Wildlife Disease Studies at Patuxent

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The study of wildlife diseases has always been part of the mission of the Patuxent Wildlife Research Center (Patuxent), in Laurel, MD. Indeed, when the original lands were being chosen and developed, personnel of the U.S. Department of Agriculture, Bureau of Animal Industry, Pathological Division, criticized the location of the facility. They believed that establishment of a wildlife demonstration and research area by the Bureau of Biological Survey in the vicinity of the planned Beltsville Agricultural Research Center could lead to a disease hazard (Morley, 1948, p. 4). Dr. Leland C. Morley, a veterinarian by training, was the first superintendent of Patuxent Research Refuge. Dr. Morley's appointment and his move into the refuge's first offices (and residence), known as the Log Cabin, occurred 7 months before President Franklin D. Roosevelt signed Executive Order No. 7514 on December 16, 1936, officially establishing the Patuxent Research Refuge. The Log Cabin residence had been acquired by the Federal government in April 1936.

The first captive wildlife research flock was established in the spring of 1936, predating the official opening of Patuxent. This flock consisted of northern bobwhite (*Colinus virginianus*), which were received from the Section of Disease Control of the University of Maryland, demonstrating that the cooperative ties between Patuxent and the university date back to the earliest days of Patuxent. These quail were used in the first experimental work done at Patuxent by biologist Phoebe Knappen (Morley, 1948, p. 17), who studied the acceptability and toxicity of various natural seeds and berries that were considered at the time to be important quail food. The first Patuxent publication about wildlife disease—"Diseases of Upland Game Birds (part 5)" by J.E. Shillinger and L.C. Morley (1941), published in "Game Breeder and Sportsman"—resulted partly from quail studies. This paper was followed by U.S. Fish and Wildlife Service (USFWS) Bulletin 21, "Diseases of Upland Game Birds," also by Shillinger and Morley (1942).

With the help of the Civilian Conservation Corps (CCC), kennels with litter boxes were constructed to house fur-bearing animals for disease research. Thirty foxes and an unspecified number of ferrets and mink were acquired for this work (Morley, 1948, p. 17). In 1938, Phoebe Knappen and Franklin H. May, an employee of the Section of Food Habits of the Department of Agriculture, studied the effects of orchard sprays on birds (Morley, 1948, p. 29). By this time, a Section of Disease Control had been established at Patuxent, and experimental facilities for this section were expanded. Also in 1938, Dr. Morley hired two additional veterinarians, Dr. Don R. Coburn (who started September 21, 1938) and Dr. William H. Armstrong (who started October 17, 1938). In 1942, Patuxent published five papers with either Dr. Coburn or Dr. Armstrong as the lead author. The subjects of these early research papers ranged from *Salmonella* in muskrats (*Ondatra zibethicus*) (Armstrong, 1942) and chinchillas (*Chinchilla* sp.) (Coburn and others, 1942) to canine distemper in a zoological park (Armstrong and Anthony, 1942).

In 1939, funds were requested for construction of a barn and greenhouse, but it was decided instead to build a laboratory for Patuxent's newly named Unit of Disease Investigations. Because the original intent had been to build a barn, the architect, Munk Pederson, designed the building to appear plain and barn-like. This is why Henshaw Laboratory was set into the hillside with a second-story entrance on one side and a first-floor entrance on the other. The new building included a large greenhouse that was used for other nondisease studies. The building remains plain in appearance, with small windows and doors, and is more barn-like than Nelson and Merriam Laboratories, whose architecture is more ornate (Morley, 1948, p. 30).

The Unit of Disease Investigations employed the following people in the early days of Patuxent:

Personnel	Position	Dates of employment
William H. Armstrong	Veterinarian	10/17/38–8/7/42
Helen M. Churchill	Bacteriologist	10/8/42–3/31/45
Don R. Coburn	Veterinarian	9/21/38–?
Phoebe Knappen	Biologist	7/1/40–6/28/42
Erling Quartrop	Veterinarian	4/28/45–6/29/46
Psyche W. Wetmore	Bacteriologist	6/1/39–7/23/42
Ralph B. Nestler	Biologist	6/1/42–?

Lumber for construction of this building and all early buildings, except Merriam Laboratory, came from two sawmills set up on Patuxent property to process trees harvested from the site of Cash Lake and downed timber along the Patuxent River bottomlands. The Patuxent sawmills were so effective that some wood was harvested and shipped to Washington, D.C., for construction projects there (Morley, 1948, p. 33). The sand and gravel used in the cement for all construction came from an open gravel pit at Patuxent.

Seventeen papers on wildlife diseases—eight on mammalian wildlife diseases and nine on avian wildlife diseases—were published by Patuxent authors during 1942–49. Arnold L. Nelson, Director of the Patuxent Research Refuge, described the work of the Wildlife Pathology Laboratory in the Bulletin for Medical Research in 1959. He said that Patuxent scientists had been working to identify diseases of wildlife and the agents causing the diseases, and indicated that "Little information exists however, on pathology, significance of disease-causing organisms on the welfare of the host, mechanisms of infection and spread, relationship between wildlife diseases and environmental stress and methods by which an effective attack can be launched to control disease" (Nelson, 1959). He described studies of Canada goose (*Branta canadensis*) mortality resulting from gizzard worms at Pea Island National Wildlife Refuge in North Carolina. Patuxent scientists also were studying diseases of waterfowl, especially aspergillosis, the diseases of icteric birds (blackbirds), and the relations of stress factors to infectious diseases and parasite infestation during the 1950s (Nelson, 1959). Trichomoniasis in mourning doves (*Zenaida macroura*) also was being studied, with an emphasis on mode of infection and immunity factors (Nelson, 1959).

Nelson acknowledged that the study of mammalian diseases was much more limited. He mentioned two ongoing studies, one on the parasites found on mammals at the Patuxent Research Refuge and the other on distemper in wild mammals (Nelson, 1959). Also at this time, staff at the Walter Reed Army Institute of Research in Silver Spring, MD, were studying wildlife diseases that were considered zoonotic—that is, diseases that spread between animals and humans. This work was conducted at Fort George G. Meade Army Post, on land that is now part of Patuxent Research Refuge. Patuxent scientists published 36 papers on wildlife diseases in the 1950s; 15 of these were on mammalian diseases and 21 were on avian diseases.

Diseases caused by toxicological agents, namely pesticides, became an area of concern for wildlife populations in the 1940s, and Patuxent began studies at that time. The program increased in scope under the leadership of Dr. John L. Buckley, Patuxent's director from 1959 until 1963, and was renamed the Environmental Contaminants Research Program to distinguish it from the study of wildlife diseases caused by other agents. More emphasis was placed on statistically rigorous controlled experiments. In 1962, the bestselling book "Silent Spring" by Rachel Carson (Carson, 1962) highlighted this type of threat to wildlife. In 1963, Secretary of the Interior Stewart Udall dedicated a new building at Patuxent, named the "Biochemistry and Wildlife Pathology Laboratory" to indicate its dual role. The building housed state-of-the-art necropsy facilities to further the study of wildlife diseases.

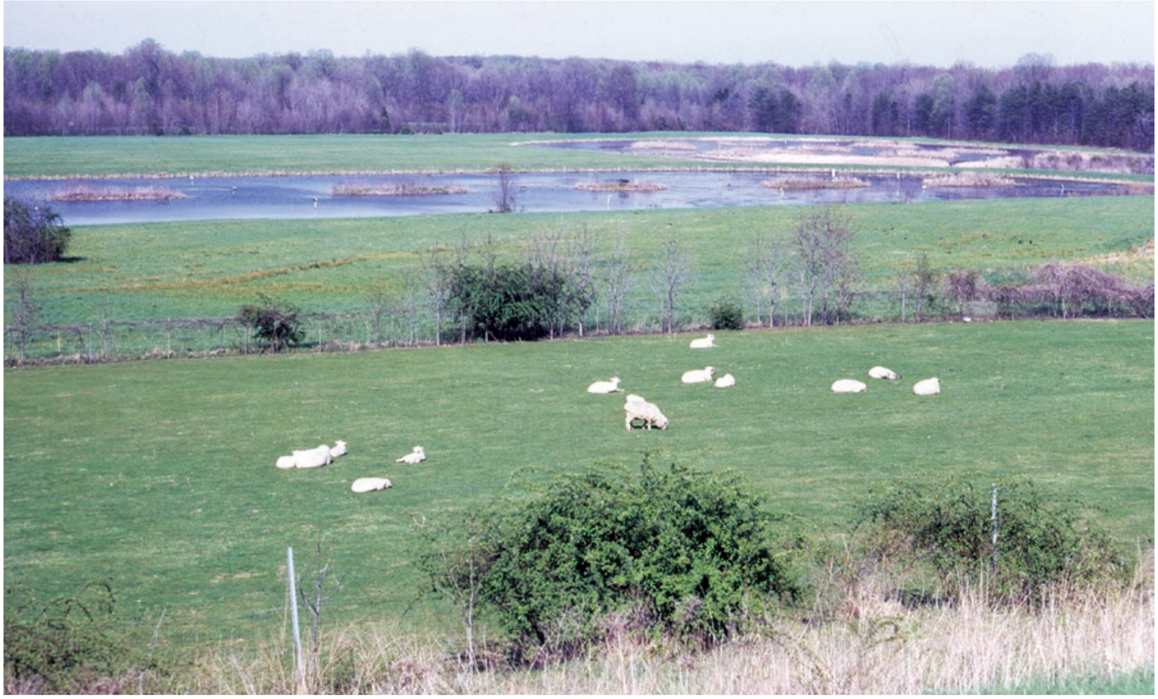
The study of lead poisoning in waterfowl also was begun in the 1960s. Louis N. Locke and George E. Bagley (1967) published the first report from Patuxent on lead poisoning, "Coccidioses and lead poisoning in Canada geese," in the journal "Chesapeake Science." The study of lead toxicity in wildlife continued (Heinz, 2016) with more recent work by Nimish Vyas, who studied lead poisoning in passerines from skeet shooting ranges in the early years of the 21st century (Vyas and others, 2000). In 1969, Locke and others (1969) published another important lead study that identified lead poisoning as a mortality factor in condors. This work was conducted at Patuxent by using captive Andean condors (*Vultur gryphus*) as a surrogate for the endangered California condor (*Gymnogyps californianus*).

Another development in the 1960s that had a large effect on wildlife disease studies at Patuxent was the establishment of an endangered species research program that included not only field research, but captive breeding programs for at least eight species, including masked bobwhite (*Colinus virginianus ridgwayi*), bald eagles (*Haliaeetus leucocephalus*), Mississippi sandhill cranes (*Grus canadensis pulla*), whooping cranes (*Grus americana*), and Puerto Rican parrots (*Amazona vittata*) in addition to the Andean condors.

Also in the 1960s, the role of parasites as disease agents in wildlife began to receive greater emphasis in Patuxent research (Herman, 1966). Carlton Herman, a parasitologist, eventually became leader of the Wildlife Disease Section, as it was called in the 1960s–70s. Richard Kocan, another parasitologist, worked on trichomoniasis in mourning doves (Kocan, 1971), and Barry Tarshis, Herman, and Kocan worked on the relation of black flies (*Simulium nigricoxum*) and leucocytozoon infestations (Tarshis and Herman, 1965; Kocan, 1968a, 1968b; Kocan and Barrow, 1968; Herman, 1969b).

In the 1960s, Patuxent scientists produced a total of 67 wildlife-disease-centered publications—52 on avian species, 8 on mammalian species, and 7 on the general topic of wildlife disease. Included among these publications is the chapter by Herman on "Bird-borne Diseases in Man" (Herman, 1969a) in the first comprehensive veterinary textbook on pet birds, "Diseases of Cage and Avian Birds," edited by Margaret L. Petrak (1969). Other notable wildlife disease research included work on viruses that cause eastern equine encephalitis and myxovirus in deer plus duck viral enteritis (duck plague).

The start of the Endangered Species Program caused a shift in emphasis in the study of wildlife diseases owing to the presence of live animals in pens at Patuxent for long-term (10 or more years) rather than periodic (1–3 years) research studies. Starting in 1970, a veterinary hospital was located in a double-wide trailer on a dead-end road off the loop road in the endangered species area. A veterinarian was hired to manage the clinical care of the endangered species. James Brown, the



Domestic sheep maintained at Patuxent Wildlife Research Center, Laurel, MD, for disease studies, 1972. Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.

first veterinarian to work in this position, was followed by James Carpenter, who came in 1975. Louis Sileo (1976–83) and Louis Locke worked at the Patuxent environmental contaminants research laboratory. Sileo and others (1983) reported on a die-off of captive kestrels at Patuxent attributed to hemorrhagic enteritis and hepatitis.

In 1975, wildlife disease study at Patuxent experienced a major shift. A new laboratory to study wildlife diseases, the National Wildlife Health Center, was established in Madison, WI, as part of the efforts of the USFWS (later U.S. Geological Survey [USGS]) to better diagnose and fight disease outbreaks at wildlife refuges across the country. Over the next two decades, many Patuxent staff members migrated to this new laboratory, and general wildlife disease research at Patuxent ended, though research on wildlife diseases caused by environmental contaminants and those affecting endangered species continued.

In the 1970s, the number of publications fell precipitously as a result of the move of many members of the wildlife disease research staff from Patuxent to Madison. From 1970 through 1974 (before the move), 38 papers were published—33 on avian wildlife disease studies and 5 on general wildlife disease subjects. From 1975 through 1979, only 13 papers were published—3 on mammalian diseases and 10 on avian diseases. This decrease in the number of publications on wildlife diseases demonstrates more than anything else the shift in program emphasis on wildlife disease research away from Patuxent. Wildlife disease publications during the 1970s included 43 on avian disease, 3 on mammalian disease, and 5 on the general topic of wildlife diseases, for a total of 51 papers; however, papers continued to be published on trichomoniasis (Kocan, 1971) and plasmodium (Kocan and Perry, 1976) infections. Several papers were published on avian cholera (Locke and Banks, 1972; Locke and others, 1972). Several publications in the latter half of the 1970s

Dan Day and Glenn Olsen, U.S. Fish and Wildlife Service, inspecting a sandhill crane in the old trailer veterinary hospital at Patuxent Wildlife Research Center, Laurel, MD, 1988. Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.

Jane Chandler and Glenn Olsen, U.S. Geological Survey, inspecting a whooping crane in new veterinary hospital at Patuxent Wildlife Research Center, Laurel, MD, 1996. Photo by U.S. Geological Survey.

about parasites in cranes (Forrester and others, 1978; Carpenter and others, 1979) and endangered black-footed ferrets (*Mustela nigripes*) (Carpenter and Novilla, 1977; Carpenter and others, 1976) demonstrate the shift toward wildlife disease studies involving the captive endangered species colonies at Patuxent.

