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GIS and Wildlife Management Activities at Airports

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ABSTRACT

Wildlife observations collected over time at a US Air Force Base (AFB) have been visually displayed through Geographic Information System (GIS) technology. By continuing to expand upon the capabilities of GIS, USDA Wildlife Services has been able to manage the Seymour Johnson AFB airfield and surrounding areas in a practical manner. A Wildlife Hazard Assessment of the AFB used GIS to clearly display the location of birds and mammals observed on the airfield. Baseline themes of natural features (i.e. rivers, woodlands, etc.) were related to wildlife observations to determine areas requiring management. Additionally, GIS has been a useful tool to educate both military personnel and the public. Routine briefings of Aircrews, Supervisors of Flying, and Crew Chiefs have been beneficial in the military environment. Discussions concerning off-base attractants between the AFB and the city of Goldsboro have been enhanced through the use of GIS. This technology allows Seymour Johnson AFB to incorporate the long-term monitoring of bird strikes, species behavior, and natural resources into a visual display that allows audiences to better understand management as it pertains to wildlife hazards on airfields.

INTRODUCTION

Wildlife utilizes airfield environments because of the diverse natural and man-made habitats that provide food, water, and shelter. Much of this wildlife does not pose a hazard to air traffic safety; however, species such as blackbirds, waterfowl, gulls, deer, and foxes can exacerbate or directly pose hazards to air traffic safety. When habitat conditions are conducive for populations of birds and mammals to proliferate, the potential for strikes increases. Strikes between aircraft and wildlife can cause considerable monetary damage to aircraft and in some cases, the loss of aircraft and human life.

The United States Air Force (USAF) has taken a proactive stance toward establishing effective Bird/Wildlife Aircraft Strike Hazard (BASH) programs at their facilities worldwide. Accordingly, the Airfield Maintenance and Flight Safety Offices at Seymour Johnson Air Force Base (SJAFB) established a BASH program for the installation. From October 1998 through September 2001, 183 bird strikes occurred at SJAFB or to SJAFB aircraft. These bird strikes occurred in the pattern, on low level routes, at Dare County Bombing Range, and at other military bases. Many of the bird strikes did not result in damage; however, a bird strike involving a flock of Lesser Scaup in April 2001 resulted in almost $3 million in damage. This bird strike prompted SJAFB to seek additional help with their BASH program, and as a result, USDA Wildlife Services was contacted.

STUDY AREA

SJAFB is home to the 4th Fighter Wing (4FW) and the 916th Air Refueling Wing (ARW). The mission of the 4FW is to prepare and provide professional expeditionary air forces to fulfill any 4FW tasking…anytime, anywhere (SJAFB website, 2003). The 4FW was the first operational F-15E Strike Eagle Wing in the Air Force. SJAFB also is the home to the tenant 916th Air Refueling Wing (ARW). The 916th is the only Air Force Reserve wing in North Carolina. The peacetime mission of the Reserve wing is to train and support competent citizen airmen and to be ready to respond at a moment's notice to world-

wide operations. Nearly 200 full-time airmen provide continuity and training support for more than 550 traditional reservists from all over the state and places beyond.

SJAFB occupies 3,238 acres of land in the coastal plain of North Carolina. The base is 57 nautical miles from the Atlantic Coast and lies within the Atlantic Flyway waterfowl migration corridor. SJAFB terrain has elevations ranging from 60 to 110 feet above MSL. The base is in the Neuse River/Stoney Creek watershed, and a system of open ditches, covered concrete pipes, drop inlets, and catch basins has been incorporated into the drainage pattern. The base has 1,320 acres of improved ground cover, and the perennial vegetation cover is composed of common Bermuda grass, Kentucky 31 Fescue, Kobke (legume), Crabgrass (native), and White Dutch Clover. Semi-improved grounds cover 655 acres. The semi-improved ground around the runway is mowed between 7 and 14 inches. Vegetation on these grounds consists of Bermuda grass, Tall Fescue, Lespedeza, White Clover, and Crabgrass. Approximately 485 acres of the base are unimproved grounds. The majority of cover consists of wood cover from native hardwoods (primarily oak) and soft pines (SJAFB, 2003).

The habitat surrounding SJAFB consists of agricultural fields, rivers, ponds, forest, and wetlands. The city of Goldsboro, where SJAFB resides, operates a wastewater treatment facility off the approach end of the runway adjacent to the Neuse River. The facility has several holding ponds that are 5 feet deep and cover 177 acres. In addition to the ponds, a wetland was recently established 1.5 miles northwest of SJAFB. The 40-acre wetland site has 4 ponds that have been planted with wetland vegetation. The water level is between one and three feet in most places (SJAFB, 2003).

