Wildlife Services

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Protecting Agriculture
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National Wildlife Research Center

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Reducing Wildlife Hazards to Aircraft and Other Vehicles

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Groups Affected:

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

Major Cooperators:

- Airline Pilots Association
- Airports across the United States
- Bird Strike Committee USA
- Federal Aviation Administration
- Indiana State University
- Mississippi State University
- Michigan State University
- National Association of State Aviation Officials
- North Carolina Division of Aviation
- Port Authority of New York and New Jersey
- Purdue University
- 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
- University of Georgia
- University of Illinois-Springfield

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 wildlife hazards at airports. NWRC scientists conduct research to provide guidance to the FAA, WS, and the general public 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

Changes to Aircraft Lighting to Increase Bird Awareness. — Collisions between birds and aircraft (also known as bird strikes) are expensive, risk human lives, and increase bird mortality. Because birds see differently than people, changes to aircraft lighting systems have been proposed as a way to make birds avoid aircraft. NWRC researchers and partners from Purdue University investigated brown-headed cowbirds' responses to aircraft lighting systems tuned to match the birds' visual capabilities. Using a radio-controlled aircraft fitted with non-pulsing 470-nanometer lights (lights that falls within the 'blue' portion of the visible spectrum), scientists observed an increase in cowbird alertness. Cowbirds showed alert behaviors twice as fast to radio-controlled aircraft with lights turned on versus those with lights turned off. Researchers also observed that high ambient noise levels delayed the birds' avoidance of the aircraft, possibly by causing sensory overload and distracting the birds. Researchers concluded that use of 470-nanometer lights on aircraft might improve some birds' abilities to detect and avoid aircraft. Such lighting systems may also make wind turbines, towers, and other large stationary structures more detectable to birds. Additional studies have focused on identifying which wavelengths of light are most detectable to birds, as well as when lighting systems should be activated during aircraft flights.

Chemical Control for Invasive Earthworms. — Though gardeners and fishermen love them, earthworms can be a problem for airport managers trying to prevent bird strikes. Earthworms are food for many birds, including gulls and European starlings, which can be a hazard to aircraft. For example, after a rainstorm at Calgary International Airport in 2004, two aircraft struck gulls that were feeding on earthworms and sustained damage during takeoff. Currently, no toxicants or repellents are registered for earthworm control in the United States. In a series of laboratory and field studies, biologists at NWRC's Ohio field station confirmed that tea-seed cake pellets (TSP), a byproduct of tea oil, caused earthworms to come to the surface and dry up, temporarily reducing two non-native earthworm populations. TSP contains triterpene saponins (natural detergents used in soaps) that irritate earthworms' mucus membranes. Researchers also studied the impact of the repellent on ring-billed gulls and saw no adverse effects to birds that fed on TSP-killed earthworms. Although effective, TSP may need to be applied several times a year to ensure continued control.

Collisions Between Aircraft and Large Animals. — Because of their large size, animals such as eagles and coyotes can cause significant damage to aircraft and pose a risk to aircraft passengers and crew. Recently, NWRC scientists reported on large animal-aircraft collision trends and patterns. Of the 234 eagle collisions with civil and military aircraft reported to the FAA, U.S. Air Force, and U.S. Navy from 1990 to 2013, 52 percent caused aircraft damage. During this 23-year period, bald eagle-aircraft

collisions increased by 2,200 percent, and golden eagle-aircraft collisions rose by 400 percent. During about the same time period, more than 1,000 carnivore-aircraft incidents were reported. Sixteen species were identified, with coyotes being the most frequently struck species. Overall estimated carnivore damage to aircraft from 1990 to 2012 was $7 million. Although the incident rate for carnivores increased 13 percent per year, the rate of damaging incidents remained fairly constant. Researchers recommend increasing runway patrols at night from July through November and maintaining high-perimeter fences to exclude medium- and large-sized mammals. To help reduce eagle-aircraft collisions, researchers recommend the use of non-lethal methods, such as hazing, on airfields and the removal of food sources that might attract eagles to airport environments.

Speed Kills: Ineffective Bird Responses to Oncoming Vehicles. — How birds respond to approaching objects greatly impacts their ability to detect predators, forage, flock, and avoid collisions. Understanding variations in animals' visual capabilities and other sensory systems may shed light on how they detect and avoid threats from approaching aircraft, other vehicles, wind turbines, and communication towers. To better understand birds' responses to approaching vehicles, NWRC researchers placed brown-headed cowbirds into a simulation chamber where they watched videos of vehicles approaching at various speeds. Researchers watched the birds' reactions to the videos and noticed that while they could successfully avoid slower moving vehicles, cars moving faster than 75 miles per hour overwhelmed the birds' escape strategies. Instead of adjusting their escape time to the car's speed, the birds only evaluated the distance between themselves and the vehicle. No matter how fast the car approached, the birds usually took off when it was roughly 90 feet away. Helping birds overcome this apparent fixed avoidance distance threshold will enable researchers to develop aircraft and other vehicle lighting systems that will help birds respond to approaching objects sooner and avoid collisions.