Wildlife disease studies at Patuxent in the 1980s focused on two species, whooping cranes and gray wolves (*Canis lupus*). The whooping crane disease research focused on two diseases—disseminated visceral coccidiosis, which occurs naturally in cranes, but was seen in increased numbers because of captive rearing (Carpenter and Novilla, 1980; Carpenter and others, 1980; Novilla and others, 1981; Carpenter and others, 1984); and eastern equine encephalitis, which developed suddenly in 1984, killing seven whooping cranes (Carpenter and others, 1985; Carpenter and others, 1986; Dein and others, 1986). Dr. L. David Mech was hired to manage the endangered species Minnesota field station working with gray wolves. He was a former graduate student of Durward Allen, a Patuxent wildlife research biologist in the 1940s, who had moved on to Purdue University of Indiana. Mech, in his wolf research, collaborated with Ulysses S. Seal (Veterans Administration Medical Center, Minneapolis, MN) and others about disease research and immobilization techniques (Mech and others, 1984, 1985, 1986; Kreeger and others, 1987).

Additions to the Patuxent research staff in the 1980s included Chris Franson (1979–84), a veterinarian, who worked with the environmental contaminants program. Joshua Dein (1984–87) joined the Patuxent Endangered Species Program as a veterinarian and helped develop the first institutional animal care and use committee. When Dein and Franson departed to join the staff at the USGS National Wildlife Health Center, Glenn H. Olsen was hired (1987–present [2016]) to work in clinical veterinary medicine (50 percent) and research (50 percent). Beginning in the late 1980s, Olsen and Carpenter planned and drafted the blueprints for a new Patuxent Veterinary Hospital that opened on December 3, 1994; it was partly funded by Baltimore Gas and Electric Company.

Published papers on wildlife diseases in the 1980s totaled 39—25 on avian diseases and 14 on mammalian diseases. Patuxent also hired a nutritionist, John A. Serafin (1980–82), who worked with the Endangered Species Program and published several papers on nutritional diseases (Serafin, 1981, 1982, 1983).

The 1990s was a decade of changes for Patuxent and certainly for wildlife disease research. In 1994, Patuxent joined the National Biological Survey and gained several field stations. From a wildlife disease standpoint, the most important of these was arguably a former National Park Service field station colocated at the University of Rhode Island in Kingston. Howard S. Ginsberg (1994–present [2016]), a medical entomologist, joined Patuxent at this field station. In 1990, Dr. Carpenter left Patuxent for Kansas State University. In 1991, Patrice N. Klein (1991–95) was hired as a veterinarian to work in pathology and clinical medicine. In October 1996, Patuxent joined the USGS. In 1994, a new veterinary hospital was opened in a 3,000-square-foot building 0.2 miles west of Gabrielson Laboratory. In addition to serving the needs of Patuxent's captive wildlife, the facility has been used for many research projects.

Forty-one papers that originated at Patuxent were published on wildlife diseases from 1990 to 1999—19 on avian diseases, 9 on mammalian diseases, 12 on general wildlife diseases, and 1 on diseases of turtles. During this decade, Patuxent initiated a more intensive monitoring and research program involving reptiles and amphibians and published one paper on shell diseases in turtles (Lovich and others, 1996). Other important publications include a paper on mycotoxin-related epizootic disease in the captive crane colony (Olsen

Thom Lewis and James Carpenter, U.S. Fish and Wildlife Service, force feed with gavage a sandhill crane, Patuxent Wildlife Research Center, Laurel, MD, 1981. Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.

and others, 1995); several papers on Lyme disease; and a book, “Ecology and Environmental Management of Lyme Disease,” edited by Howard S. Ginsberg (1993). Papers on wildlife diseases in endangered species, primarily wolves and cranes, continued to predominate, along with those on Lyme disease. Several papers were published on new techniques that would be used in future programs (Olsen and others, 1990; Olsen, 1999). One techniques paper on surgically implanting radio transmitters in ducks (Olsen and others, 1992) led to the development of an entirely new method of research on duck populations, especially far-ranging seaducks (Olsen and others, 2005).

In the first decade of the 21st century, research on wildlife diseases continued at Patuxent and at field locations around the world. Since 2005, the veterinary staff has been actively involved with implanting platform transmitting terminals (PTTs), also called satellite radio transmitters. Most of this work has been in support of various projects funded by the Sea Duck Joint Venture, a multiagency group supporting seaduck conservation, but some work has involved learning more about the habits of seaducks in relation to licensing of sites for offshore wind energy. Another important area of study with implant and backpack PTTs has been a project on avian influenza in Eurasia and Africa, and the potential for this disease to be transmitted by migrating waterfowl (Prosser and others, 2011).

Another emerging disease of this decade (2000–10) was West Nile virus, and Patuxent researchers were active in this area, studying the vectors of transmission (Ginsburg, 1993), the effect of the virus on endangered species, and possible methods for prevention through vaccination (Olsen and others, 2009).

Patuxent has had a long and distinguished history of research on diseases of wildlife. Although much of the leading role in this area changed owing to the formation of the National Wildlife Health Center, Madison, WI, Patuxent still (2016) does major investigations dealing with disease, especially in regard to diseases of the Patuxent captive colonies of endangered species and other wildlife. Patuxent veterinarians maintain close contact with the veterinarians at the Health Center and collaborate on many field studies that focus on diseases.

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Red fox (*Vulpes vulpes*) in pen, Patuxent Research Refuge, Laurel, MD, 1972. Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.

Urban Wildlife Research at Patuxent

Lowell W. Adams

Introduction

Urban wildlife research at Patuxent Wildlife Research Center (Patuxent) has spanned the last 50 years of Patuxent's 80-year history (1936–2016). Urban research dealt with birds, mammals, reptiles, invertebrates, wetlands, stream ecology, contaminants, diseases, and parasites. The U.S. Fish and Wildlife Service (USFWS) officially established an urban wildlife research program in June 1972 (Geis, 1981). The program focused on birds and was headed by Dr. Aelred D. Geis at Patuxent's central campus in Laurel, MD. In this chapter, I present a review of urban wildlife research conducted by Dr. Geis and other investigators at Patuxent's central campus and its various field stations.

Birds

Early research conducted by Dr. Geis dealt with changes in the bird community as the planned development of the town of Columbia, MD, was underway. From 1966 to 1971, he conducted breeding and wintering bird surveys at Town Center and in the Village of Wilde Lake (Geis, 1974a, 1974b, 1976). During the breeding season, the number of birds of species associated with farmland and field habitat declined. Birds in this category included northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaida macroura*), eastern meadowlark (*Sturnella magna*), red-winged blackbird (*Agelaius phoeniceus*), and grasshopper sparrow (*Ammodramus savannarum*). Numbers of wood thrush (*Hylocichla mustelina*) (woodland species) and indigo bunting (*Passerina cyanea*) (edge species) also declined. Birds whose numbers increased during this period included northern mockingbird (*Mimus polyglottos*), chipping sparrow (*Spizella passerina*), song sparrow (*Melospiza melodia*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and house wren (*Troglodytes aedon*). The number of northern cardinals (*Cardinalis cardinalis*) did not change.

In Columbia, housing type affected species composition and bird density (Geis, 1974a, 1974b, 1976). Detached houses with lots on which some of the original trees had been retained had the most varied species composition. Bird diversity declined in more intensely developed areas characterized by townhouses and apartments. Townhouse and apartment complexes, however, showed the greatest bird density, consisting mostly of house sparrows and European starlings. Geis (1974a, 1974b, 1976) observed that starlings and house sparrows were related to building design and quality of construction. Unboxed eaves provided small openings beneath house roofs that birds used for nesting sites (fig. 1), and widely louvered air vents and latticework used to camouflage air-conditioning units at apartment buildings provided attractive nesting sites for starlings and house sparrows.

Also in Columbia, Geis and his colleagues compared two methods for counting birds in urban areas (DeGraaf and others, 1991)—point counts and transect counts. They reported that transects centered on roads through residential developments and divided into 300- × 300-foot (ft) plots for recording data reduced many of the problems associated with counting birds in urban areas, such as varying noise and visibility.

Figure 1. Bird nest in a house eave, Columbia, MD. Unboxed eaves provided small openings beneath house roofs in which birds could build nests. Photo by Aelred D. Geis, U.S. Fish and Wildlife Service.

Because 80 percent of bird observations were recorded in the first 4 minutes of sampling, they concluded that 4 minutes per plot was a reasonable time limit (DeGraaf and others, 1991).

Geis (1980a) surveyed breeding and wintering birds at Cylburn Park in Baltimore, MD, before construction of adjacent Coldspring Town. The 174-acre park was a natural area containing a large forest tract in an urban setting. Coldspring Town was planned as a high-density residential area (10 dwelling units per acre). In addition to Cylburn Park and predevelopment Coldspring Town, Geis (1980a) surveyed a nearby mature residential area of detached and two-family attached housing with scattered native trees and an abundance of mature shrubbery during 1974–76. Buildings ranged from 25 to 60 years old. Geis (1980a) reported the greatest density of birds and the smallest number of species in the mature residential area. In contrast, the mature forest of Cylburn Park had the lowest density of birds and the largest number of species (33, compared with 22 in the mature residential area).

In the 1970s, Geis addressed questions related to bird feeding. He focused research efforts on the seeds birds liked to eat and, therefore, the most efficient way for people to feed birds. From 1977 to 1979, volunteers recorded more than 179,000 bird visits and food consumption at experimental feeders near their homes (Geis, 1980b; fig. 2). Geis reported that the small oil sunflower seed and white proso millet were preferred by birds under Maryland conditions. The large, black-striped sunflower seed, at the time the traditionally used sunflower seed for feeding birds, also was reported to be preferred. Many seeds in wild bird mixes sold on the market, including wheat, milo, peanut hearts, hulled oats, and rice, however, were generally unattractive to birds. Feeding preferences differed by species. Nevertheless, on the basis of Geis's work, oil sunflower and white proso millet became widely popular seeds for feeding birds. At the time, oil sunflower seeds were not marketed as birdseed. Geis's work created public demand, and he played a role in convincing the seed industry to make oil sunflower seeds available as birdseed. Geis's research report was in high demand by the public and was distributed widely as a USFWS Special Scientific Report (Geis, 1980b).

Patuxent biologists completed some urban bird research before establishment of the urban wildlife research program mentioned above. Linehan and others (1967) reported early results from an ecological study of urban woodlots in Delaware initiated in 1964. These investigators studied birds in nine woodlots during the breeding seasons of 1966 and 1967. Woodlot sizes ranged from 2 to 36 acres. Fifty-three species were recorded. Of 27 species common in the woodlots, only 13 were considered true forest birds. Many were edge species that could make use of the considerable amount of edge habitat associated with the small woodlots. Linehan and others (1967) observed that red-eyed vireo (*Vireo olivaceus*)

Figure 2. Bird-feeding station, Howard County, MD, 1980—one of the sites where birdseed was tested. Photo by Lowell W. Adams, Urban Wildlife Research Center, Columbia, MD.

breeding density was positively related to woodlot size. The red-eyed vireo was 1 of 21 species later identified by Darr and others (1998) and other researchers as an "area-sensitive" species whose probability of occurrence increases with the size of unfragmented forested areas. Of the 21 principal species recorded in the Delaware urban woodlots, only 4—wood thrush, red-eyed vireo, red-bellied woodpecker (*Melanerpes carolinus*), and eastern wood-pewee (*Contopus virens*)—were classified as area sensitive by Darr and others (1998). The small Delaware woodlots lacked woodland warblers and tanagers, along with vireos and other forest interior species that require larger forested tracts to breed and nest successfully. Nevertheless, the Delaware urban woodlots provided habitat for many birds. Linehan and others (1967) concluded, "Very dense populations of a large variety of breeding birds are found in urban woodlots of 20 or more acres which have adequate shrub understory, mature and dead standing trees, and vegetative edge types that are of sufficient width and proper quality." Results of additional work conducted in Delaware urban-suburban woodlots were reported by Jones and others (1966), Longcore and others (1966), and West and others (1966).

Patuxent researchers studied a black-crowned night heron (*Nycticorax nycticorax*) nesting colony in the Patapsco River estuary of Baltimore Harbor, MD, during May–July 1988 (Erwin and others, 1990, 1991). The colony consisted of more than 300 nesting pairs, and researchers were interested in determining whether or not birds avoided using contaminated areas of the urban estuarine environment as feeding sites. Flight directions of birds from the nesting colony were documented, and some birds were followed with aircraft and small boats. More birds appeared to fly west and northwest toward Baltimore than to other areas when leaving the colony on foraging flights, although results were not statistically significant. Areas west and north of the nesting colony were more heavily developed than areas to the east and south. Researchers speculated that city lights might have attracted small fish, crabs, and invertebrates, which, in turn, attracted the herons. Black-crowned night herons that feed in contaminated urban-suburban environments may not as a result experience direct threats to their survival or reproductive success (Rattner and others, 2000), but access to high-quality, uncontaminated wetlands with a large prey base probably could better sustain colonial wading bird populations.

Sparling and others (2007) studied nesting success and foraging behavior of red-winged blackbirds in stormwater wetlands in metropolitan areas. Such wetlands are constructed to manage stormwater runoff from developed sites following rain events. Controlling stormwater is required by law in many jurisdictions. Sparling and his colleagues focused on stormwater retention wetlands draining residential, commercial, and highway sites. These investigators studied birds at 12 stormwater retention wetlands in Prince George's, Howard, and Anne Arundel Counties, MD, during 1993–94. They noted no significant differences in nest success among the wetland types. Number of nests was positively correlated with percent of area occupied by cattail (*Typha* spp.), and nest success and foraging rates were similar to those reported for natural wetlands. Forty-seven species of birds were recorded, and investigators concluded that stormwater wetlands could provide suitable habitat for red-winged blackbirds and perhaps other species. Although constructed for stormwater control, wetland features can be designed to either attract or discourage wildlife use. Such features include size and shape of the wetland, side slope (steep or shallow), water depth, and percent of area occupied by cattails.

Monitoring wetland contaminants, particularly zinc and copper, in stormwater wetlands would provide more information about potential problems with contaminants. In a related study of the same sites, Sparling and others (2004) focused on contaminant exposure of nestling red-winged blackbirds. Investigators reported elevated concentrations of zinc and copper in wetland sediments and carcasses of 8-day-old chicks. Sediment zinc concentrations were negatively correlated with average red-winged blackbird clutch size, hatching success, fledgling success, and nest success. Overall, however, nest success was comparable to national averages. Additional study of this issue could yield important information that could be used to help educate the public about the benefits of controlling sedimentation rates and prevent wetland areas from becoming toxic sinks to wildlife.

