLACKWELL, S. L. LIMA, and T. L., DEVAULT. 2011. Testing the terrain hypothesis: Canada geese see their world laterally and obliquely. Brain, Behavior & Evolution 77:147–158.

MARTIN, J. A., J. L. BELANT, T. L. DEVAULT, B. F. BLACKWELL, L. W. BURGER, Jr., S. K. RIFFELL, and G. WANG. 2011. Wildlife risk to aviation: a multi-scale issue requires a multi-scale solution. Human-Wildlife Interactions 5:198-203.

MOORE, B. A., P. BAUMHARDT, M. DOPPLER, J. RANDOLET, B. F. BLACKWELL, T. L. DEVAULT, E. R. LOEW, and E. FERNÁNDEZ-JURICIC. 2012. Oblique color vision in an open-habitat bird: spectral sensitivity, photoreceptor distribution, and behavioral implications. Journal of Experimental Biology 215:3442-3452.

WASHBURN, B. E. and M. J. BEGIER. 2011. Wildlife Responses to long-term application of biosolids to grasslands in North Carolina. Rangeland Ecology and Management 63:131–138.

WASHBURN, B. E. 2012. Avian use of solid waste transfer stations. Landscape and Urban Planning 104:388-394.

WASHBURN, B. E., and T. W. SEAMANS. 2012. Foraging preferences of Canada geese among turfgrasses: implications for reducing human-goose conflicts. Journal of Wildlife Management 76:600-607.

Major Research Accomplishments:

- WS experts published a comprehensive book on wildlife-aviation issues titled “Wildlife in Airport Environments: Preventing Animal-Aircraft Collisions through Science-based Management” (2013, Johns Hopkins University Press).
- WS identified several commercially available tall fescue varieties, including Titan LTD, 2nd Millennium, and Crossfire II, which grow successfully in airport environments but are not a preferred food source for geese.
- WS used advanced satellite tracking technologies and an operational risk-management process to quantify the risk that breeding and migrating ospreys pose to military flight operations along the Eastern seaboard. The U.S. Department of Defense is incorporating this information into natural resource management plans and mission planning systems to mitigate the risk of collisions between ospreys and military aircraft.
- WS and collaborators have confirmed that specific light wavelengths and pulse frequencies can alert and evoke an earlier escape response in some birds. The discovery will aid in the development of new aircraft lighting systems intended to enhance bird detection of approaching aircraft and, subsequently, escape behaviors.