Methods

Wildlife Services conducts comprehensive ecological surveys (assessments) of wildlife populations, their associated habitats, and wildlife attractants found on airport facilities and in surrounding areas. This process is referred to as a Wildlife Hazard Assessment (WHA) and follows methods published in an internal agency manual (USDA 1998). The methods are a combination of qualitative and quantitative techniques commonly used by natural resource professionals in the areas of wildlife biology and wildlife management. Through analysis of collected data, the WHA process seeks to identify the species composition and behaviors of wildlife over time (daily and seasonally) and the geographic occurrence of these factors as they relate to aviation safety at the site.

A standardized sampling design modeled after the U.S. Fish and Wildlife Service Breeding Bird Survey was used to assess species occurrence, location, and frequency of bird species relative to the airfield and aircraft movements on a seasonal basis. The survey design at SJAFB contains 10 individual observation points located throughout the airfield environment. The surveys were conducted on a weekly basis for the first twelve months and bi-weekly thereafter. During each survey, the observer recorded the time of day, species present, the number of each species observed, activity, cover type, and grid number at each of the 10 sample points.

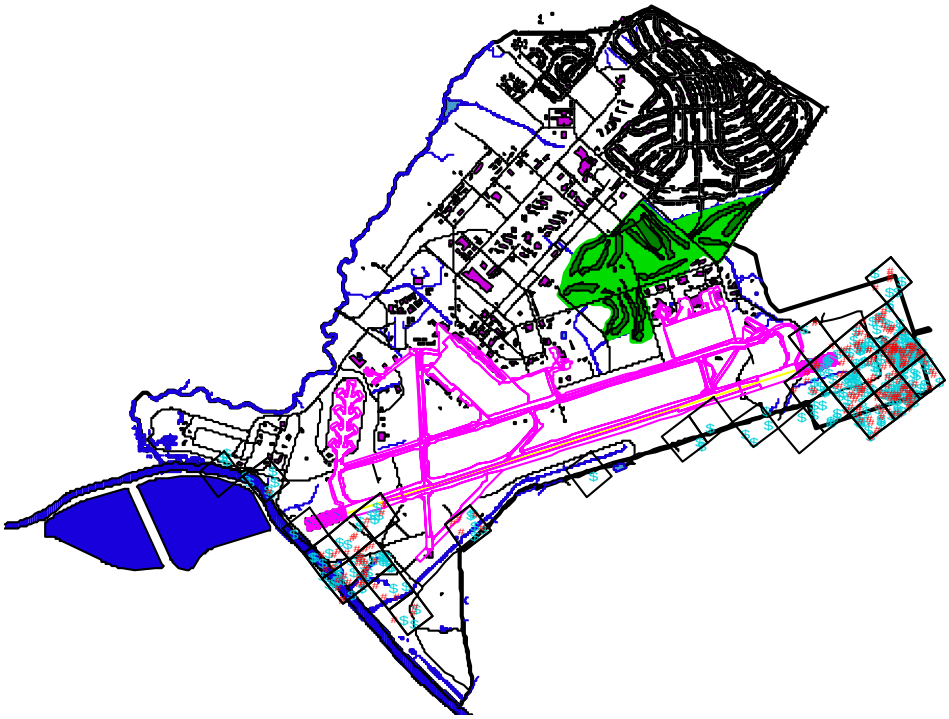
To enhance statistical analysis of the collected survey data, Geographic Information System (GIS) technology was implemented to visually display wildlife observations. The GIS Specialist at SJAFB created maps for the USDA Wildlife Services biologist by adding shape files of the runway system, buildings, rivers, ponds, and agricultural fields. A grid system also was overlaid on the map. In addition, multiple databases were imported into the program so that many different aspects of the WHA could be displayed.

Results

GIS displayed the distribution of all observed birds on the airfield (Figure 1).

Figure 1. All bird species observed on Seymour Johnson Air Force Base between November 2001 and October 2002.

GIS also showed the distribution of mammals on the airfield and allowed viewers to easily distinguish between mammals that pose a greater hazard to human and aircraft safety at SJAFB (white-tailed deer) compared to those whose hazard to aircraft is not as great (opossums, foxes, etc.) (Figure 2).



For more information on bird strikes visit
http://www.birdstrikecanada.com/ and http://wildlifedamage.unl.edu

Figure 2. White-tailed deer (red dots) and other mammals (blue triangles) observed on Seymour Johnson Air Force Base between November 2001 and October 2002.

Groups of birds with similar familial and/or genus relationships and behavioral attributes were selected and plotted in GIS, and this information was used to determine management strategies on the airfield (Figure 3).