Patuxent researchers also have studied the effect of urban light on birds. On the Hawaiian Island of Kauai, more than 1,000 fledgling seabirds of three species were attracted to coastal lights during autumn flights to the ocean (Telfer and others, 1987). All three species are either threatened or endangered. The birds, apparently on their first flight to the ocean, became disoriented and crashed into buildings, wires, vehicles, and other structures. The phenomenon has increased since the early 1960s as urban areas have grown and the number of high-intensity lights has increased. From 1978 to 1985, 11,767 Newell's shearwaters (*Puffinus auricularis newelli*), 38 dark-rumped petrels (*Pterodroma phaeopygia sandwichensis*), and 8 band-rumped storm-petrels (*Oceanodroma castro cryptoleucura*) were found downed—that is, either dead (8.6 percent) or still alive, but injured or stunned on the ground, unable to fly. The anomaly was most severe at river mouths near urban coastal areas. Apparently, young birds followed rivers from inland nesting grounds to the sea and became disoriented because of urban lights along the coast. Through a program established with public cooperation and government-run "aid stations," 90 percent of the downed birds were returned to the wild. Telfer and his colleagues reported that light shielding can reduce the problem, and some resort owners were convinced to turn off some of their decorative lights during the most critical period.

Other researchers at Patuxent described methodologies for reporting bird species richness and community structure. Using Breeding Bird Survey data (Sauer and others, 1997), Cam and others (2000) found significant negative correlations between bird species richness and urban land use in six physiographic regions of the Mid-Atlantic States (fig. 3).

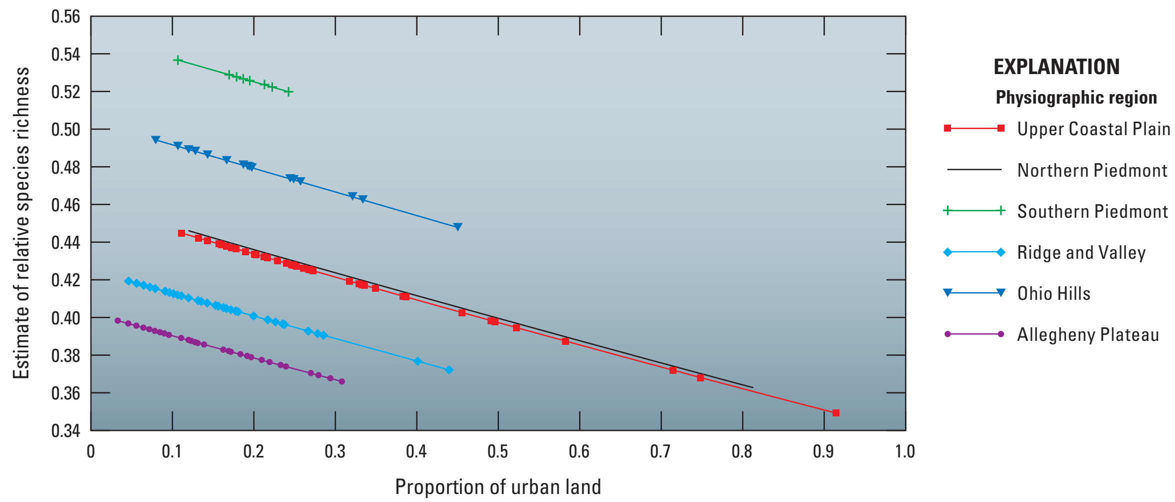

Figure 3. Relation between relative species richness and proportion of urban land (arcsine square-root transformed) by physiographic region. Relations were estimated by using a model. (Modified from Cam and others, 2000)

These investigators pointed out that local species richness may be affected by local and regional factors. They presented a method to estimate relative species richness that accounts for potential variation in species detection probability and allows flexibility in specification of a reference community. For example, it is not likely that all species are detected during sampling sessions. The defined species list ideally is derived from regional data, they noted, and a smaller regional pool might help to account for fewer species at a site.

Research at Patuxent has yielded conclusions about planning for and management of urban and urbanizing areas (Leedy and Geis, 1980; Geis 1986a, 1986b). Geis (1986a) reviewed the early history of the development of the planned community of Columbia, MD. In 1965, county zoning called for a minimum of 20 percent open space, a minimum of 15 percent low-density residential housing, and a maximum of 10 percent attached housing. Zoning was changed in 1973 to require a minimum of 30 percent open space, a minimum of 12 percent low-density residential housing, and a maximum of 12 percent attached housing. Less than a decade later, these regulations were changed again to require a minimum of 36 percent open space and a minimum of 10 percent low-density residential housing. Although these zoning changes were prompted by changes in housing demand, they also had ecological benefits. Geis (1986a) noted that many trees were preserved during development and that many more trees and shrubs were planted following development. In addition, the water areas (three lakes and many ponds) that were created benefited wildlife. These characteristics plus the large amount of open space retained after development were considered positive for wildlife populations. Geis (1986a) noted, however, that originally there was no plan to manage open space. It was simply mowed on a regular basis (fig. 4), providing little wildlife habitat. He suggested that the open space could be managed to enhance both wildlife habitat and public wildlife viewing opportunities. He also noted that building design and construction characteristics in some areas allowed populations of European starlings, house sparrows, and common pigeons (*Columba livia*) to increase, often causing nuisance situations for residents.

Figure 4. Early residential development and open space in Columbia, MD. Geis (1986b) noted that open space could be managed to enhance wildlife habitat and public wildlife viewing opportunities. Photo by Aelred D. Geis, U.S. Fish and Wildlife Service.

Geis (1986b) pointed out that the amount of woody vegetation retained during development and planted after development was the most important factor for the well-being of birds in Columbia. In Europe, he noted, although many areas are intensively manicured near buildings, a hedge is used to separate these areas from less intensively managed areas that are infrequently mowed. He argued that managing open space to include meadow habitat and reduce the amount of regular mowing would provide better habitat that could be beneficial to bird populations.

Obrecht and others (1991) described a 1960 agreement between the USFWS and Potomac Electric Power Company (Washington, D.C.) for managing vegetation on a newly constructed electric transmission line right-of-way through the Patuxent property. A diverse shrub community that was allowed to develop on the right-of-way after construction provided habitat for wildlife. Management consisted of periodic removal of tall-growing tree species to avoid conflict with the overhead electric transmission lines, which was accomplished by selectively applying herbicide to the stems of each unwanted plant. The site effectively showed how right-of-way management can benefit wildlife in metropolitan areas.

Darr and others (1998) used forest breeding bird data in combination with county zoning and a woodland conservation ordinance to develop a forest conservation plan for the watershed of the Western Branch of the Patuxent River in Prince George's County, MD. These investigators were interested in developing a forest conservation plan that would benefit area-sensitive forest breeding birds that require large tracts of forest for successful nesting. Breeding birds were surveyed during the nesting seasons (late May–early July) of 1992 to 1994. Forest tracts were catalogued into seven size classes that ranged from 1.2 to 5 acres to greater than 1,236 acres. Twenty-one of the 100 bird species recorded were determined to be area sensitive. The researchers identified 22 forest tracts of a size that likely would support successfully nesting populations of area-sensitive birds and indicated that giving these areas priority for conservation efforts could have a desirable benefit. They concluded, "The resulting conservation plan will maintain and enhance breeding habitat for area-sensitive forest birds, while still allowing for additional development as human populations increase."

In the southern Piedmont Physiographic Province of the southeastern United States, human population growth was leading to increased conversion of rural, forested, and agricultural lands to urban and suburban areas. Conroy and others (2003) argued that this process leads to loss of "natural capital" in the form of biological diversity and ecosystem function. Although the resilience of ecosystems decreases with increasing human effects on the systems, humans evolved in these ecosystems and are dependent on them for sustaining human life. Conroy and others (2003) suggested that incorporating the concept of ecosystem and landscape resilience into the landscape-level decision-making process could lead to more effective decision making in the future. To incorporate this concept, the economic value of ecosystem services would need to be determined and factored into landscape-level urban and suburban planning.

Mammals

High white-tailed deer (*Odocoileus virginianus*) densities in many metropolitan areas throughout the United States have created human-deer conflict situations (Rudolph and others, 2000). Wildlife researchers have studied nonlethal methods of controlling urban deer density, and Dr. Brian Underwood of Patuxent's field station at the State University of New York College of Environmental Science and Forestry, Syracuse, has been involved with some of that work. He was a member of a team that evaluated immunocontraception for managing suburban white-tailed deer in Irondequoit, NY (a suburb of Rochester). During 1995–98, the team studied efforts required to treat female deer and assessed the utility of using immunocontraception to control growth of the deer population. The researchers reported that the effort to capture and mark deer and to administer follow-up treatment remotely with a dart gun was inversely related to deer density (Rudolph and others, 2000). Some deer were difficult to approach for treatment. Dr. Underwood and his colleagues concluded that the technique had the potential to hold suburban deer populations between 30 and 70 percent of ecological carrying capacity. This technique could be useful in localized populations where treatment involves 100 or fewer deer out of a total population of 200 or fewer animals (Rudolph and others, 2000).

Follow-up research in Irondequoit from 1997 to 2000 focused on using immunocontraception for managing deer on a local scale (2–4 square miles) (Porter and others, 2004). These investigators studied females only and reported that deer showed strong site fidelity. Annual survival was 64 percent, and the major cause of mortality was deer-vehicle collisions. Dispersal rates were less than 15 percent for yearling and adult deer. The study supported the idea of localized, neighborhood-scale management because of high site fidelity, as well as small home-range sizes and limited seasonal movement of the deer.

Reptiles

Ferebee and Henry (2008) studied the movement and distribution of the eastern box turtle (*Terrapene carolina*) in Rock Creek Park, Washington, D.C. The park is surrounded almost entirely by urban development and, at 1,754 acres, is one of the largest national parks in a major city in the United States. These investigators focused their work within a 37.6-acre study area in the northern section of the park during 2001–04. The population density of turtles (2.42–4.02 turtles per acre) was low when compared with that in nearby areas of Patuxent (20.75–22.25 turtles per acre) and Mason Neck National Wildlife Refuge, VA (25.62 turtles per acre). In Rock Creek Park, males outnumbered females 5.3:1. The researchers found no significant evidence of natural recruitment. The old-age structure, low recruitment, low productivity, low population density, removal as pets, and high potential for substantial road mortality, particularly for females, led these investigators to conclude that long-term survival of box turtles in the park was uncertain.

Invertebrates

Aliberti Lubertazzi and Ginsberg (2010) studied dragonfly diversity (Aeshnidae, Corduliidae, Gomphidae, and Libellulidae) at small wetlands along an urbanization gradient in Rhode Island. These investigators reported that diversity, species richness, and evenness did not change along the gradient, although relatively rare species generally were found at the rural end of the gradient.

Wetlands

Wetlands are important habitats for many wildlife species and provide other benefits, including groundwater recharge, flood storage, sediment retention, and water-quality enhancement. Unfortunately, by the mid-1980s in the 48 conterminous States of the United States, urbanization had caused the loss of 22 percent of saltwater wetlands and 6 percent of freshwater wetlands (Guntenspergen and Dunn, 1998). Many wetlands that had not been destroyed were altered and degraded. The distribution of water within the hydrologic cycle typically was altered with land development.

Syphax and Hammerschlag (1995) summarized the first efforts to restore freshwater tidal marshes in the Anacostia River of Washington, D.C. Tidal marshes historically were common along the river, and annual wildrice (*Zizania aquatica L.*) and other wetland plants were abundant. During the 1920s to 1940s, the U.S. Army Corps of Engineers dredged and channeled the Anacostia River from the Potomac River to Bladensburg, MD, to improve navigation. In 1940, the marshes at Kenilworth were dredged.

Reconstruction of 32 acres of emergent wetlands of the old Kenilworth marshes began in October 1992 with the addition of fill material to create a gradient of moist soils and water depth. Tidal channels were cut that approximated the original channels. In May 1993, 16 local native plant species were introduced. Hammerschlag and Krafft (2006) reported on 5 years of post-reconstruction monitoring of the 67-acre Kingman Marsh, one of four reconstructed wetlands of the Anacostia River. Vegetation establishment was initially strong but declined with grazing pressure from resident Canada geese (*Branta canadensis*). By 2004, only two of seven planted species remained. Efforts to control the size of the goose population by nonlethal means were unsuccessful.

A similar effect of resident Canada goose grazing on wetland plants was noted along the tidal marshes of the upper Patuxent River at Jug Bay near Upper Marlboro, MD (Haramis and Kearns, 2007). Through experimental use of fenced exclosures during 1999–2004, these investigators demonstrated striking growth of annual wildrice in areas where geese were denied access. Consequently, a goose reduction plan was implemented by addling eggs to reduce recruitment and opening areas to Maryland's September resident goose-hunting season to reduce population size. Approximately 1,700 geese were harvested during a 4-year period. These actions, along with fencing and planting, resulted in dramatic restoration of annual wildrice and other vegetation along a 6-mile- (mi) long section of the upper Patuxent River.

Stream Ecology

Research ecologist Dr. Mary Freeman, based at Patuxent's field station at the University of Georgia in Athens, was a member of a research team studying effects of urbanization on small streams of the Piedmont Physiographic Province of north-central Georgia near Atlanta. One of the team's first publications focused on habitat quality and fish assemblages along an urbanization gradient (Walters and others, 2005). Field work was conducted during 1999–2000. Fish-species richness and density declined with increased urbanization. Centrachids, largely species of bass and sunfish that were more resistant to disturbance, became dominant, and other species declined or were locally extirpated. The number of endemic species as a group declined with increasing urbanization. The researchers concluded that human disturbance might cause major changes in species composition despite only minor changes in species richness.

Also early in its work, the team investigated the function of riparian forests as stream protection buffers in urban and suburban areas at a relatively small scale (Roy and others, 2005a). The unit of measurement was the "reach scale," a 650-ft length of stream. The researchers studied five small streams during 2001–03. Streams with riparian forest had greater channel width and contained more large woody debris than streams without riparian forest (open streams), which had more algae; contained more tolerant fish and habitat generalists, such as largescale stoneroller (*Campostoma oligolepis*) and southern studfish (*Fundulus stellifer*); and had greater herbivore density and size. Catchment-scale (watershed level) land cover may have important effects on fish communities, and reach-scale studies do not detect catchment-scale effects. Roy and his colleagues concluded that preservation of forested riparian fragments alone may not adequately protect stream ecosystems.

The Georgia research team also investigated effects of hydrologic alterations on stream fish assemblages (Roy and others, 2005b). Three land-cover categories based on degree of ground-surface imperviousness (less than 10 percent, 10–20 percent, and greater than 20 percent), with increasing imperviousness representing increasing urbanization, were studied. Altered stormflows in summer and autumn were related to decreased richness of endemic, cosmopolitan, and sensitive fish species. Hydrologic variables explained 22 to 66 percent of the variation in fish-species richness and abundance. The researchers concluded that use of more porous pavement (for roads and parking lots), rain gardens, and drainage swales would increase infiltration and minimize alteration to stream ecosystems.