Evaluation of Avian Radar to Prevent Bird Strikes. — The Federal Aviation Administration and WS' Airport Wildlife Hazards Program continue to look for better tools and methods for preventing bird collisions with aircraft. One tool receiving considerable attention is avian radar. These systems have the potential to track bird activities on and near airports during the day and night--providing real-time estimates of bird locations, altitude and speed which could warn pilots and ground personnel of potential wildlife hazards. To evaluate the ability of such systems to detect and track free-flying raptors and waterbirds, NWRC and Indiana State University researchers compared data gathered from a Merlin Aircraft Birdstrike Avoidance Radar (DeTect, Inc.) and field observers at the Terre Haute International Airport in Indiana. Researchers focused initial studies on large species, such as turkey vultures, red-tailed hawks, Canada geese and sandhill cranes. A field observer would notify a radar operator when a bird entered the study area and provide updates on the bird's location every few seconds. The operator would confirm whether or not the bird was being tracked by the radar. Such an approach helped to identify instances when known birds were not tracked by the radar system. Most of the large, single birds seen by field observerswithin two nautical miles of the radar were tracked by the radar about 30 percent of the time. Flocks of large birds, even those that were located several nautical miles away, were tracked by the radar about 40 to 80 percent of the time. The results suggest that avian radar can be a useful tool for monitoring bird flock activity at airports, but less so for monitoring single, large birds such as raptors.

Selected Publications:

DeVault, T.L., B.F. Blackwell, T.W. Seamans, S.L. Lima, and E. Fernandez-Juricic. 2015. Speed kills: ineffective avian escape responses to oncoming vehicles. Proceedings of the Royal Society B 282:20142188. doi: 10.1098/rspb.2014.2188.

DeVault, T.L., B.F. Blackwell, T.W. Seamans, and J.L. Belant. 2016. Identification of off airport interspecific avian hazards to aircraft. Journal of Wildlife Management 80(4):746-752. doi: 10.1002/jwmg.1041

Doppler, M.S., B.F. Blackwell, T.L. DeVault, and E. Fernandez-Juricic. 2015. Cowbird responses to aircraft with lights tuned to their eyes: Implications for bird-aircraft collisions. The Condor 117:165-177. doi:10.1650/CONDOR-14-157.1.

Seamans, T.W., B.F. Blackwell, G.E. Bernhardt, and D.A. Potter. 2015. Assessing chemical control of earthworms at airports. Wildlife Society Bulletin 39(2):434-442. doi: 10.1002/wsb.545.

Sheridan, E., J. Randolet, T. L. DeVault, T. W. Seamans, B. F. Blackwell, and E. Fernandez-Juricic. 2015. The effects of radar on avian behaviour: implications for wildlife management at airports. Applied Animal Behaviour Science 171:241-252.

Washburn, B.E., M.J. Begier, and S.E. Wright. 2015. Collisions between eagles and aircraft: An increasing problem in the airport environment. Journal of Raptor Research 49(2):192-200. doi: 10.3356/rapt-49-02-192-200.1

Major Research Accomplishments:

- WS research discovered that placing 470-nanometer lights on aircraft or at airports may improve some birds' abilities to detect and avoid aircraft. The lights may also make wind turbines, towers, and other large stationary structures more detectable to birds.

- WS research found tea-seed cake pellets may be an effective control for use with invasive earthworms found on airports. Earthworms are an attractive food source for many birds which are considered hazardous to aircraft.

- WS researchers reported on large animal-aircraft collision trends and patterns from 1990-2003. During this 23-year period, bald eagle-aircraft collisions increased by 2,200 percent, and golden eagle-aircraft collisions rose by 400 percent. During about the same time period, more than 1,000 carnivore-aircraft incidents were reported.

- WS studies to better understand birds' responses to approaching vehicles, such as cars and airplanes, found that birds could not avoid cars moving faster than 75 mph. Instead of adjusting their escape time to the car's speed, the birds only evaluated the distance between themselves and the vehicle.

- WS research with avian radar suggest that the tool may be useful for monitoring bird flock activity at airports, but less so for monitoring single, large birds, such as raptors.