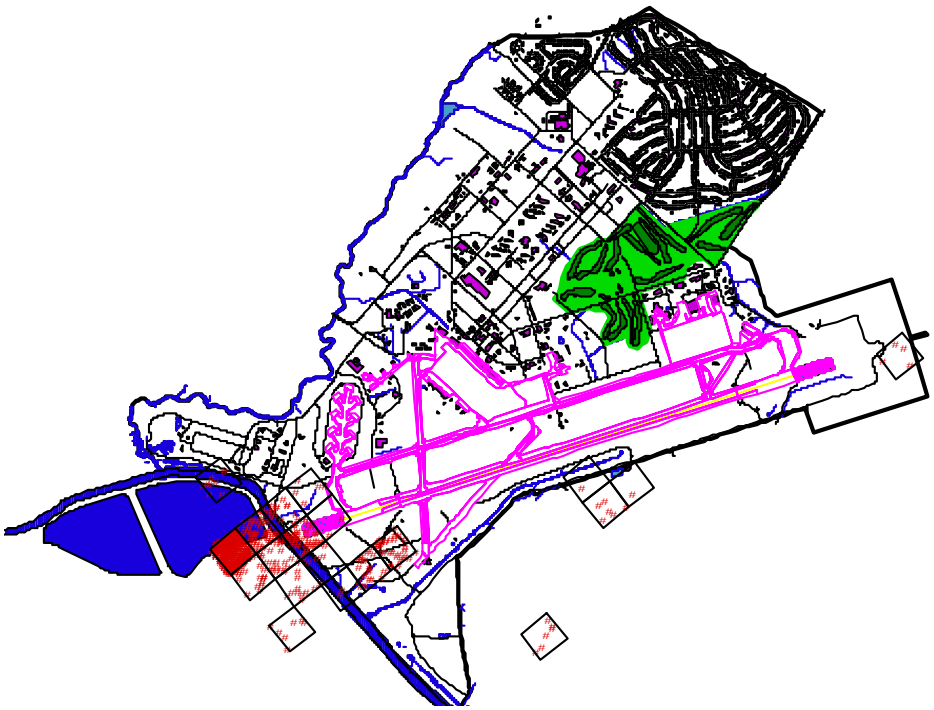


Figure 3. Location of waterfowl on Seymour Johnson Air Force Base between November 2001 and October 2002.

Discussion

The mission of the 4FW is to prepare individuals to fulfill any tasking that comes their way. In order for aircrews to fulfill their mission, they must be able to fly, and they must be able to fly safely. This requires both military personnel and USDA Wildlife Services to delicately balance wildlife and aircraft safety. Often times aircrews are faced with the prospect of not flying or having an ineffective sortie due to a large flock of birds flying over the base, or it may be a single Bald Eagle flying over the approach of the runway. By understanding the wildlife species that exist in the airfield environment, their abundance, their seasonal variation, and the habitat that they are attracted to, it becomes easier to determine which species pose the greatest hazards to aircraft safety and which habitat needs to be modified.

GIS offers a visual perspective of the seasonal trends of wildlife abundance on the airfield. This, in turn, can further assist military and USDA Wildlife Services personnel in defining Phase I and Phase II (the phases define the time of year when bird activity is generally low compared to when there is an increased threat of bird strikes due to excessive bird activity) times of the year. With this added knowledge, the number of bird strikes has the potential to be reduced. At SJAFB, GIS maps were referred to when determining which wildlife activity constituted Phase I and Phase II. During the periods when tens of thousands of blackbirds were known to fly over the base, Phase II was initiated. During months when the GIS maps showed minimal bird abundance and activity, Phase I was initiated.

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GIS has enhanced the effectiveness of the BASH program at SJAFB. By looking at the GIS maps after the birds or mammals have been plotted, SJAFB personnel can visually identify the areas on the airfield that are attractive to wildlife. These maps have then been taken to briefings with Airfield Maintenance, Civil Engineering, and other relevant Air Force personnel to mitigate wildlife attractants on the airfield. These maps also have been used to assist with wildlife-related discussions between landowners and base personnel. And since encroachment has become an issue at SJAFB, these maps can be used to assist with understanding the possible risks associated with the increasing pressure to develop land near the airfield.

Rapidly increasing wildlife populations and increasing air traffic are just two of the factors that contribute to the realization that the number of wildlife strikes are likely to increase. Despite this, however, damage and loss of life from wildlife strikes can be minimized (Wright and Dolbeer, 2000). Successful reduction of wildlife hazards at airports requires the integration of several management tools to minimize the attractiveness of habitat, modify the behavior of hazardous species, and reduce the populations of some of these species (Sprague and Kendrot, 2001). GIS utilization can be a first step to accomplishing these goals by allowing individuals to track changing wildlife hazards so efforts to reduce the risk of wildlife strikes can provide the greatest benefits.

Acknowledgements

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