Additional research in Georgia documented that stream hydrology and sedimentation affect the ability of riparian forests to maintain healthy stream ecosystems in urban catchments. Roy and others (2006) reported that excessive sedimentation in streams was detrimental to sensitive specialist species, and, where such conditions prevailed, forest cover along the stream would not protect the species. The Cherokee darter (*Etheostoma scotti*), a sensitive species that was on the Federal list of threatened species, was not found in the study streams that exhibited the most stormflow alteration. Maintenance of the Cherokee darter most likely will require management of both stormflow alteration and sedimentation loads (Roy and others, 2006). In the north-central Georgia study area, these processes were driven largely by urbanization in the catchment. Riparian forests were important but were not sufficient to protect streams in highly urbanized catchments. Percent forest cover was important at the 0.6-mi stream-length scale only if urbanization was less than 15 percent of the catchment area (Roy and others, 2007). Forest cover at the reach scale (650 ft of stream length) had no effect on fish assemblages. The most sensitive fish species became rare when the level of impervious cover (as a measure of urbanization) reached 2 percent (Wenger and others, 2008).

Urbanization is accompanied by road construction, and roads can alter stream ecosystems. The design of culverts constructed where roads cross over streams greatly affects fish assemblages. Norman and others (2009) reported that, of the culverts tested, the bottomless box culvert appeared to allow unrestricted movement for benthic and water-column fishes. The three-barrel pipe culvert and the box culvert with a bottom restricted fish movement.

On the basis of their research, the Georgia team reviewed the effectiveness of measures for managing aquatic species as areas are urbanized (Wenger and others, 2010). This information was useful in the development of the Etowah Habitat Conservation Plan (HCP) (Etowah HCP Advisory Committee, 2007) for three federally protected fish species in the area—the Etowah darter (*Etheostoma etowahae*), Cherokee darter (*Etheostoma scotti*), and amber darter (*Percina antesella*). The plan included a management policy to address the effects of stormwater runoff and other stressors, and an adaptive management strategy to incorporate new data over time and to adjust management policies on the basis of the new data. Wenger and others (2010) predicted that use of the HCP offered a high probability of long-term persistence of the three fish species.

Other Patuxent researchers have studied the effects of urbanization on fish communities in coastal New England streams (Coles and others, 2004). These investigators found that cyprinids (minnows) and centrarchids (sunfish) were the dominant taxa. Cyprinid richness decreased with increasing urban development, but no clear urban effect was noted for centrarchids. Contaminant-tolerant species, such as white sucker (*Catostomus commersonii*), blacknose dace (*Rhinichthys atratulus*), and bluegill (*Lepomis macrochirus*), were fairly widespread and indicated no strong association with degree of urban development.

Diseases and Parasites

Louis Locke, a histopathologist at Patuxent, reviewed diseases and parasites of urban wildlife at an urban wildlife symposium in 1973 (Locke, 1974). He discussed diseases affecting only wildlife species, such as pox, trichomoniasis, salmonellosis, canine distemper, and Type C botulism, as well as diseases with public-health implications. Included in the latter category were histoplasmosis, cryptococcasis, rabies, and arboviruses, such as eastern, western, and St. Louis encephalitis.

Patuxent investigators at field stations in New York studied the distribution and abundance of West Nile and eastern equine encephalomyelitis virus vectors (mosquitoes) in Suffolk County in relation to human population density and land-use/land-cover patterns (Rochlin and others, 2008). Land-use/land-cover information was obtained from aerial orthophotographs supplied by Suffolk County (2001). Areas were categorized as residential, natural, barren, or saltwater. The researchers reported that land-use/land-cover information provided more accurate spatial resolution and was more useful than human population density in describing mosquito distribution patterns.

Summary

Patuxent Wildlife Research Center (Patuxent) biologists have contributed to an improved understanding of urban wildlife ecology, conservation, and management. The urban wildlife research program established at Patuxent in 1972 was headed by Dr. Aelred D. Geis. Early in his program, Geis studied the relation between bird habitat factors and development of the new town of Columbia, MD, and documented changes in bird communities as urbanization advanced. He determined that population numbers of farmland and field species, such as northern bobwhite, mourning dove, eastern meadowlark, red-winged blackbird, and grasshopper sparrow, declined, whereas population numbers of other species, such as northern mockingbird, chipping sparrow, song sparrow, European starling, house sparrow, and house wren, increased with development. His results showed that building design and construction features affected the density of so-called nuisance birds such as house sparrows and European starlings. Later, Geis studied supplemental bird feeding by people and found that the small oil sunflower seed and white proso millet were preferred by birds under Maryland conditions. At the time (late 1970s), oil sunflower seeds were not marketed as birdseed. Geis's work

created public demand and helped convince the seed industry to make oil sunflower seeds available as birdseed. Additional urban bird-related research by other investigators at Patuxent included work on the effects of habitat fragmentation on area-sensitive species and effects of contaminants and artificial light on birds.

Results of studies by Geis and other Patuxent scientists helped guide planners and managers of urban and urbanizing areas by showing that trees and shrubs preserved or planted in urban open spaces, along riparian areas of streams, and within watersheds are valuable for wildlife. Geis's work in the Columbia study area showed that reduced mowing and increased creation of meadow habitat in urban open space would increase both the availability of wildlife habitat and public wildlife viewing opportunities.

Urban wildlife-related research at Patuxent included investigations of nonlethal methods of controlling white-tailed deer density in metropolitan areas; movement and distribution of the eastern box turtle in Rock Creek Park, Washington, D.C.; dragonfly diversity at small wetlands along an urbanization gradient; and diseases and parasites of urban wildlife. Research efforts also focused on wetland restoration in metropolitan Washington, D.C., and stream ecology in north-central Georgia near the State's expanding capital city of Atlanta. Patuxent's location in the Baltimore-Washington metropolitan area facilitates its continuing study of urban wildlife, as well as potential future collaborations with researchers at nearby universities.

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Patuxent Research Refuge—Supporting Wildlife Science

Bradley A. Knudsen

Patuxent Research Refuge in Laurel, MD, was established by President Franklin D. Roosevelt through Executive Order 7514, dated December 17, 1936. This Order clearly expressed the purpose of the refuge—"…to effectuate further the purposes of the Migratory Bird Conservation Act… reserved and set apart…as a wildlife experiment and research refuge." Since 1936, Patuxent Research Refuge has amassed a myriad of purposes through various land acquisition authorities or additional Executive Orders—for example, "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (16 U.S.C. 715d, Migratory Bird Conservation Act of 1929), and "…recreation, conservation, wildlife preservation, and related scientific and educational activities" (Executive Order 11724, June 27, 1973).

The original research purpose remains the primary purpose of the refuge and is applied to any lands added to the refuge since its initial establishment. This purpose remains unique within the National Wildlife Refuge System. The purpose of many refuges is to provide habitat to benefit migratory birds. Other refuges, such as Horicon National Wildlife Refuge in Wisconsin, have a unique purpose—"to provide habitat for redhead ducks" (http://www.fws.gov/refuge/Horicon/about.html, accessed June 19, 2015). Patuxent Research Refuge's purpose is to support the critical function of wildlife research (http://www.fws.gov/refuge/Patuxent/about.html, accessed June 19, 2015).

Two long-time employees offered interesting perspectives on Patuxent Research Refuge and its ability to provide opportunities for wildlife research. Retired refuge biologist Holliday Obrecht, a scientist for nearly 30 years, often said that the refuge rarely had to turn away a research request because of the variety of habitats the refuge had to offer (Holliday Obrecht, U.S. Fish and Wildlife Service, oral commun., 2012). Retired wildlife research scientist Dr. Chandler Robbins, in a recent video production, "History of Patuxent" (U.S. Geological Survey, 2011), which highlights the history of Patuxent, says, "It was Gabrielson's dream [referring to Dr. Ira Gabrielson, who was instrumental in the establishment of Patuxent Research Refuge] to maintain a variety of habitats to conduct research…" Other speakers who appear on the video include Susan Haseltine, Gary H. Heinz, Kathy O'Malley, Matthew Perry, Chandler Robbins, and Gregory Smith of the U.S. Geological Survey (USGS), and Bradley A. Knudsen and Frank McGilvrey of the U.S. Fish and Wildlife Service (USFWS).

Trends in the quantity and type of research conducted at Patuxent Research Refuge over the years are shown in figure 1 and table 1, respectively. Much of the research, particularly the decades-long research that has been so critical in documenting habitat and wildlife change over time, has, of course, been conducted by employees stationed at Patuxent Research Refuge. The refuge, however, also has provided research opportunities for nonstaff researchers (universities, State agencies, county environmental managers, and others) on this 12,841-acre "outdoor laboratory" for decades. Since 2000, nonstaff research projects have actually outnumbered projects conducted by staff members.

The variety of flora and fauna studied is equally extensive. Birds certainly have been a focal point, but insects, pollinators, reptiles and amphibians, mammals, fish, fungi, and bacteria have all been included in the multitude of research subjects addressed at Patuxent Research Refuge during the past more than 75 years (1940–2016). The disciplines of population modeling, habitat management, endangered species propagation, toxicology, wildlife and human disease transmission, and environmental threats (habitat fragmentation, acid rain, water quality) have all been topics of past and ongoing research at Patuxent Research Refuge.

In What Other Ways Does Patuxent Research Refuge Support Wildlife Research?

- As mentioned above, the refuge encompasses more than 12,800 acres of federally protected land that can be available for research studies, both short- and long-term, essentially for the foreseeable future.
- The refuge provides a secure land base with law enforcement personnel who offer protection and security for the many captive animal colonies housed on the property.

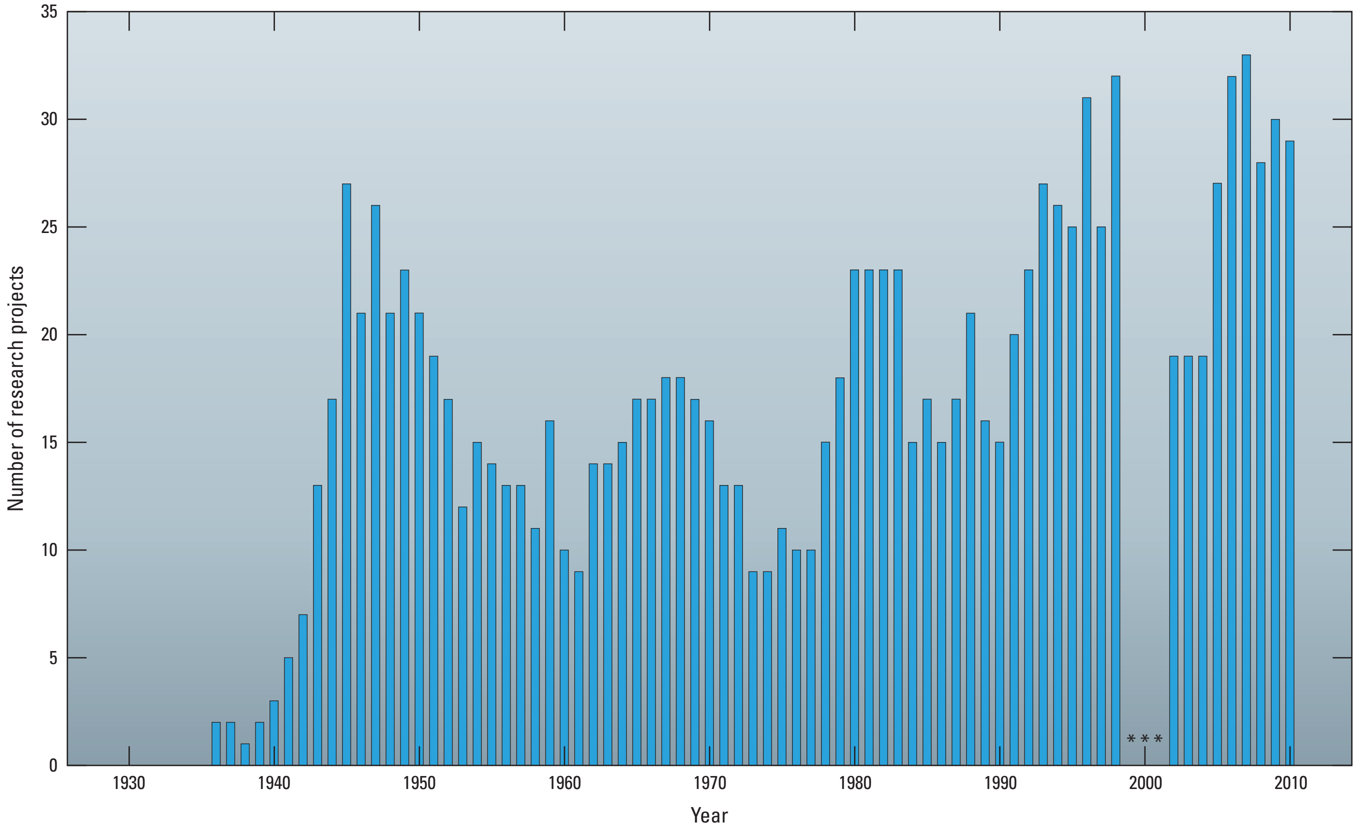

Figure 1. Number of U.S. Fish and Wildlife Service/U.S. Geological Survey research projects conducted by researchers at Patuxent Research Refuge, Laurel, MD, 1936–2010. (*, missing data)

Table 1. Earliest and longest running research at Patuxent Research Refuge, Laurel, MD.

Date	Researcher(s)	Research subject	Reference
		Earliest	
1936–42	Stewart and Robbins	Winter and breeding bird abundance and distribution	Stewart and others, 1952
1936	Hotchkiss and Stewart	Vegetation of Patuxent Research Refuge	Hotchkiss and Stewart, 1947
1936	Armstrong	Fur animal autopsies	None
		Longest running	
70 years	Stewart and Robbins	Christmas bird counts	Robbins, 1966
40 years	Stewart/Henny/Martin	Red-shouldered hawk (*Buteo lineatus*) nest survey and population ecology	Stewart, 1949; Henny and others, 1973; Martin, 2004
40 years	Uhler/McGilvrey/Haramis/Obrecht	Wood duck (*Aix sponsa*) box management and research	Perry and others, 2000
38 years	Stickel/Hall/Henry	Eastern box turtle (*Terrapene carolina*) surveys	Henry, 2003
32 years	Bystrak/Dawson	Mist netting birds for banding	None
30 years	Martin	Butterfly surveys of Central Tract (location of most research study sites; generally closed to the public)	None

- The refuge offers a variety of public uses—hunting, fishing, wildlife observation, environmental education, and interpretation programs— that minimize disturbance to research projects. Its Central Tract, where the bulk of the research is conducted, is closed to public use, except on a few days in the fall when a controlled deer-management hunt is held.

- The National Wildlife Visitor Center in the refuge (fig. 2) is a 40,000-square-foot public facility that presents high-quality exhibits on wildlife research, natural-resource problems, and wildlife conservation. It also offers meeting space for science seminars and workshops for as many as 250 participants.

- The refuge provides office space for the USFWS Division of Migratory Bird Management. Colocation of this group allows for scientific information exchange and collaboration on a variety of wildlife-related needs.

- The refuge supports a large volunteer program of as many as 250 participants annually, many of whom become advocates for the refuge in particular and natural resources in general. Volunteers provide critical support for outreach events and assist with some of the research projects, thereby enhancing and increasing research capability.

Figure 2. Visitor Center facing Lake Redington, Patuxent Research Refuge, Laurel, MD, 1994. Photo by Matthew C. Perry, U.S. Geological Survey.

- Through environmental education and interpretation programs, each year thousands of students are exposed to the wonders of nature and the importance of the outdoors. It is not unreasonable to hope that their participation has helped nurture a conservation ethic in at least some of these young people, and perhaps has inspired some of them to go on in life to become the next Chan Robbins, Ira Gabrielson, or Rachel Carson.

Dedication of the first and largest fishing pier accessible to persons with disabilities at Patuxent Research Refuge, Laurel, MD, 1992 (left to right: Patuxent Director Harold O'Connor, Prince George's County Executive Parris Glendenning, U.S. Representative Steny Hoyer, and Facility Manager Bill Lomax). Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.

A Memorandum of Agreement (MOA) between the USFWS and the USGS, signed by the respective directors of these agencies in September 2000, dealt primarily with the shared responsibilities for operations and maintenance of the substantial infrastructure at Patuxent; however, an important part of this MOA addressed the furthering of and recommitment to Patuxent's research purpose. The MOA described the concept of priority research, defined as "…projects… important to DOI [Department of the Interior], the FWS [U.S. Fish and Wildlife Service], the NWRS [National Wildlife Refuge System], and/or State Fish and Game agencies, and… address important management issues/techniques, and species of concern…," and emphasized the importance of conducting such priority research at the Patuxent Research Refuge and the Patuxent Wildlife Research Center located on the refuge.

This commitment ensures that research will continue to be an essential part of the refuge's future and reaffirms the facility's research purpose. Former Patuxent Wildlife Research Center Director Harold J. O'Connor used to say, "Patuxent Wildlife Research Center is the research part of Patuxent Research Refuge" (Harold O'Connor, U.S. Geological Survey, oral commun., 1994). I would add the following companion statement: Although the nature of research may change over time, research on nature will always be timely.

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History of the Library at Patuxent Wildlife Research Center

By Lynda J. Garrett

Patuxent Wildlife Research Center (Patuxent) in Laurel, MD, celebrated its 75th anniversary in 2011. The Patuxent Research Refuge was established in 1936 and, in 1956, it was renamed the Patuxent Wildlife Research Center. The two names have been virtually synonymous throughout the decades since and although three agencies—U.S. Department of Agriculture (USDA), U.S. Fish and Wildlife Service (USFWS), and U.S. Geological Survey (USGS)—have managed the facility, the refuge and research staffs have acted essentially as one unit (Perry, 2004). The library has supported all the various management and research staffs located at Patuxent since its inception. This chapter recounts primarily the library's history and staffing during the period I was employed there (1969–2013).

The library has been an important part of Patuxent since the establishment of the research facility. I worked in the Patuxent library for more than 43 years, but little information about its early days is available. The USDA library bookplates that can be found in many old volumes from the 1800s in the library hint at some sort of transfer or donation many years ago. Helen P. Alexander was Patuxent's librarian for several years during the 1960s. She left Patuxent in the mid-1960s and later served at the brand-new National Agricultural Library in Beltsville, MD, which opened in 1969.

I applied for a position at Patuxent in February 1969. I was not interested in a career at that time because I expected my husband to be drafted soon. I was told I would need a Civil Service rating to be a candidate for a Federal job, even a clerk-typist position. I went to the Civil Service Commission (now Office of Personnel Management) in Washington, D.C., to take the test. Half of the test was multiple choice; the other half was typing! The only machines available were old manual typewriters. I had not touched one of those in years, so I did not pass the typing test. Thankfully, applicants could repeat that part of the test on another day, and were allowed to bring an electric typewriter. Therefore, I rented a portable electric machine and passed on my second try.

I arrived at my new Federal clerk-typist job in March 1969, and operated the antiquated switchboard in the director's office in the Gabrielson Laboratory building (Gabrielson), as a General Schedule- (GS) 3 employee, for 6 months. Gabrielson, which had just opened in December 1968, was named for Ira N. Gabrielson, the first director of the newly formed USFWS in 1940, who earlier had been influential in the creation of Patuxent Research Refuge in 1936. Evelyn Schoenborn was the director's secretary, and my supervisor.

Ruth Nunnally was the GS-5 library technician, but no librarian position existed at that time. The director, Eugene Dustman, knew that Ruth planned to retire in the summer. He noted that I had listed previous library experience on my application and had me in mind to replace Ruth, which I did, in August 1969, as a GS-4. Ken Chiavetta became my new supervisor.

I had a break in service at Patuxent from July 1970 to November 1971, while my husband served his time in the U.S. Army in Kentucky. When we were ready to return to Maryland, I inquired about whether I might be able to have my old job back. However, Sue Samson was the library technician at that time, having recently arrived at Patuxent with her husband, Fred, who was a biologist. Therefore, I contacted my former supervisor, Ken Chiavetta, who arranged for me to have the job in the Pesticides Library located in the Merriam Laboratory (Merriam). The main duty there was mailing reprint requests on postcards for articles to be filed in the pesticides file cabinets—all 15 of them. That collection is still (2016) located in the basement of Gabrielson, room G10. Sue and Fred moved away in 1972 and, once again, I accepted the library technician position.

The library was on the second floor of Merriam. Initially, most of the library was in the large room that spanned the width of the building at the north end of the hall—room 212—and was very crowded. Migratory bird biologists located in Merriam who were assigned to the newly formed Migratory Bird and Habitat Research Laboratory (MBHRL) were scheduled to move to Gabrielson. After the move, the library was assigned the vacated space and, consequently, was able to expand.

At that time in the 1970s, Patuxent housed two additional library collections. One was located in the Chemistry-Pathology building, later renamed the Stickel Laboratory. The other library collection, housed in Gabrielson, consisted of materials belonging to the Non-Game Bird Section. Chan Robbins, the section chief, and Ceil Nalley, a statistical assistant, looked after the collection. During the 1970s, those holdings served the newly created MBHRL, which disbanded in 1981 when migratory bird research returned to Patuxent.

The Merriam Library was supervised by Ken Chiavetta, the editor of "Wildlife Review." Ferne Maines, a library aide, was also part of the library staff. "Wildlife Review" was a USFWS print quarterly index that was published in Chicago beginning in 1935. Following the retirement of Waldo McAtee, the editor since its inception, in 1948, "Wildlife Review" moved to Patuxent, where it was edited, in turn, by Neil Hotchkiss, Bill Stickel, and Ken Chiavetta. In conjunction with "Wildlife Review" activities, the Patuxent library developed extensive holdings in wildlife literature, and "Wildlife Review" became an invaluable reference for wildlife professionals (Humphrey, 1992). In 1975, both "Wildlife Review" and Ken were transferred to Fort Collins, CO. "Wildlife Review" continued as a print product until 1995, when the National Biological Service discontinued funding the publication because of budget reductions. The database continues today (2016) as a commercially available electronic title offered through subscription by EBSCO Publishing (Ipswich, MA) as "Wildlife and Ecology Studies Worldwide."

In the spring of 1978, I took the Civil Service librarian equivalency exam. My passing score allowed me to move from a library technician position to a librarian position, GS-7. During 1975–83, the library was supervised first by Patuxent's director, Lucille Stickel, and then by William Stickel, a renowned wildlife research biologist. The Stickels both retired in 1983.

In 1983, David Trauger became Patuxent's director and established the Branch of Technical Services. The branch chief was biologist Nancy Coon. The Information Management Section was supervised by biologist Matt Perry, and included the library and manuscript tracking, which was handled by Nancy Bushby, a technical information specialist.

One of Dave Trauger's early decisions was to consolidate all of the Patuxent library's holdings into the Merriam location. He also authorized an extensive remodeling of the library. Work included painting the walls, painting all metal shelving and file cabinets, and installing carpeting and a drop ceiling. New shelving was added to rooms down the second-floor hallway to make room for titles relocated from the Chemistry-Pathology Laboratory and Gabrielson. The remodeling process required moving all library materials at least twice! Kinard Boone, a newly hired technician, did most of the moving each time.

In 1990, under Director Harold O'Connor, the Branch of Technical Services was abolished and its information-transfer functions were moved to the Office of Administrative Services under Joe Nagel. I was disappointed with this change because I believed that organizing the support services as a separate Branch of Technical Services underscored their importance and enhanced their visibility. In 1994, the library was moved again—this time to the second floor of Gabrielson. All of the stacks were in one room, but shelving space was reduced by about 10 percent. The pesticides and pollution collection was relocated to the Gabrielson basement, first to room G2 and, later, to room G10.

In the spring of 1996, just before Joe Nagel resigned, still another reorganization occurred; it placed the library under Information Resources Management (IRM), with Bob Munro supervising Wanda Manning, the library technician, and me. As a result of this reorganization, the library was again aligned with other technical support staff. In 2003, Bob retired and Rodney Payne was hired as the IRM coordinator. Rodney remained in this position until October 2008. Wanda Manning, who had worked at Patuxent since 1989, resigned in 2003.

(Left to right) Dick Coon, Nancy Coon, Matt Perry, and Lynda J. Garrett in front of the current periodical display rack in the Patuxent Wildlife Research Center library, Laurel, MD, 2000. Photo by U.S. Geological Survey.

Various part-time contractors and students followed until 2009. Long-time library volunteer Betty Murphy left in 2010.

I was offered some generous travel opportunities during the years that the Federal Interagency Field Librarians Workshops were held. These workshops were held in Washington, D.C., in even years and in other cities (Denver, CO; Seattle, WA; and New Orleans, LA) in odd years. The training sessions provided during the workshops were valuable, but they were discontinued in 1986. In 1993, I traveled to Tucson, AZ, for museum property training because of a concern in USFWS headquarters that historical government property needed a different type of management.

The library at Patuxent supports research and the publishing of that research. The five functions discussed below—literature searching, interlibrary loan, journal subscriptions, cataloging, and the Patuxent bibliography—constitute the library's support role.

Literature Searching

During most of my working years, computer literature searching was not available to the individual researcher. Librarians at the Department of the Interior Library completed requested literature searches until 1984, when Patuxent acquired an account with Dialog (now [2016] ProQuest Dialog™), which allowed our local Patuxent library personnel to complete precision searches. I ran these searches through the years along with IRM staff members Nancy Bushby and Nancy Hestbeck. By 2001, the Biological Resources Division (BRD) of the USGS began subscribing to "Cambridge Scientific Abstracts" (CSA), which later merged with ProQuest. In 2005, BRD added the research tool Web of Knowledge (now [2016] Web of Science™), which includes BIOSIS® and Zoological Record®. The Web of Knowledge/Web of Science™ research tools enabled all researchers to conduct independent searches. I completed several comprehensive searches to contribute to the preparation of books written by Patuxent staff members.

Interlibrary Loan

Interlibrary loan (ILL) support has always been an important library function. Until 1980, ILL requests were typed on four-part forms and mailed to a library we hoped would own the book or journal. The ILL request process changed dramatically when Patuxent joined Online Computer Library Center, Inc. (OCLC), a worldwide library cooperative, in 1980. OCLC allows requests to be generated online to libraries that are listed as owners of the requested title; in addition, it allows the librarian to request an item from multiple potential lenders, sequentially, using the same request form.

Currently (2016), the Patuxent library staff fills almost twice as many ILL requests for other libraries as we originate ourselves, which reflects the breadth of our library holdings. Records indicate that in fiscal year 1991 (October 1990 through September 1991), we requested 1,162 ILLs for our staff and filled 482 requests from other libraries. In fiscal year 2011 (October 2010 through September 2011), we requested 321 items and filled 488 requests. Filling article requests is faster and more efficient since the installation of a scanner in the photocopy machine. The ability to e-mail the portable document format (pdf) file has simplified the paperwork required and shortened the waiting time for the requesting scientist.

The major reason that we do not place or fill as many requests as we did in the past is the increase in the number of journal titles to which libraries have access online. The USGS Libraries Program subscribes to a comprehensive list of titles that are accessible to all USGS employees—an estimated several thousand unique journal titles in 2011. USGS-wide access to these materials maximizes the equitable availability of information to scientists and eliminates duplicate subscriptions among the various USGS library locations, thereby conserving financial resources.

Through the years, the use of ILLs has greatly contributed to the preparation of a number of books written by Patuxent authors. The successful completion of many of these large projects would have been difficult or perhaps even impossible without easy access to the great variety of literature that has been requested by the library. Patuxent library staff members, in turn, assist other researchers by lending books from the more than 6,000 Patuxent titles offered through the OCLC library utility.

Journal Subscriptions

It was easy to predict that Patuxent's journal subscriptions would change as USGS-wide access to e-journals became more common, reducing the number of subscriptions the library purchases. Many researchers prefer the convenience of desktop access to publications. In 1995, we ordered about 160 print journal titles, whereas for 2011, we ordered just 26 print titles, and the price of some of those "core" titles included online access. Eventually, the list may be reduced to only those titles that do not offer online access. Another result of the availability of e-journals is that we no longer send journals to the bindery—in fact, the government contract binding company that Patuxent used for many years is no longer in operation.

Cataloging

Not long after my title was converted to librarian, I was offered the opportunity to attend a cataloging course in the Library Science program at the University of Maryland. By 1980, when we prepared to join OCLC, Patuxent management decided to use Library of Congress cataloging for our collection and to discontinue the local scheme that was in use at the time. This decision modernized the library and greatly facilitated the day-to-day cataloging of our materials. By 2002, we began offering our catalog online through Reference Manager Web Publisher software.

Patuxent Bibliography

During 1989–2010, the library was the fortunate recipient of the services of a devoted volunteer, Betty Murphy. Her project was to work in the Patuxent author archives, collecting copies of our past publications and placing them in the files in the Gabrielson basement. She also entered the citations into the ProCite (a proprietary commercial reference management software program) database that Nancy Bushby customized for the Patuxent bibliography in the mid-1980s, when Nancy was responsible for tracking manuscripts. This searchable database is currently (2016) available online and can be accessed from the Patuxent Web site (under "Our Products" [http://www.pwrc.usgs.gov/products/]), where many of the citations include the Universal Resource Locator (URL) link to the full text content.

Patuxent's bibliography has been used to populate two other USGS databases. Our citations were uploaded to the USGS Publications Warehouse database in 2009 and, in 2010, I began using our bibliography to update our records in the USGS Information Product Data System (IPDS) report-tracking database. My involvement with the Patuxent bibliography has been one of the most satisfying projects of my career as a librarian.

The years I spent working at the Patuxent library have constituted a wonderful career—far more satisfying than teaching high school history, my first job upon graduating college. It was pure serendipity that caused my curiosity to lead me through the "wildlife" gate on Route 197 in Laurel, MD, in 1969.

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Dr. Lucille Stickel, U.S. Fish and Wildlife Service, a major supporter of Patuxent Wildlife Research Center library holdings and functions in the 1960s and 1970s. Photo by U.S. Fish and Wildlife Service.

Patuxent's Research Program in an Era of Transitions

James A. Kushlan

Introduction

It was a telephone call to me, not totally unlike that received 9 months earlier by Ron Pulliam (Director of the National Biological Survey [NBS]) from Bruce Babbitt (Secretary of the Interior), which has since entered the lore of United States wildlife conservation history (Pulliam, 1998). The call, in the summer of 1994, bore an offer I never would have imagined being given to me, nor being accepted by me. It differed from Pulliam's job offer experience in that I had indeed applied for the position, albeit solely at the behest of long-time colleagues at the Patuxent Wildlife Research Center (Patuxent) in Laurel, MD. They had been promised an open search for a new director of Patuxent. I had applied to test whether the promise was true.

The NBS director requested on my behalf, and I received, an unprecedented 3-year leave of absence from the University of Mississippi, where I was then chairman of the biology department. Previous appointees to Federal agency positions had received only their allocated 2 years. I was honored to have the offer to lead what in my early professional career was viewed by all as the most important research facility in all of wildlife biology. I wanted to help scientists publish science that was, in fact and in appearance, credible and nonadvocative. This concept had gained traction in recent years (National Academy of Sciences, 1992), and helping to see it through was appealing to me.

I did revel in the possibilities of facilitating expansion of the biological knowledge base available to the Department of Interior (DOI) land-management agencies, especially for migratory birds and even more especially for waterbirds. Therefore, I agreed to undertake what was to be a 3-year tour of duty helping Patuxent during its transition and assisting my colleagues in the process. To be sure, I knew at the time that it would be a difficult, although fascinating, task, and I could proceed boldly dealing with management of a research facility.

Of course, grand plans rarely work out as anticipated. It turned out that the Patuxent at which I arrived in the fall of 1995 had been shorn of its field stations and renamed Patuxent Environmental Science Center (Perry, 2004). Its budget was to be cut $1.5 million and, to accommodate this reduction in funding, one option was to reduce the staff by about two dozen people and eliminate functionality. In October 1996, Patuxent's remaining functions were transferred to the U.S. Geological Survey (USGS). This chapter describes the story of that transitional period at Patuxent: transitions in form, function, structure, aspirations; transitions in the trajectory of many professional careers; and transitions in agencies, including the U.S. Fish and Wildlife Service (USFWS), NBS, National Biological Service, and USGS, and their differing perspectives. It also is the beginning of the story of the future of biological science in the DOI, a tale that as of this writing more than two decades later (2016) has yet to completely unfold.

A History of Agency Roulette

It is generally acknowledged that wildlife studies came into the Federal government in 1885 with the establishment of a Section of Economic Ornithology within the Division of Entomology at the Department of Agriculture (USDA) (Allen, 1954). Its early focus, as that organizational hierarchy indicates, was on the negative and positive relations between birds and agriculture. What birds were there, where, when, and what did they eat? In 1896, the group became the Biological Survey and, under President Theodore Roosevelt's patronage, the Bureau of Biological Survey (Bureau) in 1905. President Roosevelt was one of the great naturalists of his era, an observant amateur ornithologist, and a widely accepted scientific mammalogist (Kushlan, 2011). Roosevelt admired the USGS and he wanted a biological equivalent. Under Roosevelt's direct influence, the Bureau added mammals to its emphasis, along with the new natural history museums and zoos (Matthiessen, 1959). The Bureau also delved into bird and mammal taxonomy and distribution, and their status and trends. The enforcement of the 1900 Lacey Act, which prohibited the interstate transfer of birds killed in violation of State laws, also became their responsibility. The identity, name, and function of the Bureau had lasted a long time—35 years—when a merger with the Bureau of Fisheries of the Department of Commerce produced the USFWS, all in the DOI. It was during this period, in part to address the habitat destruction that characterized the Dustbowl Era, that scientific wildlife management began in earnest, focusing first on waterfowl and fishery stocks (Matthiessen, 1959).

The wildlife research function known as Patuxent took life on December 16, 1936, when President Franklin D.

Roosevelt signed Executive Order 7514, transferring land along the Patuxent River in Maryland to the USDA and authorizing it to be used as a research refuge, essentially a wildlife experiment station equivalent to the nearby agricultural experiment station, in support of the Migratory Bird and Conservation Act (Perry, 2016). The Patuxent Research Refuge was officially dedicated on June 3, 1939, and moved from the USDA to DOI with the USFWS. As habitat was the principal research question of the time, much of the work over the next decades centered on the land base of the experiment station, including its fields, woodlots, and constructed wetlands. From the time the first director, Arnold Nelson, was appointed, the research and the land were under common management.

With the reorganization of the USFWS in 1956, the Patuxent Research Refuge was administratively renamed the Patuxent Wildlife Research Center. Over the decades, Federal wildlife research needs broadened gradually from habitat to such issues as harvest management, and then further to population dynamics, pesticides, endangered and declining species, and nongame birds. With this expansion of need, Patuxent grew in mission, staffing, physical plant, and geographic reach, becoming the largest and arguably the most famous wildlife research laboratory in the world (Perry, 2016).

By the early 1980s, an increasingly complex array of research activities derived from multiple sources was administratively reorganized into disciplines within a centralized structure made to conform to modern management principles. In the late 1980s and early 1990s, Patuxent management explicitly chose to add roles of public use and outreach to its science core (Ballard, 1989) as the Laurel (MD) campus was expanded by incremental increases of land from adjacent Federal agencies and by the building of the National Wildlife Visitor Center, which was funded to highlight the USFWS research history. These role expansions and facility transactions altered both the function and the funding of Patuxent in fundamental ways. Patuxent had always been run on funds appropriated to the USFWS for the research region (Region 8 in Washington, D.C.), and had always been managed solely as a research facility (Perry, 2004).

With increased public use and new facilities and lands to manage, these core funds by necessity were increasingly used to pay for nonresearch matters. Finally, in 1992, additional funds were appropriated to the USFWS Northeast regional office for Patuxent, a refuge manager was appointed to serve under the director, and plans were underway to divide responsibilities between the refuge managers of the region and Patuxent, with Patuxent retaining management control of the historical core of the land and the refuge system taking over the rest (Perry, 2004). This plan did not materialize. At its peak, Patuxent was an institutional juggernaut. It comprised more than 200, mostly scientific staff members; 11 field stations; a $20 million budget; and 12,800 acres of land and facilities (Perry, 2004).

On Earth Day, April, 21, 1993, President Clinton announced his intention to undertake a biological survey of the Nation. This announcement, a single sentence in his speech (http://www.presidency.ucsb.edu/ws/?pid=46460, accessed July 30, 2015), articulated the vision of his Secretary of the Interior, Bruce Babbitt, who, like Roosevelt, was an admirer of the USGS in his youth, wanted a biological equivalent of the USGS, wanted an agency where science was independent of the land-management bureaus, and wanted enhanced capacity to provide the inventories and scientific studies the agencies needed. His rationale was to get ahead of oncoming environmental crises (Stone, 1993).

The new bureau was to be formed by extracting the research functions and staff from the other DOI agencies. It was organized within the 1994 budget process accompanied by the passage of authorizing legislation in the House of Representatives, but not in the Senate, leaving the agency as administratively and budgetarily authorized, but not organically established. But, carrying the vision on, Secretary Babbitt signed an order (Secretarial Order 3165) on May 17, 1993, announcing his intention to create the new bureau and setting that process in motion. On August 20, 1993, letters were mailed transferring personnel with their functions as of passage and signing of the fiscal year (FY) 1994 budget beginning October 1993.

Among other science functions transferred to the NBS were other DOI research centers (some historically spawned by Patuxent), Cooperative Research units at land-grant universities, and research scientists from the National Park Service (NPS) and other bureaus. Also among functions and personnel transferred to the NBS were several from the USFWS Migratory Bird Management Office such as the Bird Banding Laboratory, Breeding Bird Survey, and other inventory activities; the NPS's Center for Urban Ecology; the USFWS Biological Survey Group housed at the National Museum of Natural History; NPS Cooperative Parks Studies Units at universities; and park-based research scientists.

In June 1994, University of Georgia professor Ronald Pulliam became director of the NBS and took over forming his agency. It was to be academic, scientific, independent, unbiased, peer reviewed, and agency responsive, and to address more than wildlife. It would additionally be about ecosystems and technology and tend to big questions of ecology and resource management (Stone, 1993). On January 5, 1995, Secretary Babbitt (Secretarial Order 3185) changed the agency's name to National Biological Service and clarified that its primary role was to meet the biological research needs of the DOI. The agency was short-lived.

A new Congress elected under House of Representatives Speaker Newt Gingrich's leadership took office in January 1995. His "Contract with America" had formally promised to abolish the NBS (Pulliam, 1998a). In 1996, the functions and employees of the NBS became part of the Biological Resources Division of the USGS (Pulliam, 1998b). Additional transitions were in store for everyone. Patuxent's identity, form, and functions underwent substantial changes during this period (Perry, 2004).

Identity

Name changes quickly became an issue. What had been for decades Patuxent Wildlife Research Center was renamed, as of May 10, 1994, Patuxent Environmental Science Center. By the time of my arrival in 1995, the decision had long since been made to change Patuxent's name (Perry, 2004). Among my first assignments was to call on Maryland Senator Paul Sarbanes, who wanted Patuxent's original name reinstated (Perry, 2004). The order came out a few days later, and at Patuxent we had a celebration to enjoy our name restitution. A name change did not change anything fundamentally, but was psychologically uplifting.

With a new logo featuring the bald eagle (*Haliaeetus leucocephalus*), the identity of Patuxent had returned to its roots. When moved to the USGS, it officially became "USGS Patuxent Wildlife Research Center," but it always remained for most just "Patuxent." Of course, outside the wildlife community, "Patuxent" is a Naval air station, a prison, or a Maryland river. Within the wildlife community, it remained one of the centers of its science.

Form

The form I found at Patuxent in 1995 was in my view entirely logical in that its three main disciplinary functions, each with its independent history, were divided among three branches for migratory birds, contaminants, and endangered species. Each had a mid-level manager, who controlled the branch budget and supervision, and each had an administrative staff. Scientists were further divided into groups, each with a supervisor. The form of Patuxent consisted of a centralized command structure, based on the concept of Total Quality Management (TQM) (https://en.wikipedia.org/wiki/Total_quality_management, accessed July 30, 2015) enacted by a Quality Council that met long and regularly. When I first entered Patuxent's conference room, on the wall was a sign assuring the staff that TQM meant that whatever was said in this room by the Quality Team members of TQM stayed in this room and that employees could express their opinions without fear of retribution.

The potential imposition on creativity of TQM in a research environment worried me, and after a couple of months of consideration, I terminated TQM and the three-branch structure. Instead, all the research scientists were to report to one chief scientist and were encouraged to self-organize into recognized, but nonsupervisory, teams around projects, themes, or fields of work as they chose. This was an academic department model. It also eliminated the overhead costs of two layers of management. Finally, the concept of base funding branches was ended in favor of funding on a project basis supported by peer-reviewed proposals that competed for available base funds.

Scientists found freedom to do the work they chose, staying within the overall mission of servicing DOI, so long as they could competitively or by partnership acquire funds for their work and publish it in peer-reviewed journals. USGS headquarters was behaving somewhat similarly, offering funds derived from proposal-driven competition within the agency, and Patuxent scientists did well in this competition. Therefore, all Patuxent research became derived from internal or external peer-reviewed proposals.

Function

The NBS on its creation immediately became regionalized, with Patuxent reporting not to DOI headquarters in Washington, D.C., as it had for 60 years, but to a regional office in West Virginia. Implicit in this regionalization was that Patuxent was no longer to be a national laboratory, but a regional one. Patuxent was stripped of its far-flung field stations, and now consisted of the Laurel campus, including the National Wildlife Visitor Center; staff in Maine; the research and curatorial staff assigned to the U.S. National Museum (taken from the Denver Research Center); and the Center for Urban Ecology (taken from the NPS). The Smithsonian-based scientists were the taxonomic, curatorial, and distributional experts from the USFWS. These acquisitions brought taxonomists, mammalogists, herpetologists, botanists, urban ecologists, and wetland scientists to Patuxent.

The new agency's initial functional areas and budget categories were to be species biology, population dynamics, ecosystems, inventory and monitoring, and technology development and transfer (Stone, 1993). Species biology, population dynamics, and monitoring were within Patuxent's capabilities; ecosystems were not, even though this was clearly to be a principal focus for the new agency. Clearly in the new agency's organization, the initial intention was for Patuxent to have an eastern focus (Perry, 2004). Patuxent did wildlife research on a national, and sometimes international, scope for the entirety of the USFWS. Hal O'Connor and Dave Trauger (respectively, Director and Deputy Director of Patuxent) had gone through a strategic planning process, finished in October 1993, to attempt to align Patuxent more closely with the mandates of its new bureau and to face up to its new realities (Patuxent Wildlife Research Center Quality Council, 1993).

Within the NBS mission elements of species and population dynamics research, Patuxent was able to see the disciplines that had made it famous. National programs continued with contaminants and endangered species. Migratory birds research was clearly to be as much in the future of Patuxent as it was in the past. In the transition, the NBS failed to accumulate all of the USFWS migratory bird science capability, and Patuxent had received no new migratory bird personnel and even lost some from its former field stations to other regions; still, this was Patuxent's strength and a logical growth area.

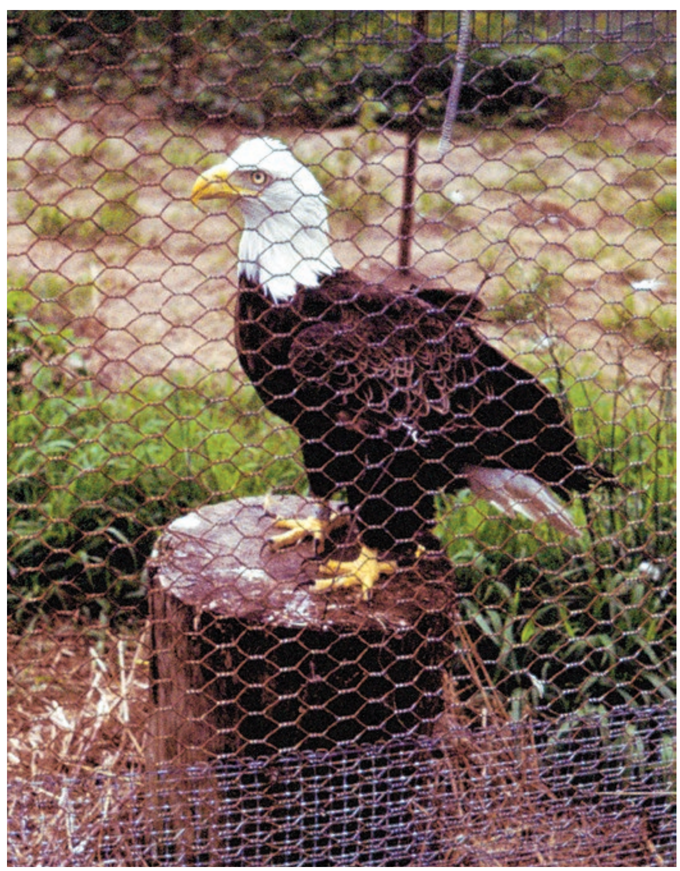
Given that developing geographic information system capabilities and ecosystem- and landscape-scale biological conservation was a fast-moving field for wildlife research, thinness of staff was indeed worrisome. Something needed to be done there. It is worthwhile, therefore, to examine Patuxent's science capabilities at the beginning of NBS.

Endangered Species

Patuxent was long the national leader in terrestrial vertebrate endangered species research, starting in 1965. It was a leader after the passage of the first Endangered Species Act, ready to support the new Federal role in biodiversity conservation, under the leadership of Dr. Ray Erickson (see the "Endangered Species" section of this report). It did the seminal species, reintroduction, and contaminant research on the bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), brown pelican (*Pelecanus occidentalis*), California condor (*Gymnogyps californianus*), masked bobwhite (*Colinus virginianus ridgwayi*), Puerto Rican parrot (*Amazona vittata*), whooping crane (*Grus americana*), Mississippi sandhill crane (*Grus canadensis*), gray wolf (*Canis lupus*), and black-footed ferret (*Mustela nigripes*). By 1995, much of this reintroduction work had passed operationally to management agencies. Patuxent's one remaining program in the endangered species branch was on cranes.

The crane program had persisted, and the issue of cranes was front and center in the National Biological Service continuing in the Biological Resources Division of the USGS. I impaneled a peer-review team (Scott and Sparrowe, 1999), which agreed that the program should be confined to research; defined the research needed as being studies on reintroduction, not husbandry; and called for maintaining the captive stock needed for this research. An implementation plan for a reintroduction program was developed on the basis of peer-reviewed proposals and, to support this work, no birds were moved. Thus, the whooping crane propagation at Patuxent survived unabated. Patuxent itself had neither the money nor the mandate to lead the reintroduction program, but encouraged partners to do so. In addition to the crane program, Dave Mech's long-term wolf study for a time was returned to Patuxent, and Jeff Spendelow in the migratory bird program studied roseate terns (*Sterna dougallii*).

CANUS (for Canada and the United States), the first whooping crane of many in the captive colony at the Patuxent Wildlife Research Center, Laurel, MD, 1991. Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.



Captive bald eagle at Patuxent Wildlife Research Center, Laurel, MD, 1979. Photo by Matthew C. Perry, U.S. Fish and Wildlife Service.

Immature roseate tern (*Sterna dougallii*) color banded for monitoring, Chatham, MA, 2011. Photo by David Monticelli, Marine and Evironmental Sciences Centre, Universidade de Coimbra, Portugal.

Contaminants

Patuxent was once the national leader in wildlife contaminant research, which had started in the mid-1940s. Under Director Lucille Stickel's leadership, Patuxent was able to benefit from attention to pesticides after Rachel Carson published "Silent Spring" in 1962 (Carson, 1962) to build a program that soon had continent-wide implications. By 1995, the program was still producing a substantial number of publications on contaminant effects on wildlife. Much of this work dealt with detailing the questions; summarizing and synthesizing the data; and attempting to address the then-current, but technically difficult, issue of secondary and generational effects by using Patuxent's remaining captive colonies of American kestrels (*Falco sparverius*) and Eastern screech owls (*Megascops asio*).

In the transition to the NBS, the Analytical Control Facility established in 1985 and housed at Patuxent (Perry, 2004) remained with the USFWS, with the rationale that this facility was a scientific service, not research. One functional result was that Patuxent lost its research chemists. Nonetheless, in 1995 Patuxent housed a cadre of contaminant biologists. As demand for their expertise decreased, they documented the continuing progress of environmental regulation. This work continued in the 1990s and thereafter, with special attention to Chesapeake Bay.

Migratory Birds

Patuxent in its largest sense (that is, including entities at the Laurel site not necessarily administered by Patuxent) in 1995 was still one of the world leaders in migratory bird studies. The bureaucratic history is convoluted, as several Federal migratory bird science entities over the previous decades had been established, merged, disestablished, or remerged (Erwin and Blohm, 2016). But over the years prior to the agency transition, migratory bird functions had been rearranged a couple of times, with some eventually becoming part of Patuxent and some remaining in the offices dealing with migratory bird management and habitat. Upon the emergence of the NBS, some of these functions, including the Bird Banding Laboratory (BBL), Breeding Bird Survey (BBS), and similar functions, were transferred, but were managed by headquarters, leaving part of the migratory bird capabilities in the USFWS, part in Patuxent, and part reporting to NBS headquarters, but nearly all colocated at the Laurel site. Thus, the core of the former and present USFWS migratory bird research and migratory bird management functions still resided physically at Laurel by 1995.

After the transition, it became clear to me that Patuxent could seek out this role to amalgamate all the former USFWS migratory bird science functions within the NBS. So a campaign was launched by others and me to secure transfer of at least the BBL and BBS from headquarters to Patuxent. I believed it to be a scientifically and logistically feasible proposition. This proposal was agreed to, with much credit going to USGS Chief Biologist Sue Haseltine, and these programs, along with personnel from the Office of Inventory and Monitoring, were transferred to Patuxent management. Patuxent then sheltered the most important of DOI's long-term bird monitoring programs, which were always considered to have been part of Patuxent in any case (Robbins, 2016; Tautin, 2016). The BBS, started by Chandler Robbins, had always physically resided at Patuxent. The BBL and the Electronic Data Processing center had resided at the Laurel site since 1942. These national responsibilities for bird monitoring were accommodated at Patuxent by erecting for the Monitoring Program a second supervisory section coequal with Research.

It was apparent to nearly all that the functionalities of the BBL were seriously out of date, relying on paper data forms; proprietary and idiosyncratic computer programs; severe and sometimes unfathomable restrictions on awarding banding permits; tight, centralized, person-mediated quality control of data input; and limited and highly controlled data availability. The BBL had long focused on waterfowl harvest, but, clearly, the BBL was a critical adjunct to ornithological research and many levels of resource management. Innovative programs for monitoring bird demography, color banding, and satellite telemetry were being initiated. To address these changes in the scientific community and to settle the BBL in its new bureaucratic home, a peer-review panel was commissioned prior to my arrival, although its report was not published until 1998 (Buckley and others, 1998). Upon its completion, I impaneled an implementation committee that included personnel from the USFWS, conservation organizations, and academia. Under the leadership of John Tautin, slowly but surely, the BBL was "reengineered" and brought into the electronic and communication age (Tautin, 2008, 2016). The process led to developments such as having Federal prisoners make bands, encouraging recoveries by telephone, and attempting to make programs more user friendly. Eventually, the data-processing unit was, for efficiency, merged with Patuxent's other information functions and the BBL became essentially all electronic, relying on the World Wide Web for its functionality.

Similarly, I impaneled a review team led by Raymond O'Connor (University of Maine, Orono) to review the operation of the BBS (O'Connor and others, 2000). Its conclusions were the well-accepted consensus opinions about what might be done better. The BBS was designed in the days of paper field notebooks, and wildlife biologist Bruce Peterjohn had already led it into the electronic era, long before the BBL was able to do so. An implementation plan that followed up on the recommendations was put into action as funding allowed.

Monitoring

Given my emphasis on research independence and eliminating middle management, the observant reader might ask why there was a Monitoring Division separate from the Research Division. The reason for the internal organization within Patuxent was twofold. The activities of the Monitoring Division, although scientific, were not necessarily research functions, and the biologists were not research scientists, but focused on customer service. The new Monitoring Division arrangement soon expanded to encompass colonial waterbird, amphibians, and pollinator monitoring programs, with Patuxent serving as the operational and data hub.

A "downside" of the separation of function was that a recognizable research/nonresearch divide came to exist within the science of Patuxent between publishing research scientists and database-managing scientists. The migratory bird data-managing scientists became increasingly separated, organizationally and intellectually, from the migratory bird research scientists. The migratory bird programs were eventually successfully coalesced by my successor, Dr. Judd A. Howell, under a single supervisory unit. After many years, Federal migratory bird science had achieved a unified home.

Patuxent Wildlife Research Center biologist Sam Droege monitoring bees with a sampling net, 2005. Photo by U.S. Geological Survey.

Reexpansion

With the loss of its distant field stations, scientific personnel, and geographic scope in the mid-1990s, Patuxent had contracted in multiple ways. Accumulation of monitoring programs increased personnel, expanded the program, and reestablished a national scope of work. But Patuxent could have benefited from employing additional scientists, especially because it initially lacked expertise in subject areas important to the National Biological Service, and later to the USGS—especially ecosystems; landscape ecology; climate change; and similar big-question, nonbird issues. Some of this expertise could be gathered as positions became available, and a plan to guide future disciplinary hires was created.

A campaign was launched by Patuxent management staff to recruit these scientists to Patuxent, whose history, administrative expertise, and prestige were positive arguments. In the end, Patuxent accumulated, in addition to the National Museum scientists and its Maine bird-focused field station, the NPS research units at the Universities of Rhode Island, Boston, and Syracuse, incorporating a wide range of park science positions including coastal geology and entomology; the NPS-derived visitor impact research program at Virginia Polytechnic Institute and State University; the world-famous wolf research program located in Minnesota; the contaminant and bird, and, later, freshwater researchers at the University of Georgia (Director Pulliam's home institution); and the bird research station with the multiagency partnership of the Lower Mississippi Joint Venture in Mississippi. As job openings and opportunities became available, positions were filled in the areas of migratory birds, monitoring, bird conservation planning, urban ecology, landscape ecology, and population dynamics, and in the reamalgamation of a wetland ecology/landscape/climate-change group that originally had coalesced at the wetlands center in Lafayette, LA, under the leadership of Dr. Robert Stewart.

In tight economic times, the perceived need and willingness for partnerships can increase. Patuxent had retained its solid relations with national wildlife refuges in the mid-Atlantic and Northeast and, owing to the addition of the Rhode Island unit, gained new connections with national parks in the Northeast. Buoyed by the long-term cooperation among refuges and parks, studies continued in these areas. Patuxent had multifaceted and positive relations with the migratory bird leadership and scientists in the USFWS, especially under the leadership of Paul Schmidt, Dave Smith, and Jon Anderson in Washington, D.C. Combined programs, joint committees, the North American Waterbird Conservation Initiative, cooperative policy setting for the BBL and BBS, parallel migratory bird science directions, and administrative issues were all collectively managed.

Patuxent continued and expanded its involvement with Chesapeake Bay by establishing relations with the leadership of the U.S. Environmental Protection Agency-managed Chesapeake Bay Program, the USFWS Chesapeake field office, the University of Maryland research campuses on the Eastern Shore and Solomon Island, the Smithsonian Environmental Research Center, and the Eastern Shore wildlife refuges. Scientists were engaged in species, restoration, wetland, and contaminant research over much of Chesapeake Bay and its watershed. Patuxent had acquired the science component of the Lower Mississippi Joint Venture, which was then under the leadership of Charles Baxter. It also engaged with the Atlantic Joint Venture, offering space for its science staff. It brought to Patuxent science staff of the USDA Natural Resources Conservation Service, with which I had worked in Mississippi. Patuxent had alumni in Cooperative Research Units at several universities, so these collaborations continued. The USGS State Water Science Centers were seen as potential collaborators, and several staff colocations occurred. Following the NPS example, Patuxent began to establish its scientists at various research universities, as it was clear that Patuxent-university partnerships were to be extremely valuable by increasing productivity.

Partnerships overall were generally beneficial, as they multiplied resources and encouraged scientific interchange. Partnerships can be difficult in practice, however, as institutions are sometimes in competition. In my opinion, partnerships worked best when they were forged by the scientists themselves; however, the partnership effort at the leadership level proved useful during the early period of reintroduction and trust building among entities, as it appeared to reduce impediments for scientists when they chose their collaborations.

Staff and functional acquisitions, targeted hiring, outplacements, and partnerships allowed Patuxent to reexpand. Eventually, staff was located at the Smithsonian Institution and seven universities as well as water-resource and environmental service offices in addition to the Laurel facility. By 2001, Patuxent encompassed 150 positions at 13 locations from Maine to Georgia, with a substantially broadened disciplinary scope. Patuxent's science purview had been reestablished, with both regional strengths and national programs.

Bird Conservation

Given its history, prior reputation, staff expertise, accumulation of well-respected bird biologists throughout the East, and responsibility for national bird databases, Patuxent was in a position to participate in and affect the bird conservation movement, and participated in conservation planning and other wildlife organizational structures with all of these nongovernmental organizations. Patuxent had for decades been an active participant in the Black Duck Joint Venture. It sponsored the organizational meeting for a Sea Duck Joint Venture. It had a field station in the "hot spot" of migratory bird land management thought and practice in Mississippi. After the alternatives had been analyzed, the BBS, established by Chan Robbins, turned out in my opinion to be the best way of estimating status and trends of North American migrant birds. The BBS bird point-count data have been digitized and archived (Robbins, 2016); Chan also undertook to digitize the Audubon Breeding Bird Censuses (Robbins, 1977). Patuxent recreated the colonial waterbird colony database (Erwin and Blohm, 2016), which it had first set in motion in the 1970s. Complementing and working with Partners in Flight and the U.S. Shorebird Plan, Patuxent took the lead in developing the North American Waterbird Conservation Plan (Kushlan and others, 2002). As these planning efforts came to fruition, Patuxent found itself a key player in the development of a continent-wide approach to bird conservation, crystallized in the public-private partnership of the North American Bird Conservation Alliance (Yaich and others, 2000). Patuxent scientists were active participants in the important scientific discussions about the North American Bird Conservation Initiative (NABCI), especially population status and trends and monitoring, and eventually in the state of the bird reports.

Funding

The story of any Federal entity is tied to the story of its funding. Patuxent's funding during the period discussed in this chapter is shown in figure 1.

The reduction in funding from FY 1995 to FY 1996 included the loss of more than half of Patuxent's base funding. Instructions for dealing with this reduction were threefold: The Center for Urban Ecology was to be closed, half of the facilities funding was withdrawn, and employees needed to be terminated (which was called a reduction in force). With this decision, much of the urban planning and park science capabilities used by the NPS that had recently accrued to Patuxent was lost.

The loss of facilities support can be understood from the immediate prior history of Patuxent, when its management emphasis had shifted from pure research to, in addition, accumulating lands, building a Visitor Center, public use, and outreach. Apart from directed appropriations for construction, which indeed covered most of the costs, funding for management of the Visitor Center and of the lands of Patuxent came from the USFWS research budget, which was arguably viewed by some as decreasing the money available for research.

The rest of the decision making was left to Patuxent. Because the funds available for salary were insufficient to support the existing staff, I had to let some employees go. I made the decision to protect the research at all costs; therefore, no cuts and no reduction in force occurred for research and immediate research support positions (other than the Center for Urban Ecology). The rest of Patuxent took a substantial functional blow as facility, administrative, and other support staff positions were eliminated. Managing the force reduction required all of my available personal and professional skills. The result was that 26 people were fired, and, overall, 35 positions were vacated. These actions inevitably had adverse consequences for both morale and functionality at Patuxent. In any organization, recovery from such a mass firing can require a professional generation. The reduction in force was perhaps especially devastating for a Federal workforce for whom job loss was not in their history.

The FY 1996 and 1997 budgets reflect the Visitor Center's move to the USFWS (see the disappearance of the yellow part of the bar in figure 1). Although it initially came to the NBS, it was transferred back because it did not have a science function. This facility was funded to highlight the history of USFWS science throughout the United States, including Patuxent. Instead it became a highlight of the Patuxent Research Refuge. The FY 1997 budget shows the accretion of funds to support the monitoring program (shown in red in figure 1), including the BBL, the BBS, and other monitoring functions transferred to Patuxent. There was a steady increase in funding available for research beginning in FY 1998, peaking at more than $9 million in FY 2001 (shown in white in figure 1). Monitoring funds also increased, to a little less than $3 million in FY 2001. By FY 2001, research funding at Patuxent had returned to the level seen in FY 1993, before implementation of the NBS, which was able to support its return to national and international engagement.

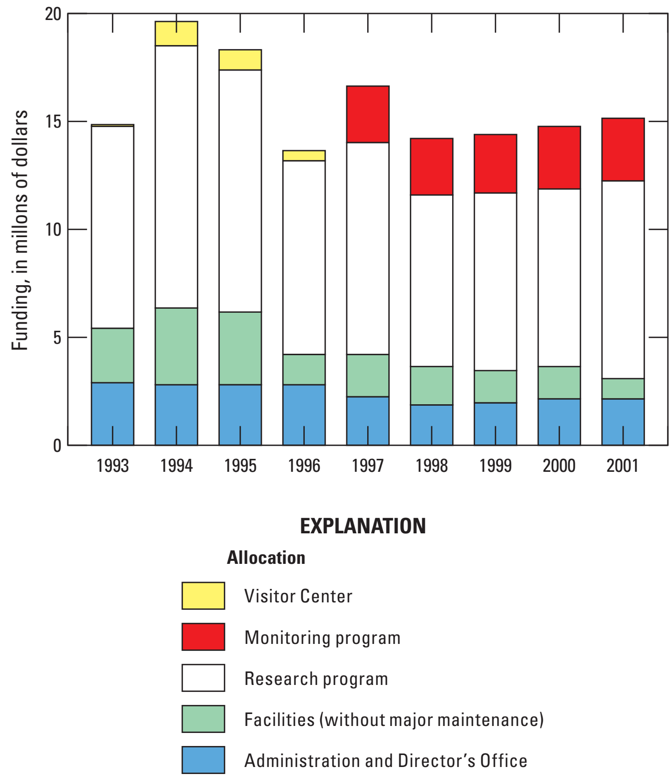


Figure 1. History of Patuxent Wildlife Research Center funding allocations, 1993–2001. (Graph modified from an unpublished presentation made by J.A. Kushlan at a meeting of Patuxent Wildlife Research Center staff, Laurel, MD, January 23, 2001.)

Facilities and the Land

Unexpectedly, facilities issues as well as science drove much of the transition at Patuxent's Laurel, MD, campus. Historically, as noted above, Patuxent and the land on which it stood were indistinguishable. The director of Patuxent was responsible for the research and for the land, which was used entirely for research, and facilities were built and converted to support it. From this trust of land and facilities came many of the internationally known fundamental management protocols for wetlands, refuge impoundments, game-bird enhancement, endangered species conservation propagation, bird banding, migratory bird conservation, contaminant studies, and the long list of other wildlife management advances. Patuxent and the lands were one. This relation became more complicated when additional lands, to be known as the South Tract and the North Tract, were accreted to the historic Central Tract from other Federal entities in the early 1990s. These lands were not intrinsically useful for research, but did add public use and even consumptive uses to the mix of management needs. Research and public use are generally not really compatible activities.

Facilities money in support of research at Patuxent disappeared in four steps. Many of the research facilities and buildings at Patuxent were old, some historically so. It was certainly the case that in adding lands and the Visitor Center, funds that used to support these research facilities on the Central Tract were now used for broader purposes, resulting in an acceleration of degradation of the research facilities. Second, when deep budget cuts hit the NBS in FY 1994–95 and, because of the past history of Patuxent management accreting nonresearch responsibilities, Patuxent lost half of its facilities funds (see above). I recall well making a speech to the staff to urge them to think of Patuxent as consisting of people, not land and buildings—good for morale, but the land and the historic buildings were in Patuxent's "blood."

The Future

This story as of this writing (2016) ended two decades ago; so much of what was then "future" has already passed. There have been three subsequent Patuxent directors and a USFWS refuge manager. Patuxent moved much of its staff to the USDA Beltsville Research Station and collapsed its office presence to one building. The biology discipline is no longer an organizational unit of USGS. Since 2002, the USGS has divided its science programs and funding streams into the "mission areas" of climate and land-use change, core science systems, ecosystems, energy and minerals, environmental health, natural hazards, and water.

The USFWS and the USGS appeared to have engaged constructively to optimize existing science capabilities (Cohn, 2005). The next generation of managers and scientists will decide how the story of DOI biological science that began in the era of transition will proceed into the middle of the 21st century.

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I acknowledge with friendship and gratitude the people of the U.S. Geological Survey (USGS) Patuxent Wildlife Research Center (Patuxent), who are and always were exceptional people in many ways, and those who served as leaders and partners through the years of this story. Although I cannot name all of the hundreds of people who were in this mix, I would like to express my gratitude to some by name. First, thanks to Ron Pulliam and Sue Haseltine, and Dennis Fenn (USGS), who provided input to my historic perspective on Patuxent. I thank my more experienced advisors, especially Marshall Howe, Dick Jachowski, John Tautin, Dave Trauger, and Marilyn Whitehead (USGS). I acknowledge my longstanding and ever full of advice scientific colleagues at the USGS, Patuxent, especially Dick Banks, Paul Buckley, Mike Erwin, Mercedes Foster, Roy McDiarmid, Matt Perry, Barnett Rattner, Chan Robbins, and Melanie Steinkamp. I appreciate help in preparing this chapter from Dick Banks, Harry Coulombe, Matt Perry, Bruce Peterjohn, Bob Reynolds, John Tautin, and Marilyn Whitehead (USGS, Patuxent).

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Facility and Research Initiatives at Patuxent for the New Millennium

Judd A. Howell

The Challenge

When I came to Maryland in 2002, I realized facilities at the Patuxent Wildlife Research Center (Patuxent) had been allowed to languish for several decades due to flat budgets and more important research priorities (CTA Architects Engineers [2000] and Patuxent Joint Working Group [2003], unpub. reports available from the Patuxent Wildlife Research Center, Laurel, MD). During my interview for the position of director, two points became very clear to me: that I needed know about facilities and that I needed to know about leadership. Both would be the challenge during my tenure at Patuxent.

First Steps

Literally, the first step was to repair the brick steps leading to Merriam Laboratory. Bricks were falling out of the steps while yellow tape and orange cones restricted passage. The work eventually had to be redone by a mason who understood historic restoration, but the effort was symbolic. It was a simple job, certainly not the highest priority, but it was highly visible and represented safe passage for the people who worked in the building. The effort showed that something was going to be done. Step 2 required hiring a new facilities manager to stabilize the facilities situation at Patuxent while plans for its modernization could be completed.

By the time I arrived, a committee from the U.S. Geological Survey (USGS) and U.S. Fish and Wildlife Service (USFWS) had developed a facilities restoration plan with a cost of $120 million (Patuxent Joint Working Group, 2003, unpub. report available from the Patuxent Wildlife Research Center, Laurel, MD). Although the plan would completely restore both agencies' infrastructure, the high price tag was an impediment to its adoption.

The Move

Having been at Patuxent for 8 months, I began to think about my first holiday message. I had been keeping staff informed about Patuxent activities with an informal message called "Thought from this Corner" (referring to my corner office), which I sent by e-mail periodically. In the third paragraph of the holiday thought, I discussed the need to abandon Stickel Laboratory, move perhaps to Beltsville Agricultural Research Center (BARC) in Beltsville, MD, and consolidate other personnel in Gabrielson Laboratory. Then I left for vacation.

By the time 2003 had begun, Patuxent was buzzing about the move. Patuxent had regular monthly meetings for all hands, including those at field stations. Generally, field station employees phoned in to listen and ask questions. By the time of the first Patuxent center-wide meeting of 2003, I had received many negative e-mails in response to the December "thought" regarding the possible move. The day of reckoning had arrived. While everyone assembled in the large conference room, I donned a highway safety vest and a hard hat, and drew a big red bull's-eye that I taped to my chest. The sound emanating from the conference room as I approached resembled that produced by a hive of bees. I stood outside the door to let the excitement build and then I entered. The room suddenly went quiet, and then someone laughed, as did others. The room seemed to fill with smiles and grins.

I said, "Okay, we have some tough work to do, so go ahead and take your best shot." I laid out the plan to move, dressed in vest, hardhat, and target. That bit of tomfoolery set the tone and lightened the mood. As a result, Patuxent worked through the tough details of abandoning Stickel Laboratory, moving out of Merriam and Nelson Laboratories, and relocating a third of the staff to BARC. The move was to be interim until new and renovated facilities were completed at Patuxent. Although some of the early sentiment was that this would destroy the unity of Patuxent, the spirit of the people remains the core of what makes Patuxent a great research institution. After seeing the completed upgrade of the Beltsville Laboratory, one scientist even asked to be relocated there. I said no, that some of us needed to share the discomfort of crowded conditions until the entire restoration of Patuxent was completed.

New Blood, New Thrusts

In the face of more than 12 years of flat budgets and an older, retiring workforce, it was imperative that the next generation of great scientists at Patuxent be recruited. During

Diann Prosser, U.S. Geological Survey, in Mongolia with swan goose instrumented with solar-powered transmitter, 2006. Photo by John Takekawa, U.S. Geological Survey.

Alicia Berlin, U.S. Geological Survey, weighing common eider in seaduck colony for selenium study at Patuxent Wildlife Research Center, Laurel, MD, 2004. Photo by Matthew C. Perry, U.S. Geological Survey.

my tenure, I oversaw the hiring of a research zoologist, Terry Chesser, at the National Museum of Natural History; a research statistician, Andy Royle, and a research ecologist, Sarah Converse, for the quantitative methods group at Patuxent; a research ecologist, Natalie Karouna-Renier, for the contaminants group; and a statistician, Clint Moore, for quantitative methods at the Athens, GA, field station. Wildlife biologist Mark Wimer was hired full time for the Breeding Bird Survey, and wildlife biologist Monica Tomosy became the new chief of the Bird Banding Laboratory (BBL), which was transformed and reengineered under her leadership, with the assistance of the computer scientist, Kevin Laurent, and the Herculean efforts of the BBL staff.

Two Student Career Experience Program Ph.D. students who worked at Patuxent during my tenure stand out. Alicia Berlin, under the direction of research biologist Matthew Perry, completed her dissertation about seaducks using Patuxent's newly constructed seaduck dive tanks. Diann Prosser, under the direction of research biologist Michael Erwin, opened the research door to China, working with the Chinese Academy of Sciences and John Takekawa at the Western Ecological Research Center, Sacremento, CA, on a project to study the transmission of highly pathogenic avian influenza, H5N1, in migratory birds. These young and brilliant minds along with their exceptional, more experienced colleagues will most likely keep Patuxent in the forefront of wildlife research for decades to come.

The Presidential Visit

On a Saturday morning, October 20, 2007, President Bush, First Lady Laura Bush, Secretary of the Interior Dirk Kempthorne, and the wife of the Secretary of the Treasury, Wendy Paulson, came to Patuxent to make a media announcement about conservation efforts for migratory birds. As part of the event, I had the opportunity to give them a tour of

President George W. Bush and First Lady Laura Bush near the crane pens at the Patuxent Wildlife Research Center, Laurel, MD, 2007. Photo by Eric Draper, White House photographer.

First Lady Laura Bush, Secretary of the Interior Dirk Kempthorne, President Bush, Bradley A. Knudsen, and Judd A. Howell at Cah Lake, Patuxent Wildlife Research Center, Laurel, MD, 2007. Photo by Eric Draper, White House photographer.

Patuxent's Endangered Species Program facilities, especially the whooping cranes. What flashed through my mind was, "How do I tell the Secretary in 60 seconds how and why we need $82 million for the rehabilitation of Patuxent?"

I looked at my watch and said that there probably was not enough time, because the group had to move on. Instead, I asked the Secretary whether I could come to his office to have that discussion. The Secretary said that would be fine. We then proceeded with our tour.

The next event was the media event. Patuxent Research Refuge Manager Bradley A. Knudsen escorted the entourage along the lake to see wildlife, and then they headed back to the podium for the announcement, which included direction to the Secretary to add funds to the National Wildlife Refuge system (http://georgewbush-whitehouse.archives.gov/news/releases/2007/10/20071020-2.html, accessed December 30, 2015).

Winter Weather and Cranes

One defining moment for Patuxent and the Refuge was the heavy, wet snow in February 2006. That snow crushed 105 of the 110 whooping crane breeding pens. The last time that had happened was in the mid-1980s, and the breeding season had been lost. My management team and I mobilized the resource, with exceptional help from the Patuxent and Refuge staffs. In a mere 3 weeks, this highly focused, hands-on effort restored the pens to operation. The Friends of Patuxent, a volunteer support group for Patuxent, supplied the funds for the food. Director's Office staff members Marilyn Whitehead and Regina Lanning acted as chiefs for the "Crane Cafe" that fed the volunteers in the field for the long hours of labor. That year Patuxent successfully reared 17 whooping cranes to be released into the wild. The event brought the entire Patuxent community together in a spirit of common cause that I will never forget.

The Final Plan

With the considerable work from all levels of the USGS and the USFWS, the final $82 million restoration plan for Patuxent had been elevated to the number 1 priority for funding by the Department of the Interior. Senate Appropriations staffers had outlined the best approach for a funding schedule. Water and sewer lines were connected to the local water and treatment district, and design concepts began to be formulated. It was a possible start for a new Patuxent. In June 2008, I retired and returned to California.

Judd A. Howell, U.S. Geological Survey, and his wife, Nancy Howell, with President George W. Bush in the White House Oval Office, 2007. Photo by Eric Draper, White House photographer.

Appendix 1. Contributors and Contact Information, September 2016.

Appendix 1. Contributors and contact information, September 2016.

[USFWS, U.S. Fish and Wildlife Service; PWRC, U.S. Geological Survey Patuxent Wildlife Research Center]

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